Pueblo County Cannabis Impact Study
# Table of Contents

- Introduction ........................................................................................................... 3
- Executive summary ................................................................................................. 4
- Social Impacts 1: The impact of legal cannabis on demographics in Pueblo County .................................................................................................................. 11
  Tim McGettigan
- Social Impacts 2: The impact of legal cannabis on poverty and homelessness in Pueblo County ................................................................. 28
  Tim McGettigan
- Social Impacts 3: Middle school and high school student cannabis use, prevention, and intervention: post legalization ........................................................................... 42
  Part 1: High school student cannabis use and perceptions towards cannabis in south-central Colorado—comparing communities that permit recreational dispensaries and communities that do not .......................................................................................................................... 42
  Tim Peters, Carol Foust
  Part 2: Marijuana education and prevention in Colorado public schools—a descriptive study of middle and high schools in the southeast and Pike’s Peak region ................................................................. 47
  Bethany Kies
  Part 3: Restorative justice intervention ..................................................................... 49
  Margie Massey, Jenny Piazza, Pam Richmond
- Social Impacts 4: Job quality in Colorado’s cannabis industry .................................. 55
  Brad Gilbreath, Patrick Radigan
- Social Impacts 5: Understanding crime and cannabis in the city of Pueblo and Pueblo County, Colorado .......................................................................................... 59
  Jennifer Schlosser
- Social Impacts 6A: Pueblo County impact study—health ........................................... 80
  Part 1: Pregnant women—impact of cannabis legalization ........................................ 80
  Jacinda Heintzelman, Lisa Persons
  Part 2: Positive urine drug screen for marijuana: relative risk in a Pueblo Colorado emergency department ................................................................................................. 88
  Joe Franta
  Part 3: Cannabis—A social use survey in Pueblo County, Colorado ................................ 94
  Judy Baca, Joe Franta, Leslie Murtagh
- Social Impacts 6B: Pueblo Department of Social Services and the impact of legal cannabis .................................................................................................................... 101
  Arlene Reilly-Sandoval
- Social Impacts 7: Attitudes regarding cannabis’ impact on community ......................... 113
  Part 1: Parenting practices, attitudes, and marijuana education .................................... 113
  Colleen Hackett
  Part 2: Religion and marijuana ................................................................................... 123
  Fawn-Amber Montoya, Carol Langer
- Economic impact of adult use retail cannabis in Pueblo County ................................ 129
  Mike Wakefield, Aun Hassan
- Cannabis buffer zones ............................................................................................... 166
  Brian Vanden Heuvel
- Water and energy use in cannabis cultivation ................................................................ 174
  Jane Fraser, Leonardo Bedoya-Valencia

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1 With non-faculty assistance from Ron Wiley
2 With assistance from Igor Melnykov
3 With assistance from Igor Melnykov, and non-faculty assistance from Karen Randall
4 With non-faculty assistance from Carey Clark
Introduction

This report constitutes the Marijuana Community Impact Study commissioned by the Board of Pueblo County Commissioners, per the scope of services submitted to the commissioners in November 2016 (which in turn referenced the Pueblo County Excise Tax Revenue Funding Agreement of June 13 2016, section 1.B.).

Specifically this report provides preliminary analyses regarding the impacts within Pueblo County since the local legalization of recreational cannabis, as follows: (A) social and economic impacts; (B) water and power usage impacts; and (C) optimal buffer zones between approved sites that grow Cannabis with THC content below 0.3% dryweight (hemp) contrasted with sites that grow Cannabis with THC content above 0.3% dryweight (recreational or medical).

Contributors to this report include the following CSU-Pueblo faculty and staff:

- Ms. Judy Baca, Associate Professor, Social Work
- Dr. Leonardo Bedoya-Valencia, Associate Professor, Engineering
- Mr. Jeremiah Blaha, Field Experience Coordinator, Teacher Education
- Dr. Carol Foust, Professor, Exercise Science, Health Promotion and Recreation
- Dr. Joe Franta, Associate Professor, Nursing
- Dr. Jane Fraser, Professor, Engineering
- Dr. Brad Gilbreath, Professor, Management
- Dr. Aun Hassan, Associate Professor, Economics
- Dr. Colleen Hackett, Assistant Professor, Sociology
- Dr. Jacinda Heintzelman, Assistant Professor, Nursing
- Dr. Bethany Kies, Assistant Professor, Exercise Science, Health Promotion and Recreation
- Dr. Carol Langer, Professor, Social Work
- Dr. Margie Massey, Associate Professor, Education
- Dr. Timothy McGettigan, Professor, Sociology
- Dr. Igor Melnykov, Associate Professor, Mathematics
- Dr. Fawn-Amber Montoya, Associate Professor, History
- Ms. Leslie Murtagh, Visiting Assistant Professor, Nursing
- Ms. Lisa Persons, Visiting Assistant Professor, Nursing
- Dr. Tim Peters, Associate Professor, Education
- Dr. Sue Pettit, Associate Professor, Education
- Dr. Jenny Piazza, Associate Professor, Education
- Mr. Patrick Radigan, Visiting Assistant Professor, Business
- Dr. Arlene Reilly-Sandoval, Associate Professor, Social Work
- Dr. Pam Richmond, Associate Professor, Social Work
- Dr. Jennifer Schlosser, Assistant Professor, Sociology
- Dr. Brian Vanden Heuvel, Professor, Biology
- Dr. Michael Wakefield, Professor, Management

Other professionals who contributed to the study include the following:

- Dr. Carey Clark (Associate Professor, Nursing, University of Maine at Augusta)
- Dr. Karen Randall (Pueblo area emergency medicine physician)
- Mr. Ron Wiley (TriKnot Restorative Counseling)

In addition, CSU-Pueblo student researchers included the following:

- Ms. Courtney Bradsby
- Mr. Jared Bressler
- Mr. John Davis
The materials provided by the researchers were compiled by Dr. Rick Kreminski, Provost and Executive VP for Academic Affairs at CSU-Pueblo (who will serve as Director of the Institute of Cannabis Research beginning in January 2018). Final typesetting and publishing assistance were provided by Elizabeth Christian, Assistant Professor of Library Services.

A few words about terminology and usage:

1. In this report, the standard scientific nomenclature of italicizing and capitalizing an organism’s genus, and italicizing the species in lower case, is followed only when a biological distinction is being made. Thus, this report only sparingly uses the formal notation *Cannabis*, namely only in those sections where the genus is of specific biological interest.

2. Strictly speaking federal law, as in the Controlled Substances Act (Title 21 of the US Code, Chapter 13) defines ‘marijuana’ in relation to the plant species *Cannabis sativa L.* and certain portions thereof; and the federal Agricultural Act of 2014 (also known as the 2014 Farm Bill) defines industrial hemp when the dryweight THC concentration of the plant species *Cannabis sativa L.* and portions thereof falls below 0.3%. As an aside, note that the Colorado constitution defines marijuana and industrial hemp with regard to the genus *Cannabis*, not the species *Cannabis sativa*. (Historically, the “L.” in the species name *Cannabis sativa L.* as it appears in the federal definitions refers to the early practice of including reference to the first to identify the plant, which in this case was C. Linnaeus. This was considered important for priority purposes, to establish precedence, in the genus-species nomenclature that, coincidentally, Linnaeus himself developed in the 1750s. His genus-species nomenclature is now standard.)

3. Since the bulk of this report concerns social and economic areas of interest, this report will primarily use ‘cannabis’ and ‘marijuana’ following more common (i.e., vernacular) usage.

Funding for this impact study was provided by the Board of Pueblo County Commissioners, supplemented by some funding from the State of Colorado.

**Executive summary**

In November 2012, Colorado voters approved Amendment 64, i.e., approved amending the Colorado constitution to allow for adult usage, taxation, and regulation of cannabis within Colorado. Statewide sales began on January 1 2014. The Board of Pueblo County Commissioners requested that CSU-Pueblo conduct a study regarding the impacts this legalization has had on Pueblo County, with details finalized in late November 2016.

The impact study was to have multiple components. The social impact component was to address areas that include, but are not limited to, the following areas of interest:

- **SI 1: Demographics** (e.g., changes in demographic composition of Pueblo County)
- **SI 2: Poverty, income and housing** (e.g., changes in income levels, redistribution of income, changes in housing availability and cost, impact on homeless population levels)
- **SI 3: Education** (e.g., impact on students, educators, and school districts)
- **SI 4: Jobs** (e.g., changes in types of employment opportunities and employment availability)
- **SI 5: Law enforcement** (e.g., court/legal system issues, such as how have law enforcement and courts handled issues including conflicts between or within federal, state and local laws; changes
in crime rates, probation services, youth corrections)

- SI 6: Public health, health care and social services (e.g., impact on health systems, service providers in the health care industry, social services and changes in drug use including opioids)
- SI 7: Attitudes regarding cannabis’ impact on community (e.g., sub-divided among certain demographic groups)

The economic impact component of the study was to attempt to quantify in economic terms the costs and benefits associated with the adoption of legalized cannabis in Pueblo County and to provide thoughtful projections of these economic impacts five years into the future. Areas of focus were to include:

- **Economic benefits of the legalization of cannabis** such as tax receipts, job creation, real estate inflation, new commercial construction, increased visitation and general business/economic growth.
- **Economic costs of the legalization of cannabis** such as increased cost law enforcement, city and county detention, medical care, welfare assistance, child and family services, public education, insurance (health, automobile, liability, etc.) and general social/governmental oversight and other areas identified by the social impact study group.
- **Discussion and conclusions** with reference to research limitations and next steps for future research.

The water and energy impact component was to examine water and energy use from facilities that grow cannabis, and proceed in two stages:

1. Collect and analyze data on how much energy and water are needed to grow Cannabis.
2. Create a systems dynamics model to project the effects under different scenarios. Results from Stage 2 depend on results from Stage 1, but creation of the model in Stage 2 was to proceed simultaneously with Stage 1 to the extent possible. The model developed would possibly allow for water and energy consumption comparisons between indoor and outdoor growing facilities.

The final buffer zone component was to provide a recommendation on the sizes to reduce likelihood of cross-contamination between operations that grow low THC Cannabis sativa (industrial hemp) and high THC Cannabis sativa.

This study should be interpreted as just a first step in examining the important, complex set of issues that relate to impacts on Pueblo County since the statewide vote approving Colorado Amendment 64 in November 2012 and the implementation that began in earnest in 2014. While a wide spectrum of faculty, students, and other off-campus colleagues participated in various aspects of this study, there were nevertheless important constraints—namely of time, and access to relevant, accurate, comprehensive data. For instance, there simply was not enough time for researchers to undertake longitudinal studies of any kind, so typically researchers had to rely on what data were publicly available. Brief summaries of the impact study components undertaken by CSU-Pueblo faculty, students and others are provided below. A recurrent theme is that in many areas, there is a dearth of available published research that is timely; thus further research, both quantitative and qualitative, is imperative, including important longitudinal work; and there is generally a need for more, high-quality, data collection and recording. In some cases, researchers conducted survey work as an initial attempt to address the relevant issues, including some focus group work; nevertheless, small sample size was routinely an issue. As a general rule, unpublished anecdotal information from a single source was generally disfavored compared with information coming from established, regularly collected and reported data sets. Anecdotes often provide important initial points of departure, but inevitably lead to the question, to what extent are the anecdotes generalizable? Another recurring issue is to what extent the data that do exist indicate an association or correlation, rather than causation.

Below is an introduction to the specific sections covered in the impact study. References cited are from the
Social Impacts 1: Demographics

From the data available, sales and use of retail cannabis has not been legal long enough to have a major impact on Pueblo County’s demography. Since the November 2000 passage of Amendment 20 allowing for the legal use of medical cannabis in Colorado, Pueblo’s population has increased at a rate slightly lower than, but comparable to, that prior to legalization. There is evidence of increased migration to Pueblo since the November 2012 passage of Amendment 64. Opinion is divided regarding whether recent migrants have a positive or negative impact on Pueblo. Educational achievement in Pueblo still lags behind the rest of Colorado. To address that deficit, Pueblo County has instituted what appears to be the world’s first cannabis tax funded college scholarship program. Household income in Pueblo falls well below incomes in Colorado’s more affluent counties. Jobs created by the legal cannabis industry may help Pueblo narrow stark income gaps. More, high quality data are required in this area.

Social Impacts 2: Poverty, income and housing

From the available evidence examined, since the passage of Amendment 64, poverty has neither increased nor decreased in Pueblo. Poverty rates are persistently higher in Pueblo than in the rest of Colorado. Thus far, it appears that legal cannabis has neither reduced, nor increased, existing poverty disparities between Pueblo and more affluent Colorado counties. There is evidence that homelessness has recently increased in Pueblo. The 2017 Point in Time Study indicates that Pueblo has much higher rates of homelessness than other Colorado counties. Some have argued that legal cannabis is the cause of rising rates of homelessness in Pueblo, but there is no detailed evidence to support this claim at this time (we do use some anecdotal information to assist with projections on costs incurred by increased homelessness attributable to cannabis, as a way to provide a cost estimate, in the section on economic impacts). Somewhat counterintuitively, Colorado’s economic boom may itself be a partial cause for increases in homelessness: Front Range wages have not kept pace with the cost of living and hourly wage earners may generally have a difficult time affording housing. Also, while homelessness among military veterans has been decreasing across the US, it has been increasing in Colorado [which may in part be due to veterans who are migrating to obtain legal cannabis (e.g. for treatment for PTSD)]. Cannabis migrants have a real but unknown impact on homeless statistics in Pueblo, including those known as cannabis refugees (who are individuals who cross state lines to acquire cannabis to medically treat their own or family member’s illnesses); federal prohibitions may be a key factor that results in homeless cannabis refugees. In recent times, a significant cause of homelessness has been attributed to high utility costs, i.e. to factors independent of cannabis. More, high quality data are required in this area.

Social Impacts 3: Education

A study was initiated to seek answers to questions related to K12 education raised by the legalization of recreational cannabis in Pueblo County and southern Colorado. Four areas of inquiry were studied. First, a data analysis was conducted of high school student survey data; specifically, the analysis examined changes in use and perceptions towards cannabis from 2013 to 2015, between communities in south central Colorado that permitted recreational cannabis sales and those communities that did not permit these sales. The second component was a descriptive study of regional education administrators, regarding marijuana prevention education efforts and policies with school districts. The third was a pilot study to test a particular marijuana education curriculum. The fourth was a planning activity around the area of restorative justice practices around marijuana offenses in Pueblo County schools. A preliminary survey found some statistically significant differences between students in communities that have never permitted recreational cannabis dispensaries and students in communities that opened recreational dispensaries in 2014; however, in regard to student use and perceptions, the preliminary study indicates that the legalization of recreational cannabis use and dispensaries has not greatly affected high school student use and perceptions. Continued data collection and analysis is necessary to track student behavior and beliefs towards cannabis. Another
survey, of public school administrators, describes the highly variable extent of prevention education (e.g. nearly half of the middle and high schools surveyed did not provide any marijuana prevention education). In addition, restorative justice is being introduced in Pueblo City schools, with data gathering planned.

Social Impacts 4: Jobs
This area examined the quality of jobs in Pueblo County’s hemp and marijuana-related businesses. It drew upon the work of job-quality researcher Arne Kalleberg, to construct a thorough assessment of whether the legal cannabis industry is creating good jobs. Job quality was assessed both objectively and from the perspective of those working in the industry; in particular, the study incorporates both economic and psychosocial indicators. This study was one of the first of its kind, to explore the concept of job quality in the cannabis industry. Factors influencing job quality include hours of work, future prospects (promotion and job security), how difficult the job is, job content (interest, prestige, independence), interpersonal relationships (Clark, 1998), and supervisor behavior and management practices (Seltzer & Numerof, 1988; Gilbreath & Benson, 2004). Some preliminary data have been collected.

Social Impacts 5: Law enforcement
The data presented in this section were gathered through a working relationship with the Pueblo County Sheriff’s Department and the City of Pueblo Police Department. The data include statistical information on various crimes conducted from 2010 to 2017, as well as the results of 20 individual interviews with city police officers. In 2013, the Cole Memo stated that the federal government would not challenge Colorado’s ability to regulate the retail sale of marijuana on the condition that “state and local governments would implement strong, effective regulatory and enforcement systems to address public safety, public health, and other public interests” (Blake & Finlaw, 2014). In response, David Blake, Deputy Attorney General for Legal Policy and Government Affairs in Colorado and Jack Finlaw, Chief Legal Counsel for Colorado Governor John Hickenlooper, outlined in a report for the Harvard Law and Policy Review (2014) the issues that Colorado continued to face after legalization. Their report lists many questions, potential problems, and issues that states considering decriminalization marijuana will face. These agencies are expected to uphold both state and federal law in the maintenance of public safety, but are provided little financial support and regulatory clarity. Some findings from examining Pueblo City and Pueblo County data along with the interviews are that marijuana seizures have decreased in the city but not in the county; overall crime has increased in the city, but apparently on trend with expected averages given the increase in population and decrease in police personnel; the largest increases in crime have been in property crime (particularly motor vehicle theft) and dangerous drug seizures (particularly heroin); violent crime has risen only marginally in the city, and decreased in the county; the legalization of marijuana has put more perceived pressure on patrol officers, who associate it with an influx in the transient population, which they then associate with increased property and other drug crimes; and police struggle with enforcing complex and changing marijuana laws and perceive the citizens struggle to keep up with confusing policy. There has been little scholarly research on the relationship between recreational marijuana laws and crime; it is essential that more research, both quantitative and qualitative, be undertaken.

Social Impacts 6: Public health, health care and social services
The impact of the legalization of recreational cannabis on pregnant women was addressed by a retrospective cohort study that looked at electronic health records at two facilities: the first was an outpatient clinic setting serving perinatal patients throughout the pregnancy and the postpartum time; the second was an acute-care inpatient facility serving antenatal patients throughout the labor and delivery process. (The data provided to the researchers from the health care facilities were de-identified, so anonymity was fully maintained.) The outpatient data set consisted of 2,072 subjects, with 163 that tested positive for cannabis and/or THC; the data set was divided into those 430 with a delivery date on or before 12/31/2013 and those 1,642 with a delivery date on or after 01/01/2014. The inpatient data set consisted of 6,467 subjects, of whom 176 tested positive for cannabis and/or THC; this was divided into the 1,078 with delivery date on or before
12/31/2013 and the 5,389 with delivery date 01/01/2014 or later. Statistical analyses indicated that there was not a statistically significant change in marijuana use after legalization for the subjects in the outpatient setting. By contrast, there was a statistically significant increase in marijuana use after legalization for the subjects in the inpatient setting, and a statistical lower bound of 3.1% for that increase (i.e., the increase is at least that great—the lower bound is 11.3% in a 1-sided test). The availability of published research on the effects of legalization of recreational marijuana use is limited, especially use during pregnancy and the effects to the unborn fetus. This current study, using the inpatient sample, supports national reports that marijuana use in pregnant women is increasing, but the outpatient sample shows contradictory results. The current study also revealed that tobacco use during pregnancy has increased, but also revealed that tobacco use increased at a higher rate in those women who did not use marijuana. Results also showed that in the inpatient population that tested positive for marijuana, more were likely to have public health insurance, both prior to recreational legalization of marijuana and after legalization. This increase in public insurance correlates with the national increase of those eligible for Medicaid with the passing of the Affordable Care Act.

The impact on medical emergency department visits was examined via another retrospective study of a local health provider, with a patient visit total of 60,050 (of which 826 had positive urine screens for marijuana) from 2013, compared with 309,506 patient visits (of which 5,076 had positive urine screens for marijuana). The statistically significant increase has a statistical lower bound of 10.8% (i.e., the increase is at least that great). Examination of diagnoses as related to positive THC testing would help identify if the increase is connected to different physical or psychological health concerns.

Another portion of the social impact study looked at the effect of cannabis legalization within the Child Protective Services system in Pueblo County. In the past five years, laws centered around the possession, sale, and transfer of medicinal and recreational cannabis have changed drastically. The subject of cannabis legalization and child welfare is multi-faceted, and further complicated by issues such as poverty, unemployment, homelessness, availability of safety net benefits, and mental health challenges that are experienced by families referred to Pueblo County Department of Social Services.

In November of 2012, Colorado voters passed Amendment 64, allowing the recreational use of cannabis, and the sale of recreational cannabis in Colorado began in January 2014. The impact of cannabis on children has been a matter of major concern in the discussion of legalization of medical and recreational cannabis. The Colorado Department of Public Safety (2016) found that the trend for students reporting first use of marijuana has gradually declined in the past two survey administrations by about 6 percentage points (CDPS, 2016). Pueblo County had the highest incidence in Colorado of high school and middle school youth reporting using marijuana in the last 30 days, with 32.1% and 22.8% respectively (CDPS, 2016). While the Colorado Department of Human Services Trails data does not track specific drugs or alcohol issues experienced by families referred to the agency, the Child Health Survey found that “…of parents with children ages 1–14, 4% reported using marijuana in the past month, and 7% reported having marijuana in the household” (CDPS, 2016, p. 71). Currently, there is a lack of research on the specific topic of the impact that legalizing cannabis has on children and families in the Child Welfare (CW) System, such as how referrals and investigations are affected, the availability of treatment options, the education and training of caseworkers handling cases involving legal cannabis, and how to manage CW cases when the primary caregiver is using legal cannabis. More research is needed on these important topics.

Social Impacts 7: Attitudes regarding cannabis’ impact on community
Regarding religion and marijuana, this component examined whether or not a person’s religious beliefs and background have any correlation with their views on the use of medicinal and/or recreational marijuana. From a literature review, multiple studies have secured findings that support the notion that regular church attendance and a sense of security in religious beliefs were factors that contributed to whether or not an individual was likely to participate in the consumption of marijuana and other substances. In one
large study (albeit dated, from 1985), the data collected show that 38% of church members reported trying marijuana, and 18% of the church members reported using the substance more than six times in a month. By comparison, 47% reported trying marijuana at least once, while 25% reported using the substance more than six times in a month. This study also found that members of the Church of Latter Day Saints had the lowest percentage of young members trying or being heavy users of all substances; participants who were from Episcopal or Presbyterian churches had the next lowest percentage of using marijuana heavily. The study showed that the fundamentalist religions and the most prescriptive of religions proved to be the most effective in preventing the use of alcohol and substances such as marijuana. The more liberal and prescriptive religions proved to be the next most effective in preventing the use of marijuana. Four focus groups were conducted involving a total of 17 participants, with the majority in the age range of 50 to 86, representing three established religions along with nondenominational fundamentalist. Because of the small sample size, further research should be done to probe the relationship between religious beliefs and marijuana usage. Despite the small sample, this study did find that the more conservative the belief system, the greater the opposition to marijuana use in all its forms. Because there is not enough research on religion and marijuana use that is recent, further study is warranted.

Another section of this study examined parenting practices, attitudes, and marijuana education. Abstinence-based approaches are the prevailing ideology behind many drug education programs and mainstream messaging about illicit substances. Given that more than half of high school students are likely to experiment with drugs of any type, abstinence-based educational approaches can clearly not be the sole answer (MTF 2014). This report borrows from the latest drug education literature that attempts to stray from zero-tolerance approaches and to adopt a “smart” framework instead (all the while not endorsing teenage cannabis use). The study began with the research question: How are parents in Pueblo County talking to their teenage children about marijuana in a state that has legalized marijuana? This research intended to explore what parents’ general views on marijuana and cannabis products are, while additionally documenting what—if anything—parents teach their teenage child or children about marijuana. The study explores whether parents are adhering to an abstinence-only model, or if they are choosing to stray from traditional educational tactics.

**Economic impact of adult use retail cannabis**

From a variety of sources (county tax receipts, Zillow, other publicly available data, data gathered and reports generated by organizations, and interviews) along with published research, the following determinations were made. Gross retail sales are multiplied by a factor ($2.29, obtained by taking an average from the literature); this yields an estimate of $57M for calendar year 2016 in direct and indirect economic impact from the sale of adult use cannabis (including taxes collected, supply chain impacts and cannabis tourism). (As an aside, the proportion of out of town customers is estimated at 60%.) Estimates were made for construction economic impacts, using construction permits (for new and remodel) and the construction industry multiplier of $3.05, yielding $1.5M for calendar year 2016. Estimates were made for annual law enforcement costs related to cannabis (and estimates of the proportion of that total attributable to legalization of adult use cannabis). Estimates were also made for costs related to homelessness (based on an estimate of the cost of one homeless individual at $29K/year, using Colorado Coalition for the Homeless estimates for the Denver area adjusted for Pueblo cost of living; this should include food, medical care and shelter costs). The overall economic impact in 2016 was estimated as $58.8M - $23.2M or a net of $35.6M, with numerous limitations cited: A number of organizations did not collect data prior to the legalization of recreational cannabis, limiting pre- and post-legalization comparisons. Many sources only included the term ‘marijuana’, thus not differentiating between locally legal medical and recreational use, or illegally obtained cannabis; this commingling necessarily confounds the impact of use of cannabis on economic impact factors. Only the most salient revenues and costs have been collected and evaluated or estimated; tertiary and lower levels of benefits and costs may exist that could be identified in future research. Perhaps because the cannabis industry is so new, there is suspicion among operators in this industry of researchers
seeking information, especially financial data. It is also difficult to obtain information from the homeless. Interviewing out-of-state customers at cannabis shops was not possible, so observational techniques were utilized. All these factors cast some doubt on the overall accuracy; certainly costs and revenues in a cash-only system should be viewed with some skepticism. As a result, all projections, including the specific numbers for absolute impact, are clearly estimates. In addition, comparisons were made to 8 other counties (2 in Colorado, 3 from Washington State, and 3 from other states where neither recreational nor medical marijuana was legal at the time of this study). Not all counties had full data sets available, i.e., some of the comparisons made were incomplete.

**Cannabis buffer zones**

Hybridization of high THC Cannabis (marijuana) with low THC Cannabis (hemp) can result in crop loss for both growing operations. If genes that promote high levels of tetrahydrocannabinol (THC) are transferred by pollen from high THC Cannabis to low THC Cannabis, the resulting seed could result in subsequent generations of plants that test above the permitted THC limit of 0.3% dryweight, requiring the crop to be destroyed and result in large investment losses (Small and Antle 2003). This is probably a less frequent occurrence because high THC Cannabis growers and low THC Cannabis growers who are growing crops for cannabidiol (CBD) production normally eliminate male plants, or grow female clones, and the extent to which pollen from high THC or high CBD Cannabis cultivation represents a large pollen source is unknown and probably minimal. On the other hand, pollen from low THC Cannabis hybridizing with high THC or high CBD Cannabis cultivation who depend on unfertilized flowers for their product is a major concern, as fertilized flowers and seed production in the high THC or high CBD production fields will significantly reduce the value of the crop. Both low THC hemp growers and high THC or high CBD growers are faced with a perennial problem of ensuring that their plants are adequately protected from contaminating pollen.

**Water and energy use in cannabis cultivation**

Practices and opinions vary about the growing of cannabis. The industry is far from having established best practices to minimize the use of inputs such as water and electricity. A preliminary finding, based on a limited number of interviews with people involved in local cannabis production, is that cannabis can be grown indoors with ½ gallon per plant per day; outdoor grows use more water. Energy use varies widely and interviews are continuing to determine the range of practices and usage. A Systems Dynamics model with seven sectors (demographics, housing, attractiveness, land use, business attractiveness, energy, and water) has been developed to analyze the region’s energy and water demand variation when a new supply chain system is introduced. Preliminary findings of a study of the impact of the legalization of cannabis on water and energy use in Pueblo County are provided, first examining how much energy and water are needed to grow cannabis, and next creating a systems dynamics model to project the effects under different scenarios.
Social Impacts 1: The impact of legal cannabis on demographics in Pueblo County

Abstract
Demography is the science of people-counting (Anderson, 2015). Demographically speaking, the impacts of legal cannabis on Pueblo County have been modest thus far. Apart from slow, steady population increases (see Graph 1), the characteristics of Pueblo’s population have largely gone unchanged since the passage of Amendment 64.

Introduction
Demography is the science of counting, tracking, and analyzing population characteristics (Anderson, 2015). Recreational and medical cannabis have not been legal long enough to have a major impact on Pueblo County’s demography. Still, in the brief window of time that is available for analysis, a number of demographic trends appear to be taking shape.

To begin with, a majority of Puebloans consistently support legal cannabis (See Tables 4, 5, and 6). This new cannabis-tolerant majority in Pueblo is consistent with nationwide trends. Recent nationwide polls report that nearly 61% of Americans believe cannabis should be legalized and 88% believe that medical cannabis should be legalized (Williams, 2017). Pueblo has opened the door to legal cannabis wider than most other communities (Halperin, 2016; Roper, 2016).

Thus far, the demographic impacts of legal cannabis on Pueblo have been modest (See Image 2 and Graphs 11 and 12). Since the passage of Amendment 20, Pueblo’s population has increased at a slightly lower rate compared with the population increase in the decade prior to legalization (see Graph 1). We found no clear evidence that legal cannabis has reduced Pueblo’s population.

There is evidence of increased migration to Pueblo since the passage of Amendment 64 (see Graph 8 and Image 2 and 3). As is often the case when considering migrants, opinion is divided about whether migrants have a positive or negative impact on the Pueblo community. Cannabis tourism has become a lucrative new component of Colorado’s economic profile (Blevins, 2015). Also, because of its pronounced aesthetic appeal, Colorado has a tradition of attracting college graduates from all across the US (Cotton, 2017). Rather than siphoning resources, in-migrating cannabis tourists and college graduates contribute to Colorado’s overall economic strength.

Educational achievement in Pueblo still lags behind the rest of Colorado (see Tables 11 and 12). To combat that deficit, Pueblo County has instituted the world’s first cannabis tax funded college scholarships (Hondros, 2017). In only its second year, Pueblo County’s cannabis scholarship program has helped more than 400 students pursue their higher education goals (Robinson, 2017b). If cannabis-funded scholarships continue, this program might help reduce the educational achievement gaps between Pueblo and the rest of Colorado.

Household income in Pueblo still falls well below incomes in Colorado’s more affluent counties (Schueler, 2017). Abundant new jobs in the legal cannabis industry should help Puebloans narrow stark income gaps (Du, 2017). It is possible that legal cannabis has already had a more positive impact on household income than official statistics reveal. For example, given the ongoing federal prohibition, most cannabis businesses are still obligated to operate in a cash-only financial environment (Seefried, 2016). If the federal prohibition ends, it is possible that businesses and individuals might feel safer about reporting cannabis-derived income. Pueblo’s leaders must pay close attention to household and per capita income statistics to ensure that Pueblo’s investment in legal cannabis pays off for its hard-working citizens.

Recently, the National Survey on Drug Use and Health revealed that cannabis use has declined among 12- to 17-year-olds in the years since cannabis was legalized (Ingraham, 2017). While adolescent use has declined, cannabis use among elderly Americans has increased dramatically, “the number of people age 65 and up
who said they use marijuana grew 250 percent between 2006 and 2013” (Ehrenfeld, 2017). Researchers speculate that adults experience more pain management issues as they grow older and, now that cannabis is legal, are beginning to rely on cannabis to manage aging-related pain and health issues.

**Research Methods**

Due to time constraints, the investigator was unable to conduct in-depth original demographic analyses of the Pueblo County population. Instead, the investigator carried out a systematic analysis of Pueblo County’s demographic profile by interrogating population statistics that have been compiled by the U.S. Census, the Colorado State Demography Office, and the Pueblo County demographic data archive.

**Discussion**

Demography is the science of analyzing population characteristics (Anderson, 2015). Demographers study the characteristics of unique populations and the way that those populations change over time. Variables that are of particular interest to demographers include such things as: employment, education, income, ethnicity and others (Chinni and Gimpel, 2011).

As of July 1, 2016, the U.S. Census Bureau (2016) reported that the population in Pueblo County, Colorado has risen to 165,123 residents. That is an increase of 6,060 (or 3.8%) residents from the 159,063 residents reported for Pueblo County in the 2010 Census.

![Graph 1: Pueblo Population from 1970–2017](source)

Since 1990, population increases in Pueblo County have followed an upward trajectory that is similar to the state of Colorado’s population increase, albeit at a lower rate. Between the years 2010–2016, Pueblo’s population increased 3.8%. In the same time frame, Colorado’s population increased from 5,029,156 to 5,557,560 which is equivalent to a 10.5% increase.
Factors that Impact Population

There are three factors that drive changes in population: fertility, mortality and migration. The fertility rate is calculated as the number of live births per 1,000 women in a specific region during a given year (Poston and Bouvier, 2017). Similarly, mortality is calculated as the number of deaths per 1,000 in a given year. Migration can be defined as the number of people who permanently relocate from one defined place to another. Migration can be either international (moving from one nation to another) or internal (moving from one state, county or city to another). Population increases whenever fertility and in-migration exceed mortality in a particular region; population decreases whenever mortality and out-migration exceed the fertility rate.

Sustained population increases since 2012 (see Graphs 1 & 2)—the year during which Colorado voters approved Amendment 64—suggest that legal cannabis has not driven residents away from either Pueblo County or the State of Colorado. Instead, sustained population increases suggest that legalized cannabis correlates positively with other population-building variables in Pueblo County and Colorado. This evidence is consistent with the fact that significant majorities have supported legal cannabis each time that Coloradans have voted on the issue since 2000.

Let the Voters Decide: Cannabis and the Will of the People

In 2000, Coloradans voted on Initiative 20, also known as the “Colorado Medical Use of Marijuana” initiative (Hecht, 2014). The initiative won the support of a majority of voters across the state of Colorado.

<table>
<thead>
<tr>
<th>TABLE 3: 2000 Election Results for Amendment 20 Throughout Colorado</th>
</tr>
</thead>
<tbody>
<tr>
<td>Votes</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>YES 915,527</td>
</tr>
<tr>
<td>NO 786,983</td>
</tr>
<tr>
<td><strong>Total Votes</strong> 1,702,510</td>
</tr>
</tbody>
</table>

In 2012, Colorado voters returned to the ballot box to decide whether or not to allow Amendment 64, which is also known as the “Colorado Marijuana Legalization Initiative,” to legalize recreational cannabis in the state of Colorado. A majority of Coloradans voted in favor Amendment 64 and, thereby, legalized recreational cannabis statewide (Ferner, 2012).

### TABLE 4: 2012 Election Results for Amendment 64 Throughout Colorado

<table>
<thead>
<tr>
<th>Votes</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>1,383,139</td>
</tr>
<tr>
<td>NO</td>
<td>1,116,894</td>
</tr>
<tr>
<td>Total Votes</td>
<td>2,500,033</td>
</tr>
</tbody>
</table>

Source: Ballotpedia, https://ballotpedia.org/Colorado_Marijuana_Legalization_Initiative,_Amendment_64_(2012)

In 2012, the Amendment 64 vote in Pueblo County closely mirrored the statewide ballot. Both the “Yes” and “No” totals in Pueblo fell within half of a percentage point of the statewide vote (Politico Staff, 2012).

### TABLE 5: 2012 Election Results for Amendment 64 in Pueblo County

<table>
<thead>
<tr>
<th>Votes</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>39,715</td>
</tr>
<tr>
<td>NO</td>
<td>32,505</td>
</tr>
<tr>
<td>Total Votes</td>
<td>72,220</td>
</tr>
</tbody>
</table>

Source: Denver Post Election Results Archive, http://data.denverpost.com/election/results/amendment/2012/64-legalize-marijuana/?pueblo

In 2013 and 2014 the Pueblo County Commissioners (MacIver, 2016) instituted a number of ordinances and regulations that enabled private investors to create legal cannabis businesses—including dispensaries, product manufacturing and grows—in Pueblo, Colorado (Halperin, 2016).

Members of the Pueblo community who were uncomfortable with recreational cannabis legalization spearheaded a number of anti-cannabis measures on the 2016 ballot (Miller, 2016)—specifically, Ballot Initiatives 200 and 300, which were rejected by voters (Stein, 2016).

### TABLE 6: 2016 Election Results in Pueblo County for Ballot Measure 200

<table>
<thead>
<tr>
<th>Votes</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>33,334</td>
</tr>
<tr>
<td>NO</td>
<td>45,728</td>
</tr>
<tr>
<td>Total Votes</td>
<td>79,062</td>
</tr>
</tbody>
</table>


This is slightly confusing but a “No” vote on Ballot 200 signaled opposition to repealing ordinances and regulations that had opened the door to recreational marijuana cultivation, product manufacturing and retail sales in Pueblo County. To vote “No” meant that the voter was expressing support for recreational cannabis.
TABLE 7: 2016 Election Results in the City of Pueblo for Ballot Measure 300

<table>
<thead>
<tr>
<th></th>
<th>Votes</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>18,479</td>
<td>39.00%</td>
</tr>
<tr>
<td>NO</td>
<td>28,872</td>
<td>60.09%</td>
</tr>
<tr>
<td><strong>Total Votes</strong></td>
<td><strong>47,351</strong></td>
<td></td>
</tr>
</tbody>
</table>


Given the persistent pattern of voter support for legal cannabis in Pueblo, it is possible to say that the majority of Puebloans do not object to living in a community where both medical and recreational cannabis are legal (Rodgers, 2017). Nor is there indication that legal cannabis dissuades new residents from migrating to Pueblo (Rothenberg, 2015).

Population dynamics are complicated and it would be imprudent to attribute Pueblo’s recent population increases to Pueblo’s support for legal cannabis (KRDO Staff, 2017). Since 1990, Pueblo County’s population growth has been consistent with steady population growth throughout Colorado (Njegomir, 2016). The passage of Amendment 64 in 2012 has not had a noticeable impact on Pueblo’s population trajectory. This suggests that the factors that have attracted residents to Pueblo prior to cannabis legalization hold the same appeal for Puebloans after cannabis legalization. We found no evidence that legal cannabis has dissuaded residents from living in, or moving to Pueblo.

GRAPH 8: Factors Affecting Pueblo County Population from 1970–2015


It is noteworthy that, as illustrated in Graphs 1 and 8, Pueblo’s population decreased from the mid-1970s until 1990. This decrease corresponds with the phenomenon of deindustrialization that had a devastating impact on many communities across the USA (Schechter, 2000). Layoffs at the Colorado Fuel and Iron Corporation dealt a severe blow to Pueblo’s economy; many Pueblo residents had little choice but to seek their fortunes elsewhere. Fortunately, Pueblo is a resilient community (McGettigan, 2016). By the early 1990s, Pueblo had begun to find its footing in the new economy. This took the form of urban revitalization initiatives (Davies, Bree, 2013) that have, for instance, transformed Pueblo into a hub of artistic and creative industry on the Colorado Front Range (Robinson, 2017a).
Coming more than twenty years after Pueblo had embarked on its post-industrial recovery, legal cannabis has contributed to an economic recovery that was already well underway in Pueblo (Wilson, 2017). The fact that it is late-arriving in no way diminishes the contribution that legal cannabis is making to Pueblo’s economic recovery (Robinson, 2017). There is evidence that legal cannabis is helping to attract and retain new generations of Puebloans. For more than a century, Pueblo has attracted migrants from all over the world (McGuire and Reckner, 2003). That Pueblo has long been a destination for migrants is reflected in the ethnic diversity that Pueblo celebrates to this very day.

### TABLE 10: Ethnicity in Pueblo County in 2015

<table>
<thead>
<tr>
<th>Hispanic Or Latino And Race</th>
<th>Estimate</th>
<th>Margin of Error</th>
<th>Percent</th>
<th>% Margin of Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population</td>
<td>161,519</td>
<td>*****</td>
<td>161,519 (X)</td>
<td></td>
</tr>
<tr>
<td>Hispanic or Latino (of any race)</td>
<td>68,312</td>
<td>*****</td>
<td>42.3%</td>
<td>*****</td>
</tr>
<tr>
<td>Mexican</td>
<td>45,678</td>
<td>+/-1,361</td>
<td>28.3%</td>
<td>+/-0.8</td>
</tr>
<tr>
<td>Puerto Rican</td>
<td>1,642</td>
<td>+/-524</td>
<td>1.0%</td>
<td>+/-0.3</td>
</tr>
<tr>
<td>Cuban</td>
<td>226</td>
<td>+/-121</td>
<td>0.1%</td>
<td>+/-0.1</td>
</tr>
<tr>
<td>Other Hispanic or Latino</td>
<td>20,766</td>
<td>+/-1,310</td>
<td>12.9%</td>
<td>+/-0.8</td>
</tr>
<tr>
<td>Not Hispanic or Latino</td>
<td>93,207</td>
<td>*****</td>
<td>57.7%</td>
<td>*****</td>
</tr>
<tr>
<td>White alone</td>
<td>85,629</td>
<td>+/-140</td>
<td>53.0%</td>
<td>+/-0.1</td>
</tr>
<tr>
<td>Black or African American alone</td>
<td>2,826</td>
<td>+/-194</td>
<td>1.7%</td>
<td>+/-0.1</td>
</tr>
<tr>
<td>American Indian and Alaska</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Native alone</td>
<td>814</td>
<td>+/-190</td>
<td>0.5%</td>
<td>+/-0.1</td>
</tr>
<tr>
<td>Asian alone</td>
<td>1,062</td>
<td>+/-115</td>
<td>0.7%</td>
<td>+/-0.1</td>
</tr>
</tbody>
</table>

Native Hawaiian and Other Paciﬁc Islander alone 54 +/-59 0.0% +/-0.1
Some other race alone 239 +/-145 0.1% +/-0.1
Two or more races 2,583 +/-304 1.6% +/-0.2
Two races including some other race 50 +/-45 0.0% +/-0.1
Two races excluding some other race, and Three or more races 2,533 +/-300 1.6% +/-0.2

Source: U.S. Census Bureau, 2011–2015 American Community Survey 5-Year Estimates

In the early 20th century, work in the mines and steel mill drew laborers from across the globe to southern Colorado (Rees, 2010). As was the case in many American communities, immigrants brought cultural traditions that enriched southern Colorado’s ethnic stew. Valuable as their contributions may have been Pueblo did not always extend a friendly welcome to migrants (Rees, 2007).

IMAGE 1: Replica of Sign Conveying Anti-Immigrant Bias at Pueblo Union Depot Train Station

In the past and present, newly-arriving immigrants have encountered xenophobia and other hardships in southern Colorado. Immigrants are easy targets and often serve as convenient scapegoats for deeply-rooted community problems (Zinn, 1990). One can ask if any of this applies to today’s cannabis migrants. Colorado has long been a destination for migrants thanks to abundant economic opportunities and Colorado’s aesthetic beauty. That was true in the early days of the industrial revolution, and it remains true to this day.
IMAGE 2: Migration in Colorado Counties from 1970–2015


Migration, Cannabis and Education

In contrast with the perspective which suggests that migrants drain communities of limited social resources, Colorado has long been a preferred destination for hard-working manual laborers and college-educated professionals (Cotton, 2017). Despite Colorado’s general lack of financial support for higher education (Cooper, 2017), Colorado remains one of the states with the highest per capita residents of college-educated professionals. This means that, instead of migrating to Colorado and depleting the state’s limited resources, a steady stream of college-educated migrants bring valuable social, cultural and economic capital to Colorado. College-educated migrants elevate Colorado’s standard of living for new and old residents alike (Frank, 2017).

At present, Pueblo does not boast as many high school and college graduates as Colorado’s more affluent counties. In an effort to narrow that education gap, Pueblo County has become the first locality in the world to fund college scholarships with cannabis tax revenues (Hondros, 2017). At present, cannabis scholarships are available to residents of Pueblo County who have graduated from Pueblo County high schools and who attend either CSU-Pueblo or Pueblo Community College. In 2017, Pueblo County funded more than 400 such scholarships (Robinson, 2017b). This investment should help increase the number of college graduates in Pueblo and, as a result, positively impact the quality of life for everyone in Pueblo.

<table>
<thead>
<tr>
<th>TABLE 11: Female Educational Attainment for Those 25 Years and Over</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Colorado</strong></td>
</tr>
<tr>
<td>Female:</td>
</tr>
<tr>
<td>No schooling completed</td>
</tr>
<tr>
<td>Nursery to 4th grade</td>
</tr>
<tr>
<td>5th and 6th grade</td>
</tr>
<tr>
<td>7th and 8th grade</td>
</tr>
</tbody>
</table>
9th grade 0.5±0.1% 1%±0.5% 0.8±0%
10th grade 0.6±0.1% 1.9±0.7% 0.9±0%
11th grade 0.7±0.1% 1.6±0.6% 1%±0%
12th grade, no diploma 0.6±0.1% 0.5±0.3% 0.8±0%
High school graduate (includes equivalency) 10.6±0.3% 13.3±1.4% 13.9±0%
Some college, less than 1 year 3.3±0.2% 3.3±0.7% 3.3±0%
Some college, 1 or more years, no degree 7.8±0.2% 9.5±1.2% 7.6±0%
Associate’s degree 4.4±0.2% 7.5±1.1% 4.7±0%
Bachelor’s degree 12.7±0.2% 7.4±0.9% 10%±0%
Master’s degree 5.7±0.2% 3.4±0.7% 4.6%±0%
Professional school degree 1%±0.1% 0.3±0.2% 0.8±0%
Doctorate degree 0.7±0.1% 0.2±0.1% 0.6±0%


<table>
<thead>
<tr>
<th>TABLE 12: Male Educational Attainment for Those 25 Years and Over</th>
<th>Colorado</th>
<th>Pueblo County</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male:</td>
<td>49.6±0.1%</td>
<td>48.6±0.4%</td>
<td>48.3±0%</td>
</tr>
<tr>
<td>No schooling completed</td>
<td>0.4±0.1%</td>
<td>0.5±0.3%</td>
<td>0.7±0%</td>
</tr>
<tr>
<td>Nursery to 4th grade</td>
<td>0.2±0%</td>
<td>0.2±0.2%</td>
<td>0.4±0%</td>
</tr>
<tr>
<td>5th and 6th grade</td>
<td>0.6±0.1%</td>
<td>0.2±0.1%</td>
<td>0.8±0%</td>
</tr>
<tr>
<td>7th and 8th grade</td>
<td>0.6±0.1%</td>
<td>0.8±0.4%</td>
<td>0.9±0%</td>
</tr>
<tr>
<td>9th grade</td>
<td>0.5±0.1%</td>
<td>0.6±0.3%</td>
<td>0.8±0%</td>
</tr>
<tr>
<td>10th grade</td>
<td>0.7±0.1%</td>
<td>1.5±0.7%</td>
<td>1%±0%</td>
</tr>
<tr>
<td>11th grade</td>
<td>0.8±0.1%</td>
<td>1.5±0.6%</td>
<td>1.1±0%</td>
</tr>
<tr>
<td>12th grade, no diploma</td>
<td>0.7±0.1%</td>
<td>0.9±0.4%</td>
<td>0.9±0%</td>
</tr>
<tr>
<td>High school graduate (includes equivalency)</td>
<td>11.1±0.2%</td>
<td>15.6±1.5%</td>
<td>13.7±0%</td>
</tr>
<tr>
<td>Some college, less than 1 year</td>
<td>3±0.1%</td>
<td>3.8±0.9%</td>
<td>2.9±0%</td>
</tr>
<tr>
<td>Some college, 1 or more years, no degree</td>
<td>7.9±0.2%</td>
<td>8.9±1.1%</td>
<td>7%±0%</td>
</tr>
<tr>
<td>Associate’s degree</td>
<td>3.8±0.1%</td>
<td>3.9±1%</td>
<td>3.5±0%</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>12.1±0.2%</td>
<td>6.9±1%</td>
<td>9.1±0%</td>
</tr>
<tr>
<td>Master’s degree</td>
<td>4.9±0.2%</td>
<td>2.3±0.5%</td>
<td>3.6±0%</td>
</tr>
<tr>
<td>Professional school degree</td>
<td>1.3±0.1%</td>
<td>0.5±0.2%</td>
<td>1.1±0%</td>
</tr>
<tr>
<td>Doctorate degree</td>
<td>0.9±0.1%</td>
<td>0.6±0.3%</td>
<td>0.8±0%</td>
</tr>
</tbody>
</table>

**Short-Term Migration: Cannabis Tourism**

Cannabis tourists are short-term visitors who contribute millions of dollars to Colorado’s economy (Blevins, 2015). Just as Las Vegas attracts many gamblers who wish to circumvent hometown gaming restrictions, cannabis tourists travel to Colorado to sidestep hometown cannabis restrictions (Salo, 2015). The economic impacts of cannabis tourism are substantial and increasing. The flood of cannabis tourists has created an accompanying flood of new jobs, new business and new tax revenues for Colorado (Ingraham, 2016).

In addition to vacation-length visits, in recent years Colorado has topped the list of destinations for interstate migrants. The only state which has experienced a higher rate of interstate migration is North Dakota (Murphy, 2016). Historic numbers of Americans have been drawn to the fracking-fueled energy boom in North Dakota, while legal cannabis has helped make Colorado the second-most desirable destination for interstate migrants.

Substantial as interstate migration numbers are, they pale in comparison to the numbers of Coloradans who are migrating *within the state*. Front Range communities have been undergoing an economic boom, but that boom has not yet reached rural communities (Simpson, 2017). Coloradans who are eager to improve their economic status have been migrating in large numbers to the Front Range.

---


![Image 3](https://demography.dola.colorado.gov/ComponentsOfChange/)

In Image 3, gray and blue-shaded counties denote regions where population is shrinking. Yellow and orange-shaded areas highlight counties where population is increasing. This image provides an illustration of the ebbs and flows of population since Colorado legalized medical cannabis in 2000. Counties that evidence declining populations tend to be rural, whereas the fastest growing counties tend to be Front Range urbanized counties (Frank, 2017).

In-state population shifts have contributed to, as of 2017, a much tighter real estate market throughout the Front Range (Svaldi, 2017a). For those who are either renting or selling real estate, increased property values are a welcome sign of prosperity, but this situation also has a downside. High rents and tighter housing markets intensify economic pressure on those of limited means (Svaldi, 2017b). While Colorado’s legal cannabis economic boom is generating new economic opportunities for many, in localities where wages...
and income remain stagnant, the booming economy can cause housing crises and other woes (Garrison, 2017). The somewhat counterintuitive relationships between cannabis-derived affluence and poverty—particularly as they impact Pueblo County—are described in the homelessness and poverty section of the Impact Study.

**The Impact of Legal Cannabis on Household Income**

Household income in Pueblo continues to lag far behind that of other Front Range communities (Schueler, 2017). Counterintuitively, household income in Pueblo has decreased in the years since Amendment 64 passed. Given that legal cannabis is among the most profitable cash crops in the world (Misulonas, 2017) it is reasonable to expect cannabis legalization to increase household incomes in Pueblo County. However, until as recently as 2015, household incomes in Pueblo have continued to fall.

**GRAPH 13: 2015 Median Household Income in Pueblo and Selected Front Range Counties**

![Graph showing median household income comparison](image)

**Source:** Colorado State Demography Office and American Community Survey 2011–2015

Passage of Amendment 64 opened the door to new legal cannabis investment, jobs and businesses in Pueblo. There is often a substantial lag between new investments and increased household incomes (Du, 2017). Pueblo has taken the lead in embracing Colorado’s new legal cannabis economy. Pueblo’s leaders must ensure that Pueblo’s hard-working residents benefit from the wealth that legal cannabis generates.


![Graph showing inflation adjusted median household income](image)

**Source:** Census ACS, [https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml](https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml)
The disparities illustrated in Graph 14 are striking. Household incomes for Puebloans follow a dramatically different trajectory than statewide and nationwide averages (Riccardi, 2017). Household incomes in Pueblo fall tens of thousands of dollars below statewide and nationwide averages. For each demographic group in Graph 14, we see an increase in household income between 2006–2008 followed by a precipitous decline. The increase from 2006–2008 is in part a result of financial speculation in an excessively deregulated home mortgage market. The precipitous decline that follows depicts the Great Recession (Grusky, et al, 2011) that resulted when the housing market’s financial bubble burst (Lewis, 2010).

Beginning in approximately 2012 we see household incomes rebounding in Colorado and throughout the US; however, we do not see the same rebound in Pueblo. Clearly, Pueblo’s economy has not yet achieved the kind of resiliency that can insulate the community from severe economic shocks (Fried, 2017). Given that Pueblo’s economic status was weaker before the onset of the Great Recession, it stands to reason that Pueblo would undergo a slower recovery from the Great Recession.

Why Pueblo’s household income would continue to decline in the years following cannabis legalization is more mysterious. It is possible that this decline is a consequence of the dissonance between state vs. federal cannabis regulations. Federal banking prohibitions require the majority of legal cannabis businesses to operate in a cash-only financial environment (Seefried, 2016). Employees who have been paid in cash might be less likely to report their earnings—particularly in an environment wherein the federal government characterizes paid employment in the cannabis industry as a federal crime.


![Graph showing per capita income over time for Pueblo, Colorado, and the US.]

Source: Census ACS, https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

We witness a similar range of disparities when examining per capita income. Wage-earners in Pueblo bring home substantially less income than their statewide and nationwide counterparts. These findings provide support for initiatives undertaken by Pueblo County to attract higher quality jobs to Pueblo. It is difficult to make headway against the income disparities illustrated in Graphs 14 and 15 if wage-earners can only apply for minimum wage jobs. This is likely why Pueblo’s political and economic leaders have expressed interest in transforming Pueblo into the Napa Valley or Silicon Valley of Cannabis (LaPook, 2016). It remains to be seen if such a stretch goal is achievable.

**Cannabis Use Among Adolescents and the Elderly**

Concerns have been raised about the dangers of cannabis use among adolescents (Hopfer, 2014). Studies have revealed that adolescents can experience long-term negative health consequences as a result of consuming cannabis (Squeglia et al., 2009), including addiction, criminal behavior and cognitive deficits. Opponents of
cannabis legalization have expressed fear that cannabis use will increase among adolescents in states that have legalized cannabis. Surprisingly, the National Survey on Drug Use and Health revealed that cannabis use has declined among 12- to 17-year-olds in the years since cannabis was legalized (Ingraham, 2017). While adolescent use has declined, cannabis use among adults has increased. That is not too surprising given that adult-use of medicinal and recreational cannabis has been legalized in many states across the US.

### Graph 16: Rates of Past-Month Cannabis Use, 1990–2016

[Graph showing trends in cannabis use from 1990 to 2016]


Perhaps the most surprising finding from the National Survey on Drug Use and Health is the phenomenon of increased cannabis consumption among elderly Americans, “the number of people age 65 and up who said they use marijuana grew 250 percent between 2006 and 2013” (Ehrenfeld, 2017). Researchers speculate that adults experience more pain management issues as they grow older. Cannabis is widely reported to help with chronic pain management, and there is evidence that an increasing number of elderly Americans are consuming cannabis to manage chronic pain and other aging-related pain and health issues (Gannon, 2017).

### Conclusion

More than some communities, Pueblo has welcomed the advent of legal cannabis. From the data in this section, since passage of Amendment 64 little has changed in Pueblo demographics. The population characteristics that defined Pueblo prior to cannabis legalization have remained largely unchanged in its wake. Pueblo’s population has increased since the passage of Amendment 64, but the rate of population increase has remained roughly unchanged before and after cannabis legalization.

Some have argued that Pueblo has been inundated by migrants since cannabis has been legalized; we found no direct quantifiable evidence to support that perspective. Out-of-state migrants to Colorado generally bring college degrees, experience and affluence that enriches Colorado. To the extent that Colorado’s new “Green Rush” attracts migrants, without further investigation that demographic phenomenon operates to Colorado’s economic advantage.

Legal cannabis has not yet had an observable impact on Pueblo’s household incomes. It is possible that the enduring federal prohibition shrouds the true impact of legal cannabis on Pueblo’s household incomes. This is a phenomenon that requires more investigation.
Recommendations
Since the passage of Amendment 64, legal cannabis has consistently generated substantial new revenues throughout Colorado. There likely has been sufficient time for cannabis revenues to observably impact Pueblo’s household incomes. Pueblo’s political and economic leaders should carefully monitor household incomes to ensure that all Puebloans derive economic benefits from Pueblo’s legal cannabis economy.

Pueblo has a long tradition of welcoming migrants to its community. Legal cannabis is attracting a new generation of migrants to Pueblo, and Pueblo has much to gain by welcoming legal cannabis migrants.

Educational achievement in Pueblo lags behind Colorado’s more affluent counties. In an increasingly information-driven world, higher educational achievement is among the most important keys to increase affluence and quality-of-life. Thus, Pueblo County should retain and strengthen its cannabis-funded college scholarship program.

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Social Impacts 2: The impact of legal cannabis on poverty and homelessness in Pueblo County

Abstract
Poverty is a state of economic distress. In the US, measures of poverty are standardized by the federal government (Harrington, 1997). Poverty and homelessness are related, but they are distinct demographic phenomena. There are many poor Americans who are not homeless. Homelessness is caused by a combination of a crisis-inducing economic shock and a lack of affordable housing (Burnes and DiLeo, 2016). The most severely housing-challenged Americans spend 87% of their annual incomes on housing (Burnes and DiLeo, 2016, p. 3). According to Don Burnes, the Executive Director of the Burnes Center on Poverty and Homelessness, for many impoverished families, an unanticipated expense of $400 (Taylor, 2017) is sufficient to trigger a plunge into homelessness.

We found no evidence that poverty has either increased or decreased in Pueblo as a result of cannabis legalization. There is evidence that homelessness in Pueblo has increased recently. Apart from anecdotal reports, we did not find definitive evidence that links increased homelessness to legal cannabis. (We do use some anecdotal information to assist with projections on costs incurred by increased homelessness attributable to cannabis, as a way to provide a cost estimate, in the section on economic impacts.) Instead, disconnected utilities reportedly from more than 7,000 Pueblo homes in 2016 has been cited as the largest single cause of homelessness in Pueblo, "It's the number one reason families are becoming homeless in our community" (Girardin 2016).

Introduction
Since the passage of Amendment 64, poverty has neither increased nor decreased in Pueblo (see Graph 1). Poverty rates are persistently higher in Pueblo than in the rest of Colorado (See Graph 2). Thus far, legal cannabis has not reduced poverty disparities between Pueblo and more affluent Colorado counties. Nor has legal cannabis enlarged those disparities.

There is evidence that homelessness, which is caused by combination of personal or systemic economic crises and a lack of affordable housing (Burnes and DiLeo, 2016), has increased in Pueblo in recent years. The 2017 Point in Time Study indicates that Pueblo has higher rates of homelessness than other Colorado counties (see Graph 3). Some have argued that legal cannabis is the cause of exploding rates of homelessness in Pueblo (Harrison, 2017), but we found no evidence to support that argument.

Homelessness experts point out that there’s no proof that marijuana leads to homelessness, or that cannabis is the main culprit behind the growing numbers. Study after study has concluded that the major factors leading to homelessness are a lack of affordable housing, inability to find work and family crises (Warner, 2016).

Cannabis is legal throughout Colorado. It seems difficult to argue that legal cannabis is the exclusive reason for increased homelessness in Pueblo, while it decreases homelessness in other counties. Other factors must be considered to determine what is driving Pueblo’s increase in homelessness.

Counterintuitively, Colorado’s legal cannabis economic boom may be one source of increasing homelessness along the Front Range (Alderman, 2017). The legal cannabis “green rush” has dramatically increased Front Range rents and property values (Armbrister, 2017). While that may be good news for landlords, Front Range wages have not kept pace with the cost of living (Burke and Acuna, 2017). Consequently, hourly wage earners are having a difficult time keeping a roof over their heads (Aguilar, 2017). Unaffordable housing in Denver has created spillover pressures on housing markets throughout the Front Range.

Homelessness among military veterans has been decreasing throughout most of the US (McDermott, 2017).
In Colorado, however, the rate of homelessness among veterans has been increasing (Mitchell, 2016). This might be because veterans are migrating to Colorado in large numbers to obtain legal cannabis as a PTSD medication (See Graph 4). Colorado recently added PTSD to the list of ailments for which individuals can qualify for a medical cannabis card (Gray, 2017). Being a federal agency, the VA still rejects cannabis as a legitimate PTSD medicine (Cohen, 2017). The dissonance between state and federal law might contribute to increased homelessness among veterans.

Cannabis refugees have a real but unknown impact on homeless statistics in Pueblo (Newton, 2016). Cannabis refugees are people who cross state lines to acquire cannabis to treat their own or loved ones’ illnesses. Cannabis refugees maintain a low profile in order to avoid legal entanglements (Ciaramella, 2015). The enduring federal prohibition on cannabis is the root cause of homeless cannabis refugees.

The largest source of homelessness in Pueblo may be utility-related (Paulson, 2016).

"It's the number one reason families are becoming homeless in our community," explained Posada director Anne Stattelman. "The number one reason people are living in motel rooms as permanent housing, because they cannot afford utilities" (Girardin 2016).

**Research Methods**

Due to time constraints, the investigator was unable to conduct in-depth original analyses of poverty and homelessness in Pueblo County. Instead, the investigator carried out a systematic analysis of Pueblo County’s poverty and homelessness profile by interrogating population statistics that have been collected by the U.S. Census, the Colorado State Demography Office, and the Pueblo County demography archive.

**Discussion**

Poverty is a state of economic distress (Haymes, et al., 2015). There is a widespread tendency to blame poverty on the presumptive character flaws of the poor (Katz, 2013). However, the wealthy exhibit character flaws also (McCall, 2013). What the poor lack that the rich have in abundance is money. Therefore, poverty is best understood as a deficiency of economic resources.

As in many communities, poverty is a persistent problem in Pueblo (Wallace, 2016). Of late, there have been neither dramatic increases nor decreases in the number of impoverished Puebloans. Based upon available poverty figures, there is no indication that legalized cannabis has had either a positive or negative impact on Pueblo’s poverty rate. As of 2015, investments in legal cannabis (Du, 2017) and new jobs in the cannabis industry have not put a dent in the Pueblo’s poverty rate.

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**GRAPH 1: Population and Number of Poor in Pueblo County, 2012–2015**

There is evidence that poverty rates are higher in Pueblo than in other Colorado counties (Schueler, 2017). There is also some indication that, in recent years, child poverty rates have declined in Colorado at twice the pace of national averages (Worthington, 2017). More data are required to clarify the nature of that trend. We found no evidence that child poverty has increased in either Pueblo or Colorado as a consequence of legalizing cannabis.

Graph 2: Child Poverty Rate in Pueblo County (ages 18 and under)


In spite of the indifferent impacts of legal cannabis on poverty, some have argued that homelessness, which is caused by a combination of personal or systemic economic crises and a lack of affordable housing (Burnes and DiLeo, 2016), has increased as a result of cannabis legalization (Harrison, 2017). Even though homelessness can often be difficult to detect, there is evidence that homelessness has significantly increased in Pueblo County.

In most cities, it is easy to see that homelessness is a problem. Lines of desperate looking people circle soup kitchens waiting for a meal. Homeless people beg for money at street corners, or fill public spaces such as parks or libraries. It is not like that in Pueblo County. For many of us, it is easy to live here for years without knowingly encountering a homeless person. And yet, we have people without homes in Pueblo (Posada Annual Report, 2016, p. 1).

The large number of Pueblo’s homeless population is illustrated by the 2017 Colorado Point in Time Study.
GRAPH 3: Colorado Balance of State: Point in Time Study, 2017—Number of Respondents by County*


Compared to many other non-metro Colorado counties, Pueblo’s homeless population is clearly substantial. Some have argued that Pueblo’s increase in homelessness is due to the undesirable consequences of legalizing cannabis.

"This is the continuation of a three-year trend," [Anne Stattelman, Executive Director of Posada] said. "Every year we’ve seen a doubling of people coming to us for help. Last year we served 7,800 individuals. That’s the most ever in our history. Around 2,700 of them probably qualify as full-time homeless." Stattelman said a third of that number are people from other states drawn to Pueblo by legalized marijuana, the hope of employment, good weather and expanded Medicaid benefits. She said 800 people in the city have listed marijuana—either using it or working in a related industry—as a reason for being in Pueblo. "They may be low-income and not homeless when they get here," she said. "But they soon become homeless because they don’t have jobs and have no place to live. Our problem in Pueblo is that we’re a poor community, we don’t have a lot of employment (and) we certainly don’t have the housing infrastructure" (Harrison, 2017).

One difficulty in determining the extent to which homelessness can be attributed to legal cannabis is that cannabis has been legalized throughout Colorado. If legal cannabis increases homelessness in Pueblo, then it should do likewise in other counties, but that is not what we observe. By itself, legal cannabis cannot explain high rates of homelessness in Pueblo and low rates in other Colorado counties. One or more additional factors must be driving the increase in Pueblo’s homeless population.
The Downside of Cannabis Affluence

A recent press release from the Colorado Coalition for Homelessness, “No Affordable Housing Available in Colorado for Minimum Wage Workers” (Alderman, 2017) helps explain escalating homelessness in the midst of Colorado’s legal cannabis economic boom. In the years since cannabis has been legalized, the real estate market in Colorado—and in Denver in particular—has skyrocketed (Armbrister, 2017). High rents might be great for real estate brokers, but for hourly wage earners exorbitant rent can be a budget-buster.

Though Colorado’s newest green revolution has generated vast new wealth for many (Borchardt, 2017), not everyone has benefited. The Colorado Coalition for Homelessness argues that wages have not kept pace with rapidly increasing housing costs in Colorado.

“The rental housing market in Denver truly is out of reach for so many in our community. As rent and home prices continue to rise, more and more families are experiencing homelessness. Working families are now living on the streets,” said John Parvensky, President and CEO of the Colorado Coalition for the Homeless. “Building more affordable housing is more critical than ever for low and extremely-low income families and individuals in our Colorado communities.”

In Colorado where the minimum wage is just $9.30 an hour, a family must have either almost 2.5 full-time wage earners or one full-time earner working 95 hours per week in order to afford a modest two-bedroom apartment. Data from the report shows that the typical renter in Colorado earns about $17.13 per hour, which is still almost $5.00 less than the hourly wage needed to afford a modest unit (Alderman, 2017, emphasis in original).

Severe housing pressures in Denver (Milkman, 2015) have an impact on other Front Range communities. If wage earners are being priced out of housing in Denver (Aguilar, 2017), then they have little choice but to live in the streets or seek affordable housing in other communities. In circumstances where wages lag behind skyrocketing housing costs there will inevitably be increases in the number of people who become homeless (Kovaleski, 2017). Thus, Denver’s housing crunch could easily create spillover housing challenges in many other Front Range communities (Fontenay, 2017).

Cannabis, PTSD and Homeless Veterans

The Colorado Coalition for the Homeless states:

Veterans are overrepresented among the homeless population. It is estimated that veterans represent nine percent of the total homeless population. Homeless veterans tend to be male (91 percent), single (98 percent), live in a city (76 percent), and have a mental and/or physical disability (54 percent) (https://www.coloradocoalition.org/veterans).

Further, the Denver Post recently reported that veterans are becoming homeless at a higher rate in Colorado than anywhere else in the US (Mitchell, 2016). Thanks to aggressive housing programs the number of homeless veterans in many states has been decreasing in recent years (McDermott, 2017). Even as the number of homeless veterans has decreased in many states, the number of homeless veterans in Colorado has increased (Verlee, 2016).

There is evidence that veterans might be journeying to Colorado to purchase legal cannabis (Gazette Editorial Board, 2016a). Veterans who suffer from post traumatic stress disorder (PTSD) have reported that cannabis is helpful in managing the life-threatening symptoms associated with PTSD (Carlson, 2017).

PTSD is a very serious health problem among military veterans. The Veterans Administration estimates that, on average, 22 veterans commit suicide every day as a consequence of unmanageable PTSD-related stress (Shane and Kime, 2016). The VA devotes enormous resources to helping veterans fight PTSD, but many veterans have complained that the VA’s preferred treatments are ineffectual. Indeed, some veterans have argued that the PTSD treatments prescribed by the VA might actually worsen PTSD symptoms.
The VA acknowledges that there is preliminary evidence which suggests that cannabis may be an effective PTSD-fighting medication:

- The belief that marijuana can be used to treat PTSD is limited to anecdotal reports from individuals with PTSD who say that the drug helps with their symptoms. There have been no randomized controlled trials, a necessary "gold standard" for determining efficacy. Administration of oral CBD has been shown to decrease anxiety in those with and without clinical anxiety (Crippa, et al, 2009). This work has led to the development and testing of CBD treatments for individuals with social anxiety (Bergamaschi, et al, 2011), but not yet among individuals with PTSD. With respect to THC, one open trial of 10 participants with PTSD showed THC was safe and well tolerated and resulted in decreases in hyperarousal symptoms (Roitman, et al, 2014). (Bonn-Miller and Rousseau, 2017).

In spite of acknowledging the potential benefits of cannabis, the VA does not recommend cannabis as a PTSD medication. In fact, the VA officially treats cannabis consumption as a form of substance abuse:

- Treatment providers should not ignore marijuana use in their PTSD patients. The VA/DoD PTSD Clinical Practice Guideline (2010) recommends providing evidence-based treatments for the individual disorders concurrently. PTSD providers should offer education about problems associated with long-term marijuana use and make a referral to a substance use disorder (SUD) specialist if they do not feel they have expertise in treating substance use.

An important reason that the VA opposes cannabis as a PTSD medication is that the DEA still officially lists cannabis as a Schedule 1 drug.
Marijuana is a Schedule I substance under the Controlled Substances Act. Schedule I drugs are classified as having a high potential for abuse, no currently accepted medical use in treatment in the United States, and a lack of accepted safety for use of the drug or other substance under medical supervision (Drug Enforcement Administration, 2017).

As long as the DEA lists cannabis as a schedule 1 drug that has “no currently accepted medical use” the VA will remain obligated to reject cannabis as a PTSD treatment (Cohen, 2017). Federal authorities resist efforts to consider cannabis as a legitimate medication (Boeri and Lamonica, 2017).

This creates a conundrum for veterans who struggle daily with the misery of PTSD (Gaffey, 2017). Many veterans argue that cannabis is the only thing that prevents them from becoming one of the 22 unfortunate soldiers who take their own lives each day (Evan and Rosenblatt, 2017). Veterans who disregard the VA’s cannabis prohibition put themselves at risk of having their military benefits “modified” (Antonacci, 2016, Lee, 2014).

Although VA doctors cannot recommend marijuana as medicine to their patients, the VA does not explicitly ban patients from participating in state marijuana programs. Per VA’s policy, a veteran who reports marijuana use to their doctor cannot have his or her VA benefits taken away. But patients can have their treatments "modified" (Lee, 2014).

Veterans support groups have pushed back against the VA’s prohibition of cannabis. In 2017, the Colorado Legislature added PTSD to the official list of illnesses for which Colorado residents can qualify for medical cannabis cards (Gray, 2017). Important as this legislative breakthrough may be, Colorado cannabis law remains in conflict with federal law. Since the VA is a federal agency, the VA will remain obligated to treat cannabis as a Schedule 1 drug. Until the DEA de-schedules cannabis (Wentling, 2017), veterans who consume cannabis will face the threat of unknown modifications to their VA medical benefits.

**Cannabis Refugees and Homelessness**

Differences in the legal status of cannabis from one state to the next have given rise to an entirely new form of homelessness. Cannabis refugees are people who cross state lines in order to purchase cannabis legally (Newton, 2016). Cannabis refugees might purchase cannabis for themselves, or they might purchase cannabis for loved ones.

Many cannabis refugees travel in recreational vehicles and, as a result, do not comply with typical profiles of homeless Americans (Jaeger, 2016). Cannabis refugees are difficult to identify because they wish to remain invisible. The legality of crossing state lines to purchase and consume cannabis remains dubious (Hubbard, 2013). There have been enough cases of cannabis refugees receiving harsh punishments to make this group of homeless Americans skittish about publicity (Newton, 2016). In particular, parents who live in states where cannabis is illegal, and who cross state lines to obtain cannabis for their desperately ill children, face the threat of prosecution for the treatment of loved ones with a Schedule 1 drug (Ciaramella, 2015).

Cannabis refugees exist throughout Colorado (Ciaglo, 2014) and some even call Pueblo their adopted home. Indeed, a group of Pueblo-based cannabis refugees has created a logo to generate awareness of their plight.
At present, the number of cannabis refugees in Pueblo remains unknown. As long as state and federal laws pertaining to cannabis remain in conflict, it is likely that cannabis refugees will remain assiduously off-the-radar. Nevertheless, cannabis refugees do exist and they have an unknown impact on homeless statistics in Pueblo.

**Local utilities and Homelessness**
Perhaps the most prolific source of homelessness in Pueblo is utility costs.

Anne Stattelman, director of Posada, said that the high rates put an undue burden on her homeless agency and other service agencies. She said unlike other companies, Black Hills Energy disconnects electrical services in sub-zero temperatures. After being disconnected, the company charges 3–4 times the amount of a bill due in deposits and fees, sometimes forcing families to become homeless because they can’t afford to reconnect. She said that there isn’t one agency in town that has assistance for residents who are shut off (Paulson, 2016).

In 2016, Pueblo community members organized a series of public meetings and protests to raise concerns about the unusually high number of utility disconnections, reportedly affecting more than 7,000 homes in 2016 alone (McMaklin, 2016).

Hundreds of ratepayers packed into the Pueblo Convention Center on Tuesday and painted the picture of a publicly traded utility financially pillaging a town... The community has some of the highest electric rates in the country, while the median household income is $20,000 below the statewide median... Colorado values do not include imposing some of the highest electric rates in the country on a community that is among the least able to afford them (Gazette Editorial Board, 2016).

Black Hills Energy wants even more money from residential ratepayers in Pueblo, who already report bare cupboards, shutoff notices, evictions and foreclosures related to the company’s high and escalating rates (Gazette Editorial Board, 2017). Posada Director Anne Stattelman attributes increasing rates of homelessness to legal cannabis:

Beginning in 2013 with the rollout of the Affordable Care Act (ACA), Posada and other nonprofits noticed an increase in individuals and families coming into Colorado from non-Medicaid expansion states. This became more noticeable when medical marijuana was legalized and more people from out-of-state applied for their card.
In January 2014 when retail marijuana was available, Posada began to see an explosion in out of state individuals and families relocating specifically to Pueblo and coming to Posada requesting shelter and services. Some of these families had housing and benefits in other states. They assumed that Pueblo's economy would do well with the new marijuana industry. They came to work in the industry and to use marijuana. People did not come to Pueblo to be homeless but they often ended up homeless because of the lack of affordable housing. Increases in the homeless population over the last four years have been consistent and Pueblo’s Point in Time Count from 2017 will show a need to house over 1,200 homeless individuals on any given night.

- In 2013, Posada served 2,444 unduplicated men, women and children
- In 2014, Posada served 3,767 unduplicated men, women and children
- In 2015, Posada served 4,946 unduplicated men, women and children
- In 2016, the agency served more than 7,800 unduplicated men, women and children

(Posada Summary April 24, 2017)

However, apart from anecdotal information, we found no detailed quantitative evidence which establishes a causal connection between cannabis and homelessness (Pompia, 2017). As of 2017, the majority of Americans admit to having consumed cannabis (O’Hara, 2017). Further, the number of Americans who admit to having sampled cannabis has doubled since 2002 (Ossola, 2015). Despite that increase in reported cannabis consumption, we found no evidence that cannabis-consuming Americans are at greater risk of becoming homeless (Lurie, 2013). Thus, it is difficult to assign a precise value to what portion of homelessness in Pueblo can be attributed to cannabis. (We do use some anecdotal data to assist with projections on costs incurred by homelessness attributable to cannabis, as a way to provide a cost estimate, in the section on economic impacts of cannabis later in this report.)

Though there is evidence that homelessness has been increasing in Pueblo, the root cause is not clear.

...Black Hills is asking for an additional $9 million from Pueblo residents, who already pay some of the highest utility rates in the state.

Those high costs are causing real hardships.

"It’s the number one reason families are becoming homeless in our community,” explained Posada director Anne Stattelman. "The number one reason people are living in motel rooms as permanent housing, because they cannot afford utilities" (Girardin 2016).

**Conclusion**

Poverty rates remain high in Pueblo, but poverty rates have neither increased nor decreased as a result of legal cannabis. Pueblo has experienced substantial increases in homelessness. Some attribute increased homelessness to legal cannabis, but we found no clear evidence to unambiguously determine the extent of that claim. Further, cannabis is legal throughout Colorado. It is unclear how to argue to what extent cannabis alone would significantly increase homelessness in Pueblo, but decrease homelessness in other counties.

It is possible that the largest source of homelessness in Pueblo may be attributable to utility costs. In 2016 alone, a local energy provider was reported to have disconnected utilities to more than 7,000 Pueblo homes.

**Recommendations**

Pueblo County should consider the use of cannabis tax revenues to address persistent poverty problems in Pueblo. The Colorado Legislature recently approved such an initiative (Calfas, 2017) and so have other Colorado cities (Goldberg, 2016). Pueblo County has already taken the bold step of funding college scholarships with cannabis tax revenues. Using cannabis tax revenues to build more affordable housing and fund job training programs could also reduce poverty and homelessness in Pueblo. Pueblo County could also use cannabis tax revenues to fund high quality daycare programs. Quality affordable daycare is often
the most significant barrier preventing young parents from re-entering the workforce. Pueblo County can consider addressing the problem of increasing homelessness by working with local energy providers to reduce the number of annual utility disconnections in Pueblo.

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Social Impacts 3: Middle school and high school student cannabis use, prevention, and intervention: post legalization

Abstract
The K12 cannabis study was initiated to find answers to questions raised by the legalization of recreational cannabis in Colorado and in particular, in Pueblo County and southern Colorado. Three areas of inquiry were studied. The first was a secondary data analysis of high school student use and perceptions towards cannabis that compared use and perceptions from 2013 to 2015 between communities in southcentral Colorado that permitted recreational cannabis sales and those communities that did not permit these sales. The second area is a descriptive study of a survey of regional school administrators regarding marijuana prevention education efforts and policies within the regional school districts. The third is planning and preparation activities to support restorative justice practices around marijuana offenses in schools within Pueblo County. The following report is organized into the three areas of inquiry and each will describe more fully the background, methods, results and conclusions of the individual efforts.

Part 1: High school student cannabis use and perceptions towards cannabis in south-central Colorado—comparing communities that permit recreational dispensaries and communities that do not

Abstract
Does permitting recreational cannabis dispensaries in a community affect high school students’ cannabis use, their perceptions towards the accessibility of cannabis, and their perceptions on the harmfulness and wrongfulness of using cannabis? In 2014, recreational cannabis dispensaries were legalized and some Colorado communities permitted recreational dispensaries and others did not. Using data from the Healthy Kids Colorado Survey collected from students in randomly selected high schools in both 2013 and 2015, data on student use and perceptions towards cannabis use was analyzed from communities that permitted recreational cannabis dispensaries and communities that did not. This study uses data collected from high schools in seven different communities in southcentral Colorado, three communities that permitted recreational cannabis dispensaries and four communities that did not. An ANOVA test with a Tukey HSD Post Hoc indicates difference between students in communities that have never permitted recreational cannabis dispensaries and students in communities that opened recreational dispensaries in 2014 in regard to student use, and perceptions towards the harmfulness, wrongfulness, and accessibility of cannabis. There were no statistically significant differences between students in 2013 and 2015 except students in communities that did not permit recreational cannabis dispensaries thought cannabis use was more wrong in 2015 than in 2013.

Introduction
In November 2012, Colorado voters passed Amendment 64, which legalized recreational cannabis for adults 21 years old and above. The ballot measure allowed for the licensing of retail stores, or dispensaries, for the distribution of recreational cannabis. The Amendment also permitted local governments to regulate or prohibit such facilities in their local jurisdiction.

Five years later, debates surrounding the effects of legalized recreational cannabis continue as local governments in Colorado decide whether they should allow recreational cannabis dispensaries in their jurisdiction. In 2016, fifteen municipalities across Colorado held ballot measures related to cannabis regulation (Colorado Municipal League, 2017). Eight communities banned recreational cannabis sales and
seven communities permitted recreational sales. Voters in Pueblo County rejected a ballot question to repeal ordinances that allowed recreational sales of cannabis.

These same debates are not just happening in Colorado but are occurring across the United States. In 2016, California, Maine, Massachusetts, and Nevada joined Colorado, Washington, Oregon and Alaska in permitting recreational cannabis. Each state has given local governments the authority to regulate retail cannabis stores. From Roseville, California (Westrope, 2017) to Braintree, Massachusetts’s (Hinckley, 2016) local governments are debating whether to permit recreational cannabis dispensaries in their communities. Debates about the pros and cons of permitting cannabis dispensaries in a community continue to grow as 14 more states have policy makers seriously working towards full cannabis legalization (Wilder, 2017).

An argument made by the proponents of allowing retail cannabis dispensaries is the economic impact of cannabis sales. The Marijuana Policy Group, a collaborative effort between researchers at the University of Colorado Business Research Division and BBC Research Consulting, found that in Colorado in just the year 2015, Cannabis sales totaled $996 Million, generating $2.39 Billion in economic impact, and creating over 18,000 new Full-Time-Equivalent (FTE) positions. The report claims that demand is expected to grow by 11.3 percent per year through 2020 (Light et al., 2016). At the local level, Pueblo County in southern Colorado generated $763,680 in tax revenues from recreational cannabis sales in 2016 and Denver County reported over $8.2 million in recreational cannabis tax revenue (State of Colorado, 2017).

Advocates for permitting recreational sales also argue the libertarian belief in self-ownership. Individuals, not government, they argue should determine what people do with their bodies (Wilson, 2014). Furthermore, many advocates for legalization state how the impact of regulated legal sales will undercut the black market and criminal activities in a community (Morris, 2014).

On the other side, an argument offered against permitting recreational cannabis dispensaries is the potential negative social impact of these stores. In 2016, Pueblo County ballot Question 200 proposed a repeal of ordinances allowing recreational cannabis sales. Supporters of the Ballot measure said that the recreational cannabis industry had caused an increase in the transient population, higher crime rates, increased emergency room visits, and an unwanted stigma (Citizens for a Healthy Pueblo, 2016). Possibly the biggest concern for supporters of the ballot initiative is the effects that legalized recreational cannabis for adults has on cannabis use by youth. In Palisade, Colorado, former teacher Diane Cox explained, “When you normalize behavior, you see it spread; when you have shop fronts and grow operations, the kids assume that it’s safer and in fact it isn’t,” (Morris, 2016).

Studies have measured youth cannabis use before and after legalized recreational cannabis in Colorado. Brooks-Russell et al. (forthcoming) found that adolescent cannabis use did not increase from 2013 to 2015 despite the opening of recreational cannabis dispensaries across the state in 2014. The authors found a “lack of difference in change by poverty status, minority status, urbanicity, or local policy permitting recreational sales”.

Johnson, Hodgkin and Harris (2017), in a study of 45 states between 1991 and 2011, found that adolescents living in states with medical cannabis laws had higher past 30-day cannabis use compared to those living in non-medical cannabis law states; however, they found no evidence of an increase in adolescent past 30-day cannabis use after enactment of medical cannabis laws. Moreover, the study found that enactment of a medical cannabis law appeared to lessen the odds of adolescent cannabis use. Other studies (Hasin et al., 2015, Wall et al., 2015) similarly do not find that medicinal cannabis laws significantly change adolescent cannabis use.

Another study indicates that a school’s vicinity to a dispensary has no effect on student use. Harpin et al. (2017) found no relationship between adolescent cannabis use and density of recreational cannabis businesses within 5 miles of schools. The Brooks-Russell et al. study also measured adolescent attitudes towards cannabis, including perceived ease of access, perceived wrongfulness of personal use, and perceived risk of harm from regular cannabis use. Brooks-Russell et al. reported that perceived ease of access, perceived
wrongfulness of personal use did not change from 2013 to 2015. However, students’ self-reported that the risk of harm from regular cannabis use declined.

**Our Study**

This study sought to answer the question “does permitting recreational cannabis dispensaries in a community affect high school students’ cannabis use, their perceptions towards the accessibility of cannabis, and their perceptions on the harmfulness and wrongfulness of using cannabis?” Students were surveyed in 2013 before recreational cannabis dispensaries were legalized in Colorado. In 2015, students were surveyed again. During those two years some communities had locally permitted recreational cannabis dispensaries and others had not. Data on students’ cannabis use and their perceptions towards cannabis were collected and then used to compare high school student use and perceptions in communities in southcentral Colorado that had permitted recreational cannabis dispensaries with high school students in those communities that had not permitted dispensaries.

**Methods**

**Sample**

This study used secondary data from Colorado high school students in fall 2013 and fall 2015. The only data used was collected from high schools in southcentral Colorado including schools from Pueblo, Teller, Park, Fremont, Alamosa, Chafee and Conejos Counties.

The data used in this study was collected through the Healthy Kids Colorado Survey (HKCS) of 2013 and 2015. HKCS is a cooperative effort between the Colorado Department of Public Health and Environment (CDPHE) the Colorado Department of Education, and the Colorado Department of Human Services. This survey of secondary students in Colorado is given every two years and has included questions on cannabis since 1999. The HKCS is conducted with methods consistent with the Centers for Disease Control and Prevention’s Youth Risk Behavior Survey. Students from a random sample of selected schools across Colorado and randomly selected classrooms within those schools complete the surveys. Across the state, 15,970 randomly selected high school students from 127 high schools participated in the 2015 state sample. In 2013, statewide 25,197 randomly selected students and 106 schools participated. There was an overall response rate of 47% for high schools in 2015 and 58% in 2013. Students completed self-administered machine-readable questionnaires during a regular class period. Participation was confidential, voluntary, and approved by parents. There were two different modules of the test, A and B that were administered in both 2013 and 2015. Module A included questions on cannabis use and perceptions towards ease of access, harmfulness and wrongfulness, Module B asked about student use but did not ask questions related to perceptions towards cannabis. Approximately half of the students completed Module A and half Module B, meaning all students were asked about cannabis use and only about half were asked about perceptions towards ease of access, harmfulness and wrongfulness.

Our study focused solely on schools in southcentral Colorado. Schools were selected based on their geographic location (southcentral Colorado) and whether the school participated in the survey in both 2013 and 2015. The survey intended to include schools from both southcentral and southeastern Colorado, but no schools participated in both years from the southeastern corner of the state. Our study included 12 high schools in 7 different communities. Three communities permitted and opened recreational cannabis dispensaries in 2014; four communities did not permit recreational cannabis dispensaries. Our HKCS data was collected from 12 high schools (n=3,649 in 2013 and n=2,696 in 2015). The high schools were in communities that permitted recreational cannabis dispensaries in 2014 (n=2,053 in 2013 and n=1,328 in 2015) and communities that have never permitted recreational cannabis dispensaries (n=1,596 in 2013 and n=1,368 in 2015).
Study Measures
To measure student use, students were asked, “During the past 30 days, how many times did you use marijuana?” Students were given the option to select 6 responses: 0 times, 1 or 2 times, 3 to 9 times, 10–19 times, 20–39 times, or 40 or more times. Perception towards cannabis included questions on the ease of access to cannabis, the perceived harm of cannabis, and the perceived wrongfulness of cannabis use. To measure ease of access, students were asked “If you wanted to get some marijuana, how easy would it be for you to get some?” Students could answer, very hard, sort of hard, sort of easy, and very easy. To measure perceived harmfulness, students were asked, “How much do you think people risk harming themselves (physically or in other ways), if they use marijuana regularly?” Students could respond, no risk, slight risk, moderate risk and great risk. A fourth question asked, “How wrong do you think it is for someone your age to use marijuana?” Students could answer, very wrong, wrong, a little bit wrong, and not wrong at all.

Analysis
A one-way ANOVA test with a Tukey HSD Post Hoc test compared the means between the four groups: 1) high school students attending schools in 2013 in communities that have never allowed recreational cannabis dispensaries, 2) high school students in 2013 attending schools in communities that permitted recreational cannabis dispensaries a year later in 2014, 3) high school students attending schools in 2015 in communities that have never allowed recreational cannabis dispensaries, and 4) high school students in 2015 attending schools in communities that permitted recreational cannabis dispensaries a year earlier in 2014.

<table>
<thead>
<tr>
<th>TABLE 1: Four groups used in ANOVA study</th>
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<tbody>
<tr>
<td>2013 High School Students in Communities that did not permit recreational cannabis dispensaries</td>
</tr>
<tr>
<td>2013 High School Students in Communities that did permit recreational cannabis dispensaries</td>
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</table>

Results
There were statistically significant differences between groups in terms of “student use” as determined by one way ANOVA (F(3, 6038)=29.931, p<.0001), and statistically significant differences between groups in terms of “wrongfulness” as determined by one way ANOVA (F(3, 2926)=16.865, p<.0001), and statistically significant differences between groups in terms of “harmfulness” as determined by one way ANOVA (F(3, 2926)=15.049, p<.0001), and statistically significant differences between groups in terms of “accessibility” as determined by one way ANOVA (F(3, 2923)=32.158, p<.0001).

The Tukey HSD Post Hoc test calculated that high school students in communities that permitted recreational cannabis dispensaries in 2014 had a statistically significantly higher cannabis use than students in communities that did not permit recreational dispensaries. This occurred in both 2013 and 2015. Comparing between years, the results are within the margin of error and do not represent a statistically significant difference from 2013 to 2015.
Similarly, in terms of how wrong was cannabis use, in both 2013 and 2015, high school students in communities that permitted recreational cannabis dispensaries had a statistically significant difference in their belief that cannabis use was less wrong than students in communities that did not permit recreational dispensaries. Furthermore, in communities that did not allow recreational dispensaries, a statistically significant difference was that students believed cannabis use was more wrong in 2015 than in 2013. In communities that permitted recreational dispensaries, the results are within the margin of error and do not represent a statistically significant difference from 2015 to 2013.

Regarding how harmful students perceived the regular use of cannabis, there was a statistically significant difference between the two types of communities in both 2013 and 2015. Students in communities that permitted recreational dispensaries believed that regular cannabis use was less harmful than students in communities that did not allow recreational dispensaries. Comparing between years, the results are within the margin of error and do not represent a statistically significant difference from 2013 to 2015.

In terms of the ease of access of obtaining cannabis, there was a statistically significant difference between students in the two types of communities in both 2013 and 2015. Students in communities that permitted recreational dispensaries believed that cannabis was more difficult to obtain than students in communities that did not allow recreational dispensaries. Comparing between years, the results are within the margin of error and do not represent a statistically significant difference from 2013 to 2015.

Discussion

In both 2013 and 2015, the high school students in communities that permitted recreational cannabis dispensaries and the students in communities that did not permit these types of dispensaries had a statistically significant difference. Students in communities that permitted recreational dispensaries used more cannabis, thought cannabis was less harmful, less wrong, and was more difficult to access than high school students in communities that did not permit recreational cannabis dispensaries. A possible explanation for this difference is that the high school students mirrored the behavior and perceptions of the adult population of their communities. By vote or by representation, the adults in a community had decided to approve or ban recreational cannabis dispensaries and a reasonable conclusion is that those adults in a community that permitted recreational cannabis dispensaries would use more cannabis, believe it was less harmful and wrong, and might perceive cannabis more difficult to access than those adults in communities that chose not to permit recreational dispensaries.

Another statistically significant finding was that in communities that did not permit recreational dispensaries, the students thought cannabis use was more wrong in 2015 than in 2013. More studies need to determine the cause of this change. The difference between 2013 and 2015, in terms of use, harm, accessibility, and the difference in wrongfulness in communities permitting recreational dispensaries did not achieve a statistically significant difference, however, across all types of communities the trend from 2013 to 2015 was that high school cannabis use declined, was thought of as more wrong, more harmful, and was more accessible. With the 2017 test being administered in fall 2017, it will be interesting to see if the trend continues and, if the results will be statistically significant. Why there is a shift in behavior and attitude or no shift will need to be studied.

Based on the 2013 and 2015 Healthy Kids Colorado Survey data, permitting recreational cannabis dispensaries in a community has not changed student cannabis use or perceptions towards cannabis. Future studies are recommended to corroborate these results. One proposed study is a survey of school administrators that collects data on cannabis violations in middle and high schools to see if the school reported data aligns with the student self-reported data.
Part 2: Marijuana education and prevention in Colorado public schools—a descriptive study of middle and high schools in the southeast and Pike's Peak region

Background
In 2012 Colorado became one of the first states in the nation to approve the use and retail sale of recreational marijuana. According to the most recent Colorado Healthy Kids Survey, approximately 1 in 5 Colorado youth (21%) have used marijuana in the past 30 days (University of Colorado, 2015). This figure, which mirrors the national rate, has remained stable since the adoption of the new laws in 2013, despite perception of risk for regular marijuana use having decreased in that time. Data from Colorado Healthy School's Smart Source survey relays that less than half of high school students perceive regular use of marijuana as a risky behavior (University of Colorado, 2015). Nationally, the perception is at an all-time low and only 44% of 10th graders and 31% of 12th graders perceive smoking marijuana regularly to be a great risk (Johnston, O’Malley, Miech, Bachman & Schulenberg, 2017). Youth Marijuana use is correlated with risks to attention, learning and memory (Jacobus & Tapert, 2014; National Academies of Sciences, 2017), increased risk for some mental health issues and poorer respiratory health for users who smoke (National Academies of Sciences, 2017).

There is emerging evidence that comprehensive or multi-modal approaches to prevention and education are effective in changing risk perceptions and reducing teen marijuana use (Lemstra, Bennett, Nannapaneni, Neudorf, Warren, Kershaw, & Scott, 2010; Norberg, Kezelman, & Lim-Howe, 2013). Smart Source data from Colorado indicates that 66% of elementary and 88% of secondary schools provide some form of health education related to alcohol, tobacco and other drugs, but how much, if any of it relates specifically to marijuana education and prevention is unknown (Colorado Education Initiative, 2016). More information is needed about the methods of marijuana education and prevention in Colorado schools to find out what is needed to align these efforts with the current best practices.

The purpose of this study was to describe the types of marijuana prevention education being used in Colorado public middle and high schools regionally, and to identify the need for additional materials and resources.

Methods
This descriptive study employed a cross-sectional survey design. The participants for the study were public school administrators within the Southeast and Pikes Peak regions of the Colorado Department of Education (CDE). A 10-question survey was created using Survey Monkey, and administered electronically through a CSU-Pueblo email account to all middle and high school principals (N=156) within the two CDE regions, which accounted for 56 school districts: 28 in the Southeast Region and 27 in the Pikes Peak region. Three weeks was given for completion of the survey, and during that time two email prompts were sent to the administrators as a reminder to complete the survey. Descriptive statistics was used to analyze the quantitative data within the survey, and open coding and thematic development was employed to analyze the qualitative data.

Results
Survey Participation
Overall, 37% of the administrators who received an email request for participation completed at least one question on the survey (n=58), and 24% of the administrators completed full survey (n= 38). Among those who completed the full survey were 21 administrators representing 11 school districts in the Pikes Peak Region and another 14 administrators representing seven school districts in the Southeast Region. Three respondents indicated that they were unsure of their region.
NO Alcohol, Tobacco and Other Drug (ATOD) Education
Out of 58 respondents, 24% indicated that their school does not provide alcohol, tobacco and other drug (ATOD) education. When asked to respond to why the school doesn’t currently provide ATOD education, thematic analysis uncovered a lack of curriculum to address ATOD Education and that resources were funneled towards other curriculum efforts. A lack of community approval and the perception that ATOD education was “not an issue” were mentioned by one respondent respectively. Furthermore, the provision of curriculum, the provision of additional personnel and funding for the educational efforts along with training and support for existing personnel were noted by respondents when asked what resources would be needed to offer ATOD education in the future.

ATOD Education but NO Marijuana Prevention Education (MPE)
Of the 42 respondents who indicated the provision of ATOD education within their school, 31% reported their school does not currently provide marijuana prevention education specifically in the curriculum. When asked why MPE is not currently provided, time constraints within existing ATOD efforts, lack of understanding on the topic and lack of curriculum options were noted. The provision of curriculum, time and general “resources” were the themes that emerged when the respondents were asked what resources were needed to provide MPE in the future. Only one respondent mentioned school board approval.

MPE within ATOD education curriculum
In total, 76% of the administrators indicated that their school provided ATOD education (n=58), and 69% of those schools provide MPE within the ATOD curriculum. Administrators who responded yes to both ATOD education and MPE were asked a series of questions regarding the MPE curriculum, including type of instructors, frequency and length of the education and type of curriculum. Responses varied. MPE is taught in grades 6–12 depending on the school district, with 52% of schools providing it for 9th grade. MPE curriculum is taught by a health educator in 59% of responding schools, and 55% of schools use a curriculum adopted by the school district for MPE.

When asked to describe the frequency and length of the MPE, four themes emerged: (1) 1–4 week unit, (2) the MPE is taught within a broader drug and alcohol unit, and (3) MPE is taught within health class.

Thematic analysis of the topics and skills taught within MPE revealed the following: risks of use and harm reduction, knowledge of effects on brain and body, general drug avoidance and refusal skills, and decision-making skills. Only five curriculums were mentioned by name: The Great Body Shop, Teen Health, Towards No Drug Abuse (TND), Second Step, DARE, and Botvin life skills.

No resources needed, updated information regarding research and best practices, and the sustainability of current personnel were the three themes that emerged when these respondents were asked what resources are needed to continue providing MPE in the future.

Marijuana Policy
Of the 44 respondents on marijuana policies within the school districts, 72% have written policies for both recreational and medical marijuana use.

Use of Restorative Justice
37% (N=35) of the administrators indicated that their school marijuana policies use a restorative justice model, 62% do not use a restorative justice model or are unsure of the model used in their school.

Conclusion
Just over half of the middle and high schools surveyed provided prevention education specific to marijuana use currently, which means that nearly half do not provide any marijuana prevention education. Furthermore, the education that is provided in the Pikes Peak and Southeast regions of Colorado varies widely in the frequency, content and grade-level application. There is very little cohesion and consistency
to the information being provided to students in middle and high schools within these regions regarding marijuana prevention education at this time. Resources identified for the future marijuana prevention education efforts are predominantly aligned with the provision of updated, effective curriculum as well as the funding and staffing needs to adequately implement the curriculum.

Policies for medical and recreational marijuana are more widely used within the two CDE regions surveyed, however, not all schools have both policies, and the majority of schools’ favor policies that are not within the restorative justice model for response.

Discussion
Rates of youth marijuana use are exceeding that of tobacco use and approaching rates of alcohol use in Colorado and yet there is no requirement for the provision of prevention education in Colorado public schools. The Colorado School Safety Resources Center includes links to prevention materials for schools from several sources, including SAMSHA. This information and resources needs to be widely distributed among CDE administrators along with training, technical assistance and the provision of financial support to implement the programming. The development of new marijuana prevention education materials is needed, as is further research on the effectiveness of existing curriculum.

Part 3: Restorative justice intervention

Introduction
The team conducting the survey for the K-12 Cannabis Research Pilot Study discovered the policies in place for cannabis offenses among youth offenders were consistently characterized as Zero Tolerance. To be precise, any youth found in violation of state laws regarding cannabis use (or any other controlled substance) is automatically suspended and/or expelled. Based on the initial informal findings of an ICR pilot project, it became evident to a subgroup of the initial K-12 study team that restorative justice (RJ) practices could potentially improve cannabis recidivism rates with youth. In addition, assistance is required to educate the Pueblo community about the non-punitive processes of restorative justice practices. A group of researchers investigated the connection of restorative justice as a possibly better alternative to Zero Tolerance in the Pueblo community. In conjunction with the Pikes Peak Restorative Justice Council (PPRJC), researchers are developing the Community Restorative Justice Initiative for Cannabis Responsibility study.

Background

Restorative Justice Definition
Restorative justice is defined as “a collaborative decision-making process that includes victims, offenders, and others who are seeking to hold offenders accountable by having them (a) accept and acknowledge responsibility for their offenses, (b) to the best of their ability, repair the harm they caused to victims and communities, and (c) work to reduce the risk of re-offense by building positive social ties to the community” (Karp, 2013, p. 4). The five values of restorative justice work, known as the 5 R’s, are “relationship, respect, responsibility, repair, and reintegration” (Title, 2011, p. 3). The philosophy of restorative justice assumes someone’s offense is the community’s responsibility, which allows all harms to be repaired in such a way that dignity is restored for all, leading to reintegration back into society (reduced recidivism).

Restorative Justice in Colorado State Statutes
The power of restorative justice is supported by “Colorado’s Statutes [that] implement restorative justice through a declaration of legislative intent in CRS 19-2-102 and through provisions enacted pursuant to five bills; HB 07-1129, HB 08-1117, HB11-1032, HB13-1254 and HB15-1094.1” (Lee, 2016). This study is timely and consistent with the value that the Colorado State Legislature places on restorative justice practice. In part, according to Colorado State Representative, Pete Lee (2017):

- HB 07-1129: recommends strongly for “...local juvenile justice planning committees to consider
restorative justice programs when developing their plans” (p. 1);

- HB 08-1117: promotes the integration of restorative justice practice within juvenile diversion groups;
- HB11-1032: states that mandatory juvenile advisement must include restorative justice practices and that “the General Assembly supports and encourages the use of restorative justice as a school’s first consideration to remediate offenses…” (p. 4);
- HB13-1254: “…expands and clarifies the restorative justice program as adopted in Colorado in 2007, 2008, and 2011 with the goal of keeping juveniles out of the criminal justice system” (p. 5), and;
- HB15-1094.1: includes a goal to involve more juvenile offenders in restorative justice practices.

**Purpose: Pueblo Community Restorative Justice Vision**

The vision for this project, Pueblo Community Restorative Justice Initiative for Cannabis Responsibility, is interdisciplinary and collaborative in nature. The project design is consistent with the call from the CSU-Pueblo Provost’s Office, the ICR mission, initiatives currently being explored in Pueblo City Schools and the nature of restorative justice practice. This project is an offspring of, yet connected to, the K-12 Marijuana Research Initiative supported by the ICR. Our work is generating “new knowledge of Cannabis and its derivatives through research and education that improves lives and contributes to science, medicine, and society” through the use of restorative justice practices (Institute of Cannabis Research Handout, n.d.).

The purpose of the Pueblo Community Restorative Justice Initiative for Cannabis Responsibility project is to:

1. Survey best practices of existing restorative justice programs in Colorado as they relate to cannabis offenses and compile a list to be placed on a website for interested parties;
2. Develop collaboration with Pueblo community stakeholders;
3. Educate and train members of the Pueblo community in restorative justice practices;
4. Pilot a study investigating the impact of restorative justice practices with youth [cannabis] offenders in the Pueblo community, and;
5. Seek other funding for sustainability of restorative justice practices.

The pilot study will be a qualitative design using the triangulation of data resulting in emergent themes. This study is a preliminary investigation into the use of restorative justice practices in the Pueblo community as an alternative to punitive measures used with youth who have offended with the most commonly identified offenses by being of “possession (18-18-406[*]), sale of controlled substances (18-18-405[*]), and paraphernalia (18-18-426[*])” (R. F. Burrs, personal communication, January 24, 2017).

In completing the work for goal area three (development of future research studies based on the evidence gleaned from the pilot project) of an initial ICR project, informal findings indicated that schools are using punitive/no tolerance practices which the Colorado Department of Education has determined has the following negative outcomes and challenges: increase in expulsions and suspensions, negative academic outcomes, negative systematic outcomes, school to prison pipeline, disproportionate disciplinary practices (Colorado Department of Education, 2015). Restorative justice practice is a non-punitive community response to youth use of cannabis and, therefore, is more valuable and effective in lowering recidivism rates. We are now connecting with prior work and building the foundation needed to engage the community, professionally develop restorative justice circle members and pilot restorative justice in the schools and community. It is our purpose to build this foundational community collaboration to support an application for a larger grant (state or federal) to potentially develop a Restorative Justice Center on the CSU-Pueblo campus to serve the southeast region of the state. Such a restorative justice proposal is its own distinct project which is necessary and timely.
Networking and Training

Below is a table of events that have transpired in preparation for collaboration with the Pueblo community.

<table>
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<tr>
<th>Date</th>
<th>Event</th>
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<tr>
<td>April-May 2017</td>
<td>Networking with community stakeholders to include Pueblo City Schools and District 70 school administrators, district and municipal court judges, Pueblo Police Department, Pueblo County Sheriff’s Department, Colorado State Representative Pete Lee, District Attorney’s office, restorative justice practitioners from Colorado Springs and Pueblo</td>
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<tr>
<td>May 16, 2017</td>
<td>Conducted Level 1 Connection Circle Participant Professional Development with Pueblo community members</td>
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<tr>
<td>June 20, 2017</td>
<td>Conducted community stakeholders informational and commitment meeting</td>
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<td>Our project team met with members of the Pueblo City Schools Expelled and At-Risk Student Services (EARSS) grant planning team members to coordinate the two grants: Pueblo Community Restorative Justice Initiative for Cannabis Responsibility and EARSS</td>
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<td>July 27, 2017</td>
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Networking with community stakeholders revealed a high interest level in restorative justice practices for youth and resulted in strong participation from the various stakeholders at the June 20th informational meeting. Participants of the May 16th professional development and the June 20th stakeholders meetings indicated a motivation and desire to continue collaboration and professional development.

During the June 20th meeting, stakeholders were asked to brainstorm ways their particular constituent group could contribute to restorative justice practices in the school system. Following is a list of results:

**Law Enforcement**
- Preconference done by law enforcement when able
- Municipal court is on board with RJ
- Holding tickets until completion of RJ
- Tracking tickets and offenders by law enforcement
- Officers suggest RJ in their narrative

**Teachers**
- Be advocates for RJ solutions
- Training on available resources
- See it working, evidence based practices
- Facilitate parental understanding
- Peer mentoring/peer aspect
- Clear systems for teachers—how to implement step by step
- Understand the root causes for each child
- Clarity on mission of grant

**School Administrators**
- Schools need resources for professional development
- Knowing difference between RJ and restorative practices
- Long term sustainability
**Discussion: Future Efforts**

The collaboration between the different grants will provide professional development and the modeling and mentoring of school implementation teams in restorative practices (prevention) and restorative justice conferences (intervention). September through December 2017, team members are committed to continuing stakeholder meetings, providing professional development and implementing restorative justice circles within select schools in the Pueblo community.

**Middle School and High School Student Cannabis Use, Prevention and Intervention: Overall Conclusion and Recommendations**

Middle and High School student use of and perceptions towards cannabis, efforts in schools to prevent student cannabis use, and interventions to address youth violators of cannabis laws requires continuous study to successfully implement effective policies. This report documents our work at CSU-Pueblo in 2017 to provide research based findings and recommendations to educators, parents, students, and policy makers in Colorado and elsewhere.

Our study indicates that the legalization of recreational cannabis use and dispensaries has not greatly affected high school student use and perceptions towards cannabis in southcentral Colorado. Continued data collection and analysis is necessary to track student behavior and beliefs towards cannabis and determine any trends in student behavior and attitude. As the 2017 Healthy Kids Colorado Survey data becomes available, our data study will continue to determine longer term trends. Furthermore, surveys and interviews will be conducted on school administrators to determine trends in cannabis violations at schools in the region.

The survey of regional school administrators found that nearly half of the middle and high schools surveyed did not provide any marijuana prevention education. More information and resources need to be provided to schools to implement marijuana prevention education curriculum. Also, new marijuana prevention education materials are needed as is further research on the effectiveness of existing curriculum.

In 2017, through the joint efforts of the EARSS, SEED and the K12 Cannabis Study grants, Restorative Justice is being introduced and practiced in schools within Pueblo City Schools. Data on the effectiveness of these practices will be gathered, as well as further education on restorative justice practices to stakeholders including school administrators, teachers, law enforcement and community members will continue. By continuing to educate and broaden the scope of RJ in the community, the use of restorative justice practices is expected to expand across Pueblo City Schools and Pueblo School District 70.

**References**


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Hinckley, Story. “Pot is legal in Massachusetts. What do opposing towns do now?” The Christian Science


Wall, Melanie M. et al. “Prevalence of Marijuana Use Does Not Differentially Increase among Youth after


Social Impacts 4: Job quality in Colorado’s cannabis industry

Abstract
This study focuses on job quality in Pueblo County’s hemp- and marijuana-related businesses. The aim of our study is to determine the quality of jobs the legal cannabis industry is creating. The study draws upon the work of job-quality researcher Arne Kalleberg to construct a thorough assessment of whether the legal cannabis industry is creating good jobs. The study, which continues in the data collection phase, incorporates both economic and psychosocial indicators of job quality. Job quality is assessed both objectively and from the perspective of those working in the industry.

The intent of this research is to determine the nature of jobs being created by the legal cannabis industry; more specifically, is the industry creating “good jobs”? This fits well with the research aim of CSU-Pueblo’s Institute of Cannabis Research agenda because it addresses both the economic and social effects of Pueblo County’s cannabis industry. The current study is one of the first to explore the concept of job quality in the cannabis industry.

There are different ways to characterize what is a good job, but we are influenced by research that has focused on work’s effects on people. Early examples include Kornhouser’s (1965) study of the psychological effects of working in Detroit’s automobile factories and Emery and Thorsrud’s (1976) work on organizational democracy and employee participation. Cooper (1979) brought attention to the effects of work stress, and Karasek and Theorell (1990) brought attention to effects of workplace psychosocial factors, especially job control and psychological demands. The net effect of these researchers has been to create a content area within organizational behavior that focuses on healthy work, particularly its psychosocial characteristics and work’s physical and psychological effects on employees.

The current study draws not only upon the work of those earlier researchers, but also on that of sociologist Arne Kalleberg. A leader in the field of job quality, Kalleberg (2011, p. 9) states that a good job:

- Pays relatively high earnings and—perhaps more importantly—provides opportunities for increases in earnings over time.
- Provides adequate fringe benefits, such as health insurance and retirement benefits.
- Enables the worker to have opportunities for autonomy and control over work activities.
- Gives the worker some flexibility and control over scheduling and terms of employment.
- Provides the worker with some control over the termination of the job.

Other factors influencing job quality include hours of work, future prospects (promotion and job security), how hard or difficult the job is, job content (interest, prestige, independence), interpersonal relationships (Clark, 1998), and supervisor behavior and management practices (Seltzer & Numerof, 1988; Gilbreath & Benson, 2004). We assess many of those factors in our study of job quality in the cannabis industry.

Method
Participants
This study assesses job quality in the cannabis industry by collecting data from respondents in cannabis organizations and non-cannabis comparison organizations in Pueblo County, Colorado.

Procedures
Participating organizations were recruited by mailing publicity on our study to organizations in Pueblo County. This was followed by e-mail messages and phone calls to organizations’ owners and managers. Explanations of the study were provided and access to organizations’ employees, for questionnaire administration, was requested.
Measures

Our questionnaire consists of over 50 items. It collects information on many demographic and employee background factors such as age, sex, ethnicity, marital status, education, prior military service, years of work experience, time (tenure) in the organization, time in current position, level in the organization (e.g., owner, manager, employee), hours worked in a typical week, and compensation classification (hourly, salaried, contractual), and work’s centrality (i.e., importance) in their life. As indicative of job quality, we collect information on pay, insurance and retirement benefits, paid vacation, flexible scheduling, yearly earnings, and whether the job is sedentary or allows healthy physical movement. In case we want to test for differences among industries, we ask what industry respondents are employed in. Specific scales we used to assess job quality are discussed next.

Autonomy. We used items previously used by Kalleberg (1977) to assess employees’ work. These include autonomy, skill usage, meaningfulness, opportunities to learn, repetitiveness, fairness (e.g., over promotions), variety, task completion, challenge, and participation.

Self-concept-job fit. We used Scroggins’ (2003) five-item measure of job, self-concept fit. An example item is “I cannot see myself in any other type of job than the one I am currently performing.”

Authentic self-expression. To measure authentic self-expression we used a six-item scale from Waterman’s (2010) Eudaimonic Well-Being Questionnaire Scale. An indicative item from the scale is “in this job, I can be who I really am.”

Supervisor behavior. We measured supervisor behavior using ten items from Gilbreath’s (2004) study of supervisor behavior associated with employee psychological well-being. Five of the items assess negative supervisor behavior, for example, “my supervisor tends to be guarded (e.g., not open) in his/her communications.” The other five items assess positive supervisor behavior, for example, “My supervisor tries to see employees’ side of situations.”

Job stress. We used four items created by Motowidlo et al. (1986) to measure subjective stress by asking employees about the stress, strain, and tension they experience because of their job. Higher scores on the scale indicate higher levels of job-related stress. Example item: “My job has been extremely stressful.”

Social support from colleagues and supervisor. The source of items we used to measure social support was the second version of the Copenhagen Psychosocial Questionnaire (Kristensen et al., 2005). It uses three items to measure support from coworkers and three items to measure support from one’s immediate supervisor. Example items: “How often do you get help and support from your colleagues? How often does your nearest superior talk with you about how well you carry out your work?”

Job control. Items for measuring job control are from the Health & Safety Executive Management Standards Indicator Tool (HSE, n.d.). The scale includes six items, for example, “I have a choice in deciding how I do my work.”

Chronic work overload. We measured work overload with six items from the Trier Inventory of Chronic Stress (Schulz, Schlotz, & Becker, 2004). Respondents indicate how often they experience feeling such as “overload through different duties that I need to take care of.”

Job satisfaction. General job satisfaction was measured using items from Quinn and Shepard’s (1974) Quality of Employment Survey. Example item: “All in all, I am very satisfied with this job.” Satisfaction with other facets of the job were taken from Kalleberg’s (1977) studies of job quality. Example: How satisfied are you with the physical surroundings at your work (e.g. cleanliness, lighting, or common areas)?

Affective commitment. Three items from Allen and Meyer’s (1990) scale were used to measure organizational commitment. An example item is “I enjoy discussing my organization with people outside of it.”

Turnover intentions. We used three items similar to Colarelli (1984) for measuring intent to quit: “I frequently think of leaving my job at this organization”; “I am planning on searching for a new job within my industry
within the next year”; and “If I had my way, I would not be working in my industry a year from now.”

**Supervisor responsiveness.** We adapted Lemay’s (2016) perceived partner responsiveness measure to assess how responsive employees perceive their supervisor to be. We changed the item prompt from “my partner usually” to “my supervisor usually.” An example item from the scale is “my supervisor esteems me, shortcomings and all.”

**Forecast of relationship commitment.** The forecast model of relationship commitment (Lemay, 2016) posits that forecasts of future relationship satisfaction determine relationship commitment and pro-relationship behavior in romantic relationships. Adapting this research to work settings, we believe that supervisor behavior, particularly a supervisor’s responsiveness to employees, will predict employees’ loyalty to the supervisor and possibly their organizational commitment. We therefore adapted 18 items from Lemay’s research for use in our questionnaire.

**Personal philosophy driving job-choice decisions.** Cooke, Donaghey, and Zeytinoglu (2013) identified seven types of job-choice decisions made employees. We measured these to see if employees in the cannabis industry are more likely than employees in other industries to fit into one or more of the types. An example of an item expressing one of the types is “I focus on achieving quality of life outside of work and then look for a job that fits with the most important things in my life.” If respondents found that none of the seven types fit them well, they were asked to write a description of the things they look for in a job. To determine its associations with the seven types, we used one item to assess how important pay is to respondents, and one open-ended item reading “to me, the following things are MORE important parts of a job than money.”

**Perceived job quality.** To assess overall perceived job quality, we asked respondents to respond to this item using a seven-point response scale ranging from strongly disagree to strongly agree: “Overall, my job is a good job.”

**Results**

At the time of this report, we had collected data in two organizations: one cannabis and one non-cannabis. Several other non-cannabis organizations are planning to participate in the study. It is difficult to gain entry into cannabis organizations in Pueblo County. It seems that owners of the cannabis organizations have more difficulty perceiving the value of an employee survey, or perhaps they expect that survey results won’t be very helpful to them. Organizations in mature industries have learned that it is a good idea to find out what is on employees’ minds in terms of perceptions and attitudes. Many of the cannabis organizations are in start-up mode and may not have operations stabilized enough to see participating in an employee survey as a priority. Additionally, they may not be staffed with professional managers or people with a human resource background who recognize the value of employee surveys. We have also been told that cannabis business owners are frequently targeted by people contacting them for various reasons (e.g., to sell them services).

Although it is impossible to determine the exact causes, it is the case that we are having difficulty gaining access to cannabis industry employees. Perhaps one or several regional advisory boards, in part consisting of legal cannabis industry managers and business owners, along with in part consisting of law enforcement organizations, hospital staff and other community groups, would help mitigate issues that relate to the need to gather high-quality data.

We now have responses to our questionnaire from 100 employees, 20 percent of whom are employed by the cannabis industry. We will continue to seek entry into more organizations to increase our research sample/number of respondents, particularly from the cannabis industry. We will be strategizing how to gain support for our study and implementing the ideas we come up with during winter and spring 2018.
References


Schulz, P., Schlott, W., & Becker, P. (2004). Trierer Inventar zum Chronischen Stress (TICS) [Trier Inventory for Chronic Stress (TICS)].

Social Impacts 5: Understanding crime and cannabis in the city of Pueblo and Pueblo County, Colorado

Abstract
This study examines the relationship between recreational cannabis (legalized in 2012) and the social impacts on crime in the City of Pueblo and Pueblo County, Colorado between 2010 and 2017. This research uses available crime data provided by the City and County to analyze how much and in what areas certain types of crime have increased or decreased. It also analyzes the results of 20 interviews conducted with city patrol officers regarding their personal experiences confronting crime in the era of legal cannabis. The results indicate that while crime in the City has increased overall, it has done so on trend with an increase in population and a decrease in police personnel. County crime has risen only in certain areas, but is also on trend with expectations. This research concludes by offering several suggestions for the improvement of policy and the allocation of essential resources as well as recommendations for future research.

Introduction
There is significant controversy that continues to surround legalized cannabis in Colorado, and Pueblo County - from before Amendment 64 was passed, to the first few months in the new era of legalization, to our current position, five years later. This report is to be read as a piece of scientific research where the data were collected using the best practices of the field, current and well tested research methodologies, and supported by the most objective research literatures available on the topic. The recommendations made in this report reflect the findings of the data, rather than personal opinions.

For the purposes of this research, crime is defined as any illegal activity conducted by persons within two main geographical areas: Pueblo County and the City of Pueblo, CO. Additionally, we will use the terms “marijuana” and “cannabis” interchangeably throughout this section. The data presented here were gathered through a working relationship with the Pueblo County Sheriff's Department and the City of Pueblo Police Department. The data include statistical information on various crimes conducted from 2010–2017 as well as the results of 20 individual interviews with city police officers.

The following sections of this report include a literature review and discussion of the current research on crime and legal cannabis, a section detailing the methods used to conduct the research being reported here, the results and findings of the present research, a discussion of the implications of those findings, and a series of recommendations to lawmakers based on the results of this research.

In 2013, a letter penned by then Deputy Attorney General James Cole addressed to all U.S. Attorneys (commonly known as the Cole Memo) stated that the Federal Government would not challenge Colorado’s ability to regulate the retail sale of marijuana under the condition that “state and local governments would implement strong, effective regulatory and enforcement systems to address public safety, public health, and other public interests” (Blake & Finlaw, 2014). The memo then went on to list eight regulatory priorities including preventing the distribution of marijuana to minors, gangs, cartels, and states where marijuana possession is still illegal. The memo also prioritized preventing the use of violence and firearms in the cultivation of marijuana and the prevention of drugged driving. In response, David Blake the Deputy Attorney General for Legal Policy and Government Affairs in Colorado and Jack Finlaw, the Chief Legal Counsel for Colorado Governor John Hickenlooper outlined in a report for the Harvard Law and Policy Review (2014) the issues that Colorado continues to face after legalization. Specifically, the taxation of retail marijuana as approved by voters in Proposition AA in 2013 allowed an excise tax and a special sales tax on retail marijuana sales. The intended use of the new taxes are to provide monies for the construction of new schools (specifically, the first $40,000,000 received annually) and to provide an increase in funding
(10% sales tax on retail marijuana and related products) for “the regulation and enforcement of the retail marijuana industry and to fund health related, education, prevention, and public safety costs” (373).

Blake and Finlaw go on to describe a variety of issues in state law enforcement related to the legalization of retail marijuana including complications in the definition of open consumption, problems officers face in testing for THC blood levels when working to enforce drugged driving laws, and issues regulating the “gray market” which addresses loopholes in laws imposed on home growers. Their report goes on to list many questions, potential problems, and issues that states considering decriminalizing marijuana will face. Chief among the authors’ concerns are the enforcement of laws and regulations, however, their recommendations fall woefully short of providing any sort of guidance for the local law enforcement agencies who work on the front lines. As will be shown in this report, these agencies are expected to uphold both state and federal law in the maintenance of public safety, but are provided with little financial support and even less regulatory clarity.

Literature Review

Among the problems in the scientific and academic research pertaining to the relationship between crime and legal recreational cannabis is that there are yet very few published studies. Research on the social impacts of medical marijuana in states where it is legal are more available, but they tell us little to nothing about the how crime and law enforcement are affected in those areas. Published opinion pieces, on the other hand, are rampant. These types of works are often well written, use much of the same scientific jargon, and can be quite difficult to discern from legitimate research. These types of literatures, therefore, will not be reported here, as they hold no scientific or academic value.

For the purposes of this report, the academic literature on legal cannabis is broken down into three main categories: 1) research dealing with the effects of legal medical marijuana, 2) research reporting on the legal and policy related impacts of any type of legalized cannabis, 3) and research investigating the impacts of crime and cannabis in general. Missing from the current literature are published, scientific studies investigating the specific impacts on crime and law enforcement faced in states where recreational cannabis is now legal.

Medical Marijuana

Based on nationally representative data, Schauer, et al. (2014) determined that the majority of current adult marijuana users consume solely or in part for recreational purposes (89.9%) while a smaller percentage (46.6%) used in part or entirely for medical reasons. Only 10.5% of people reported using marijuana strictly for medical purposes. This indicates a significant overlap among those who use marijuana to treat medical conditions and those who use it recreationally.

Similarly, Cerda, et al. (2012) found that in states with laws permitting medical marijuana use, rates of consumption were higher, as were rates of dependence. The higher rates of abuse and dependence can be explained by the fact that residents in those states are simply using more due to more permissive laws. The results of these studies are sociologically interesting given that the overlap between recreational users and medical users is significant, and that rates of use, abuse, and dependence are higher in states permitting medical use. These results would seem to indicate that while people may be following the law, they are not necessarily consuming marijuana in ways that the laws intended. Therefore, it is important to consider the difference between the law-as-written and the law-in-practice.

For Kamin (2013) the line between what is legal or not in regard to states permitting medical use becomes fuzzy as policies extend down from the federal level, into state legal territory, and finally into local enforcement. These three competing levels of policy all have differing goals and significantly different resources. For instance, in states where medical marijuana is legal, providers and patients must grapple with the fact that it is still federally classified as a dangerous, Schedule I substance. Therefore, while they cannot be prosecuted because of state protections, they are still technically breaking a federal law.
If understanding the legal implications of permitted medical marijuana use seems difficult, the allowance of recreational sale and use in Colorado has muddied things even more. What is important to remember is that the law-as-written is handed down from legislators at the state and federal level, but the law-in-practice falls almost solely within the purview of local governments, municipalities and law enforcement agencies. So, while following the letter of the law is ideal, the reality is that when those laws are so clouded by discrepancies in jurisdiction the burden of sorting them out on an individual basis falls to the locals.

**Policy Issues**

As stated previously, research on how the legalization of recreational marijuana impacts crime is almost non-existent. However, there is research that investigates (and attempts to predict) the policy related concerns between crime and cannabis.

In 2014, Pacula and Sevigny predicted that liberalizing *medical* marijuana laws would “generate savings in terms of reduced criminal justice costs and improve social welfare by eliminating criminal sanctions for minor marijuana offenses” (7). They neglect, of course, to predict the same for the legalization of recreational marijuana. Given that recreational users and medical users frequently overlap, though, we may be able to note some similarities in they way they are addressed by law enforcement.

According to John Hudak (2015) Colorado’s initial roll-out and implementation of recreational marijuana was successful. In his article, Hudak spends pages praising the ways in which the state created a swift and mostly seamless transition through a variety of working organizations, groups, and processes of “adaptive learning” wherein agencies at multiple levels allegedly worked together to learn about and address new challenges as they arose. Hudak was clear, however, that the successful implementation of policies does not mean that the policies themselves are successful. His focus remained on whether or not the policies were properly “rolled-out” and not on whether the resultant policies were at all clear or effective.

Hudak went on to make the excellent point (one often neglected or lost in partisan discussions of legal cannabis) that while the majority of Coloradans (55%) supported legalizing recreational cannabis in 2012 and polls continue to indicate their increased support for these laws, the police and law enforcement communities have remained largely against them. Without a clear understanding of why law enforcement would oppose legal cannabis, it is easy to speculate that, as a group, they disapprove of people using marijuana for pleasure because they are hanging onto some old-fashioned views about the dangers of marijuana as a “gateway” drug. However, in the research we found this not to be the case. As will be shown in this report, many of the law enforcement officials that were interviewed either felt personally favorable toward legal marijuana, or were at least neutral. Their concerns about its legalization centered around ambiguities in laws and policies, and whether or not those laws were enforceable. These policy related issues then bring us into the (extremely limited) literature dealing crime and legal cannabis.

**Relationship to Crime**

According to Anderson & Rees (2014) where recreational marijuana is legalized, states see a related drop in alcohol consumption. Given that there is evidence linking the consumption of alcohol with the commission of violent crimes, the authors concluded that with the introduction of recreational marijuana, we can also expect to see a reduction in the number of violent crimes. Additionally, they argue that given the empirical evidence available thus far, “while it is more than likely that marijuana produced by state-sanctioned growers will end up in the hands of minors, we predict that overall youth consumption will remain stable. On net, we predict the public-health benefits of legalization to be positive” (228).

The most thorough study conducted on the relationship between crime and cannabis was conducted in 2014 (Morris, e.t. al.). The authors examined Part I crimes (rape, robbery, homicide, motor vehicle theft, burglary, larceny, and assault) using national data gathered from the Federal Bureau of Investigation's Uniform Crime Report to determine the relationship between state crime rates and *medical* marijuana laws. Using a fixed-effect regression model, controlling for a variety of ecological factors and including
sociodemographic elements, the authors concluded that:

The central finding gleaned from the present study was that MML [medical marijuana legalization] is not predictive of higher crime rates and may be related to reductions in rates of homicide and assault. Interestingly, robbery and burglary rates were unaffected by medicinal marijuana legislation, which runs counter to the claim that dispensaries and grow houses lead to an increase in victimization due to the opportunity structures linked to the amount of drugs and cash that are present. This is in line with prior research suggesting that medical marijuana dispensaries may actually reduce crime in the immediate vicinity (6). These findings are in line with other studies concluding that marijuana use does not have an effect on violent crime (Pedersen & Skardhamar, 2010).

After extensive research into the scientific literature, it can be concluded that studies examining the relationship between crime and recreational marijuana laws are close to non-existent. This is likely due to the fact that few states have legalized recreational cannabis and that a relatively short amount of time has lapsed between when those laws were passed and the length of time it takes to conduct such studies. Thus, we are forced to acknowledge that much of the research on crime and cannabis is still currently underway and that we may not see the results of those studies for some time. Additionally, many of the studies currently being conducted focus on local (rather than state or national) levels of analysis which means they are not generalizable to other parts of the state or country.

Next, the methods used to carry out the current study are discussed, followed by the results of the research as well as a discussion of those findings and recommendations going forward.

Research Methods

This report investigates crime and its relationship to legalized marijuana in Pueblo County. Due to the very limited time frame available to researchers, this report is only able to focus on a small portion of crime and law enforcement in the both the City and County of Pueblo. It is also important to note that this research represents a pilot study; research that is meant to investigate the current state of affairs and make recommendations on directions of future inquiry. It is not meant to be an exhaustive investigation into all aspects of the relationship between crime and cannabis.

Given the above mentioned limitations, the data for this study were gathered because of the time, resources, and information generously provided by the Pueblo Police Department and the Pueblo County Sheriff’s Department. Both agencies were able to provide all of the data requested and have continued to act as invaluable resources to this study. The research presented here would not have been possible without the concerted efforts of the officers, employees, and administrators in these departments and I’m very grateful for their time and cooperation.

The results of these analyses were gleaned from two types of sources: the quantitative data that were provided by both the City PD and County Sheriff’s Office in response to specific research requests, and qualitative data that included twenty (20) interviews conducted with Pueblo City Police officers.

Quantitative Data

Knowing the extent of and changes in crime statistics over time is an absolutely essential part of being able to understand the relationship between crime marijuana. These data give us the big picture, over time, and allow us to better understand how crime has been affected by this important change in the law. To gather these data, both agencies were asked to provide the following:

- The raw number of marijuana seizures from 2010 or earlier to 2017
- The raw number of violent crimes processed from 2010 or earlier to 2017
- The raw number of property crimes processed from 2010 or earlier to 2017
- The raw number of drug related crimes OTHER than marijuana processed from 2010 or earlier to 2017
Recreational marijuana was legalized in 2012, so we requested data beginning in 2010 in order to assess the state of crime prior to legalization and beyond. Year to date information was provided for 2017 including only the months of January to July and is therefore incomplete. The analyses thus focus on full year data from 2010–2016. After receiving the raw numbers of crime, by type, we determined the percent change of increase or decrease in incidents between years, and in total over the seven-year time period. It is also important to note the limitations of these data insofar as the agencies providing them (Pueblo City PD and Pueblo County Sheriff) had not previously compiled these specific numbers. Therefore, the request required that an individual at each agency sort through a large amount of raw data and pull out the requested information in a very short period of time. The Pueblo City Police Department is able to employ a full time data analyst with training in criminal justice. The Pueblo County Sheriff’s Department is not able to employ such a person at this time and so the request for data fell to multiple individuals. It is also unclear how the County tracks its crime data, and so it is important to understand that some of what was received may be incomplete or contain missing data. The quantitative data will report on the information received from both agencies in response to the above requests.

**Qualitative Data**

While statistics and numbers play an important part in showing us the broader picture of crime in our community, it is equally important to understand the individual experiences of the officers on patrol every day in our city. These officers interact with community members, concerned citizens, business owners, alleged criminals, and out-of-town visitors on a daily basis. What they see and experience “on the ground” supplements the broad story of crime and cannabis in a way that only focusing on statistical data does not. To gather these data, we conducted 20 interviews with Pueblo City police officers. Participants ranged from rookies in their first year to 20-year veterans of the force. We interviewed officers from multiple areas of specialization including undercover narcotics detectives, top administrators, and patrol officers working the midnight shift. It was important to cover as wide a range in rank and specialization as possible in order to get a broader sense of the differing experiences at various levels within the department.

All interviewees participated on a voluntary basis after having been informed about the nature of the study. Participants provided their verbal consent to be interviewed confidentially and all interviews took place in a conference room in the police department. Interviews lasted approximately 45 minutes, on average.

In order to recruit participants, the researcher attended two separate “roll call” meetings on what were called “common days” where all officers working various shifts attended the meeting. At the beginning of each meeting we addressed the officers (approximately 20 of whom were in attendance each time) and described the study asking if they would be willing to sit for an interview. We explained that the interview would include questions about their experiences with crime involving marijuana, as well as their personal feelings about recreational marijuana laws. Officers seemed particularly enthusiastic to be given the opportunity to discuss their opinions about marijuana.

Because the interview pool is small (20 interviewees) it is important to note that we have excluded any information regarding rank, specialization, or years of service when referring to any direct quote or specific interviewee. This information is included in discussions of averages and other descriptive data, but because Pueblo is a relatively small police department (88 officers in 2017), it is essential to protect participants’ identities when referring to individual interview answers.

**Methodological Limitations**

Using a mixed methodology by including both quantitative and qualitative data allows for a more nuanced analysis and, thus, a more robust discussion of the findings and recommendations for future action. However, it must be noted that these data are small, including only 7 years of crime statistics and only 20 interviews. The results, therefore, cannot be extrapolated beyond discussions of the City of Pueblo and Pueblo County. Interview results should not be taken as representative of the opinions of all Pueblo City police officers,
but should be understood as the individual experiences of those officers who were available and willing to participate. Additionally, given the limited amount of time available to conduct this research, we were unable to interview officers from the Sheriff’s Department, though several offered to participate. Future research projects should attempt to interview more officers, participants from the Sheriff’s Department, and collect statistical data beyond those provided here.

**Results**

Discussions of the results of this research are separated into the two following sections: City of Pueblo, and Pueblo County. The primary research question relevant to both areas of research was: *what is the relationship between crime and the legalization of recreational marijuana in the city and county of Pueblo, Colorado?* In order to answer this question, we asked both the City and the County for the raw numbers of crime incidents to which they responded, by type, from 2010-present (July, 2017). We then analyzed these numbers to determine by what percent each type of crime increased or decreased over the seven-year period and from year to year. Additionally, we interviewed 20 city police officers at various ranks, ages, years of experience, and specialization asking them questions relevant to their experiences as officers regarding crime and the legalization of marijuana. A discussion of the findings and recommendations for future action follows.

**City of Pueblo**

Determining how the legalization of recreational cannabis impacted crime in the City of Pueblo is more complicated than simply asking whether or not crime has increased. While crime has increased in all areas, it has done so on trend with expected average increases over time for the city, accounting for population growth and a shrinking police force. The most interesting data show the specific types of crimes that have increased the most (or the least).

Overall, from 2010–2016, dangerous drug seizures have increased by 108%, total property crime has increased by 82%, and violent crime has increased by 10% in the City of Pueblo (see Graph 1 below).
Dangerous Drug Seizures

By far, the most significant increase in crime has been in the area of dangerous drug seizures by the Pueblo Police. Dangerous drugs were classified by the Police Department as: amphetamines, cocaine, heroin, and pills. These statistics account for all drugs confiscated (or seized) excluding marijuana from 2010 to 2016. Based on information provided by the Pueblo PD, dangerous drug seizures have increased by 108% over the last seven years. Starting in 2010, there were 182 total incidents of dangerous drug seizures by police in the city. In 2016 (the last full year for which we have data) there were a total of 379 incidents of dangerous drug seizures.

The confiscation of heroin increased by 448% from 2010–2016, while amphetamine seizures closely followed with an increase of 333% over the same time period. Seizures of pills increased by only 10% over seven years. Seizures of both marijuana and cocaine decreased from 2010–2016. Marijuana seizures decreased by 34% while cocaine seizures saw the most significant decrease of 61% from 2010–2016. Total incidence numbers are represented in Table 1 below, while percent changes over time are illustrated in both Table 2 and Graph 2.

<table>
<thead>
<tr>
<th>Year</th>
<th>Amphetamines</th>
<th>Cocaine</th>
<th>Heroin</th>
<th>Pills</th>
<th>Total Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>43</td>
<td>85</td>
<td>23</td>
<td>31</td>
<td>182</td>
</tr>
<tr>
<td>2011</td>
<td>36</td>
<td>59</td>
<td>72</td>
<td>39</td>
<td>206</td>
</tr>
<tr>
<td>2012</td>
<td>55</td>
<td>52</td>
<td>32</td>
<td>42</td>
<td>181</td>
</tr>
<tr>
<td>2013</td>
<td>98</td>
<td>38</td>
<td>57</td>
<td>31</td>
<td>224</td>
</tr>
<tr>
<td>2014</td>
<td>102</td>
<td>25</td>
<td>78</td>
<td>11</td>
<td>216</td>
</tr>
<tr>
<td>2015</td>
<td>161</td>
<td>31</td>
<td>121</td>
<td>28</td>
<td>341</td>
</tr>
<tr>
<td>2016</td>
<td>186</td>
<td>33</td>
<td>126</td>
<td>34</td>
<td>379</td>
</tr>
<tr>
<td>TOTAL</td>
<td>681</td>
<td>323</td>
<td>509</td>
<td>216</td>
<td>1,729</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Amphetamines</th>
<th>Cocaine</th>
<th>Heroin</th>
<th>Pills</th>
<th>Total Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Change 2010–2011</td>
<td>-16%</td>
<td>-31%</td>
<td>213%</td>
<td>26%</td>
<td>13%</td>
</tr>
<tr>
<td>% Change 2011–2012</td>
<td>53%</td>
<td>-12%</td>
<td>-56%</td>
<td>8%</td>
<td>-12%</td>
</tr>
<tr>
<td>% Change 2012–2013</td>
<td>78%</td>
<td>-27%</td>
<td>78%</td>
<td>-26%</td>
<td>24%</td>
</tr>
<tr>
<td>% Change 2013–2014</td>
<td>4%</td>
<td>-34%</td>
<td>37%</td>
<td>-65%</td>
<td>-4%</td>
</tr>
<tr>
<td>% Change 2014–2015</td>
<td>58%</td>
<td>24%</td>
<td>55%</td>
<td>155%</td>
<td>58%</td>
</tr>
<tr>
<td>% Change 2015–2016</td>
<td>16%</td>
<td>6%</td>
<td>4%</td>
<td>21%</td>
<td>11%</td>
</tr>
<tr>
<td>TOTAL % Change 2010–2016</td>
<td>333%</td>
<td>-61%</td>
<td>448%</td>
<td>10%</td>
<td>108%</td>
</tr>
</tbody>
</table>
Property Crime

The next significant area where crime increased the most between 2010 and present was in total property crimes. The Pueblo Police department defines property crimes as: burglary, larceny-theft, motor-vehicle theft, and arson. In 2010 there were 4,134 total incidents of property crime to which police responded. In 2016 (the last full year for which we have data) Pueblo police responded to 7,512 incidents of property crime. This reflects an 82% increase in total property crime incidents over a seven year time period. When we look at the statistics for specific types of property crimes, we see that the most significant increase in property crime incidents is motor-vehicle theft, increasing from 377 incidents in 2010 to 1,198 in 2017, reflecting an increase of 218% over the seven year period.

Larceny-theft incidents (which include thefts not involving the illegal entrance of a structure) followed motor-vehicle thefts with a 116% increase over seven years. In 2010 there were 2,098 incidents of larceny-theft to which police responded and in 2016 the number of incidents more than doubled to 4,528. Total incidence numbers are represented in Table 3 below, while percent changes over time are illustrated in both Table 4 and Graph 3.

<table>
<thead>
<tr>
<th>Year</th>
<th>Burglary</th>
<th>Larceny / Theft</th>
<th>Motor Vehicle Theft</th>
<th>Arson</th>
<th>Total Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1,608</td>
<td>2,098</td>
<td>377</td>
<td>51</td>
<td>4,134</td>
</tr>
<tr>
<td>2011</td>
<td>1,629</td>
<td>3,961</td>
<td>485</td>
<td>51</td>
<td>6,126</td>
</tr>
<tr>
<td>2012</td>
<td>1,764</td>
<td>4,707</td>
<td>528</td>
<td>43</td>
<td>7,042</td>
</tr>
<tr>
<td>2013</td>
<td>1,827</td>
<td>5,115</td>
<td>527</td>
<td>28</td>
<td>7,497</td>
</tr>
<tr>
<td>2014</td>
<td>1,972</td>
<td>4,531</td>
<td>663</td>
<td>36</td>
<td>7,202</td>
</tr>
<tr>
<td>2015</td>
<td>2,053</td>
<td>4,422</td>
<td>915</td>
<td>36</td>
<td>7,426</td>
</tr>
<tr>
<td>2016</td>
<td>1,737</td>
<td>4,528</td>
<td>1,198</td>
<td>49</td>
<td>7,512</td>
</tr>
<tr>
<td>TOTAL:</td>
<td>12,590</td>
<td>29,362</td>
<td>4,693</td>
<td>294</td>
<td>46,939</td>
</tr>
</tbody>
</table>
TABLE 4: Year To Year Percent Change In Total Property Crime (Including Marijuana-Involved Incidents), City of Pueblo

<table>
<thead>
<tr>
<th>Year</th>
<th>Burglary</th>
<th>Larceny / Theft</th>
<th>Motor Vehicle Theft</th>
<th>Arson</th>
<th>Total Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Change 2010–2011</td>
<td>1%</td>
<td>89%</td>
<td>29%</td>
<td>0%</td>
<td>48%</td>
</tr>
<tr>
<td>% Change 2011–2012</td>
<td>8%</td>
<td>19%</td>
<td>9%</td>
<td>-16%</td>
<td>15%</td>
</tr>
<tr>
<td>% Change 2012–2013</td>
<td>4%</td>
<td>9%</td>
<td>0%</td>
<td>-35%</td>
<td>6%</td>
</tr>
<tr>
<td>% Change 2013–2014</td>
<td>8%</td>
<td>-11%</td>
<td>26%</td>
<td>29%</td>
<td>-4%</td>
</tr>
<tr>
<td>% Change 2014–2015</td>
<td>4%</td>
<td>-2%</td>
<td>38%</td>
<td>0%</td>
<td>3%</td>
</tr>
<tr>
<td>% Change 2015–2016</td>
<td>-15%</td>
<td>2%</td>
<td>31%</td>
<td>36%</td>
<td>1%</td>
</tr>
<tr>
<td>TOTAL % Change 2010–2016</td>
<td>8%</td>
<td>116%</td>
<td>218%</td>
<td>-4%</td>
<td>82%</td>
</tr>
</tbody>
</table>

GRAPH 3: Number of Property Crime Incidents, City of Pueblo

Violent Crime

Finally, the area that showed the least amount of growth over time is violent crime incidents. Pueblo Police classify violent crimes as: homicide, sexual assault, robbery, and aggravated assault. According to the Federal Bureau of Investigation, aggravated assault typically involves a weapon or the infliction of a serious injury. Robbery involves the use or threatened use of force to take something from the possession of another.

Total violent crime increased by 10% between 2010 and 2016. The category that saw the most significant increase in incidents over time was homicide, going from a single incident in 2010 to 8 incidents in 2016 reflecting a 700% increase. The next most significant change was an increase in robberies from 159 incidents in 2010 to 223 incidents in 2016 reflecting a 40% increase over seven years.

Sexual assault incidents followed with an 22% increase going from 125 incidents in 2010 to 153 in 2016. Finally, the only category to decrease was aggravated assault incidents. Aggravated assaults decreased by 3% going from 562 to 546 incidents in 2010 and 2016, respectively.

While analyzing the percent increases of various criminal incidents over time is useful, it is most essential that we look at the total number of incidents to determine the most problematic areas still of concern. For instance, while homicide saw a 700% increase over seven years, the number of incidents has remained...
relatively small (from 1 to 8). At the same time, larceny-theft incidents only showed a 116% increase, but there were a total of 4,528 incidents in 2016 alone. Similarly, there were 1,198 motor-vehicle thefts in 2016, but only 126 heroin seizures (representing the highest number of all dangerous drug seizures). So, while it is important to see how and where types of crime have increased over time, it is equally important to understand where police resources are most needed by looking at total number of incidents. Total incidence numbers are represented in Table 5 below, while percent changes over time are illustrated in both Table 6 and Graph 4.

<table>
<thead>
<tr>
<th>Year</th>
<th>Homicide</th>
<th>Sexual Assault</th>
<th>Robbery</th>
<th>Aggravated Assault</th>
<th>Total Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1</td>
<td>125</td>
<td>159</td>
<td>562</td>
<td>847</td>
</tr>
<tr>
<td>2011</td>
<td>11</td>
<td>107</td>
<td>174</td>
<td>607</td>
<td>899</td>
</tr>
<tr>
<td>2012</td>
<td>7</td>
<td>151</td>
<td>186</td>
<td>448</td>
<td>792</td>
</tr>
<tr>
<td>2013</td>
<td>2</td>
<td>131</td>
<td>199</td>
<td>491</td>
<td>823</td>
</tr>
<tr>
<td>2014</td>
<td>13</td>
<td>188</td>
<td>186</td>
<td>441</td>
<td>828</td>
</tr>
<tr>
<td>2015</td>
<td>13</td>
<td>147</td>
<td>186</td>
<td>518</td>
<td>864</td>
</tr>
<tr>
<td>2016</td>
<td>8</td>
<td>153</td>
<td>223</td>
<td>546</td>
<td>930</td>
</tr>
<tr>
<td>TOTAL:</td>
<td>55</td>
<td>1,002</td>
<td>1,313</td>
<td>3,613</td>
<td>5,983</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Homicide</th>
<th>Sexual Assault</th>
<th>Robbery</th>
<th>Aggravated Assault</th>
<th>Total Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010–2011</td>
<td>1,000%</td>
<td>-14%</td>
<td>9%</td>
<td>8%</td>
<td>6%</td>
</tr>
<tr>
<td>2011–2012</td>
<td>-36%</td>
<td>41%</td>
<td>7%</td>
<td>-26%</td>
<td>-12%</td>
</tr>
<tr>
<td>2012–2013</td>
<td>-71%</td>
<td>-13%</td>
<td>7%</td>
<td>10%</td>
<td>4%</td>
</tr>
<tr>
<td>2013–2014</td>
<td>550%</td>
<td>44%</td>
<td>-7%</td>
<td>-10%</td>
<td>1%</td>
</tr>
<tr>
<td>2014–2015</td>
<td>0%</td>
<td>-22%</td>
<td>0%</td>
<td>17%</td>
<td>4%</td>
</tr>
<tr>
<td>2015–2016</td>
<td>-38%</td>
<td>4%</td>
<td>20%</td>
<td>5%</td>
<td>8%</td>
</tr>
<tr>
<td>TOTAL % Change 2010–2016</td>
<td>700%</td>
<td>22%</td>
<td>40%</td>
<td>-3%</td>
<td>10%</td>
</tr>
</tbody>
</table>
Pueblo County
Crime incidents in Pueblo County (here defined as the surrounding area not included in the official city limits of Pueblo, and under the jurisdiction of the Sheriff’s Department) followed somewhat similar trends as those crime incidents that occurred in the city during the same time period. As expected, the volume of crime differed because the county represents more rural areas where, for instance, the population is smaller, and drug confiscation incidents are less frequent, but tend to yield a higher volume in product seizures when they do occur. Overall, from 2010–2016 dangerous drug seizures have increased by 52%, property crime has decreased by 13% and violent crimes have decreased by 6% in Pueblo County.
**Dangerous Drug Seizures**

Dangerous drugs are defined by the Pueblo County Sheriff’s Department (SD) as including: amphetamines, heroin, cocaine, and pills. In 2010, the SD reported 64 total incidents of dangerous drug seizures and 97 total incidents in 2016. This represents an increase of 52% over seven years. Drug seizures at the county level are, again, important to understand in context. While drugs are less frequently seized in the county, when they are seized they tend to represent a much larger volume than smaller but more frequently occurring incidents within the city. For instance, in 2011 the Pueblo County Sheriff’s Department reported 41 incidents of pill seizures. Many of these likely occurred during the same incident call, rather than disparately across multiple locations and time periods. In 2012, however, they only reported 33 total incidents where pills were confiscated. This means that while pill seizure incidents in the county dropped by 20% between 2011 and 2012, total dangerous drug seizures rose by 9%. For these reasons, it is not particularly helpful to discuss the percent increase or decrease of particular drug seizure incidents, but rather total drug seizures year to year. Total incidence numbers are represented in Table 7 below, while percent changes over time are illustrated in both Table 8 and Graph 6.

<table>
<thead>
<tr>
<th>TABLE 7: Dangerous Drug Seizures, Pueblo County</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
</tr>
<tr>
<td>2010</td>
</tr>
<tr>
<td>2011</td>
</tr>
<tr>
<td>2012</td>
</tr>
<tr>
<td>2013</td>
</tr>
<tr>
<td>2014</td>
</tr>
<tr>
<td>2015</td>
</tr>
<tr>
<td>2016</td>
</tr>
<tr>
<td>TOTAL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 8: Year To Year Percent Change In Dangerous Drug Seizures, Pueblo County</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year</strong></td>
</tr>
<tr>
<td>% Change 2010–2011</td>
</tr>
<tr>
<td>% Change 2011–2012</td>
</tr>
<tr>
<td>% Change 2012–2013</td>
</tr>
<tr>
<td>% Change 2013–2014</td>
</tr>
<tr>
<td>% Change 2014–2015</td>
</tr>
<tr>
<td>% Change 2015–2016</td>
</tr>
<tr>
<td>TOTAL % Change 2010–2016</td>
</tr>
</tbody>
</table>
Property Crime

Total property crime in Pueblo County (defined as burglary, larceny-theft, motor vehicle theft, and arson) decreased by 13% between 2010 and 2016. In 2010 there were 1,561 total incidents of property crime while in 2016 there were 1,362 total incidents. Of all property crimes, motor vehicle theft was the only type to increase (by 70%) while burglary and arson showed no change and larceny-theft decreased by 23% overall. Total incidence numbers are represented in Table 9 below, while percent changes over time are illustrated in both Table 10 and Graph 7.

**TABLE 9: Total Property Crime, Pueblo County**

<table>
<thead>
<tr>
<th>Year</th>
<th>Burglary</th>
<th>Theft</th>
<th>Motor Vehicle Theft</th>
<th>Arson</th>
<th>Total Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>258</td>
<td>1,193</td>
<td>106</td>
<td>4</td>
<td>1,561</td>
</tr>
<tr>
<td>2011</td>
<td>259</td>
<td>1,169</td>
<td>108</td>
<td>2</td>
<td>1,538</td>
</tr>
<tr>
<td>2012</td>
<td>310</td>
<td>1,145</td>
<td>123</td>
<td>2</td>
<td>1,580</td>
</tr>
<tr>
<td>2013</td>
<td>197</td>
<td>1,069</td>
<td>96</td>
<td>5</td>
<td>1,367</td>
</tr>
<tr>
<td>2014</td>
<td>225</td>
<td>966</td>
<td>97</td>
<td>3</td>
<td>1,291</td>
</tr>
<tr>
<td>2015</td>
<td>263</td>
<td>891</td>
<td>147</td>
<td>0</td>
<td>1,301</td>
</tr>
<tr>
<td>2016</td>
<td>257</td>
<td>921</td>
<td>180</td>
<td>4</td>
<td>1,362</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,769</td>
<td>7,354</td>
<td>857</td>
<td>20</td>
<td>10,000</td>
</tr>
</tbody>
</table>

**TABLE 10: Year To Year Percent Change in Total Property Crime, Pueblo County**

<table>
<thead>
<tr>
<th>Year</th>
<th>Burglary</th>
<th>Theft</th>
<th>Motor Vehicle Theft</th>
<th>Arson</th>
<th>Total Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Change 2010–2011</td>
<td>0%</td>
<td>-2%</td>
<td>2%</td>
<td>-50%</td>
<td>-1%</td>
</tr>
<tr>
<td>% Change 2011–2012</td>
<td>20%</td>
<td>-2%</td>
<td>14%</td>
<td>0%</td>
<td>3%</td>
</tr>
<tr>
<td>% Change 2012–2013</td>
<td>-36%</td>
<td>-7%</td>
<td>-22%</td>
<td>150%</td>
<td>-13%</td>
</tr>
</tbody>
</table>
Violent Crime

The Pueblo County Sheriff’s Department defines violent crime as including homicide, sexual assault, robbery, and aggravated assault. In 2010 there were a total of 335 incidents of violent crime in the County while in 2016 there were 315, representing a 6% decrease overall. Assaults, homicides, and robberies all declined over the seven-year period, while sexual assault was the only category to increase going from 91 incidents in 2010 to 99 in incidents in 2016, representing a 9% increase over time. In all, there have been a total of 2,234 incidents of violent crime from 2010–2016 in Pueblo County. Total incidence numbers are represented in Table 11 below, while percent changes over time are illustrated in both Table 12 and Graph 8.

**TABLE 11: Violent Crime, Pueblo County**

<table>
<thead>
<tr>
<th>Year</th>
<th>Homicide</th>
<th>Sexual Assault</th>
<th>Robbery</th>
<th>Assault</th>
<th>Total Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>3</td>
<td>91</td>
<td>12</td>
<td>229</td>
<td>335</td>
</tr>
<tr>
<td>2011</td>
<td>1</td>
<td>100</td>
<td>7</td>
<td>212</td>
<td>320</td>
</tr>
<tr>
<td>2012</td>
<td>2</td>
<td>122</td>
<td>10</td>
<td>208</td>
<td>342</td>
</tr>
<tr>
<td>2013</td>
<td>1</td>
<td>114</td>
<td>7</td>
<td>205</td>
<td>327</td>
</tr>
<tr>
<td>2014</td>
<td>2</td>
<td>122</td>
<td>12</td>
<td>161</td>
<td>297</td>
</tr>
<tr>
<td>2015</td>
<td>2</td>
<td>121</td>
<td>4</td>
<td>171</td>
<td>298</td>
</tr>
<tr>
<td>2016</td>
<td>2</td>
<td>99</td>
<td>5</td>
<td>209</td>
<td>315</td>
</tr>
<tr>
<td>TOTAL</td>
<td>13</td>
<td>769</td>
<td>57</td>
<td>1,395</td>
<td>2,234</td>
</tr>
</tbody>
</table>
**TABLE 12: Year To Year Percent Change In Violent Crime, Pueblo County**

<table>
<thead>
<tr>
<th>Year Change</th>
<th>Homicide</th>
<th>Sexual Assault</th>
<th>Robbery</th>
<th>Assault</th>
<th>Total Incidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010–2011</td>
<td>-67%</td>
<td>10%</td>
<td>-42%</td>
<td>-7%</td>
<td>-4%</td>
</tr>
<tr>
<td>2011–2012</td>
<td>100%</td>
<td>22%</td>
<td>43%</td>
<td>-2%</td>
<td>7%</td>
</tr>
<tr>
<td>2012–2013</td>
<td>-50%</td>
<td>-7%</td>
<td>-30%</td>
<td>-1%</td>
<td>-4%</td>
</tr>
<tr>
<td>2013–2014</td>
<td>100%</td>
<td>7%</td>
<td>71%</td>
<td>-21%</td>
<td>-9%</td>
</tr>
<tr>
<td>2014–2015</td>
<td>0%</td>
<td>-1%</td>
<td>-67%</td>
<td>6%</td>
<td>0%</td>
</tr>
<tr>
<td>2015–2016</td>
<td>0%</td>
<td>-18%</td>
<td>25%</td>
<td>22%</td>
<td>6%</td>
</tr>
<tr>
<td>TOTAL % Change 2010–2016</td>
<td>-33%</td>
<td>9%</td>
<td>-58%</td>
<td>-9%</td>
<td>-6%</td>
</tr>
</tbody>
</table>

**GRAPH 8: Number of Violent Crime Incidents, Pueblo County**

*Graph showing the number of violent crime incidents in Pueblo County from 2010 to 2016.*

**Interviews with City of Pueblo Officers**

In June of 2017 we interviewed twenty (20) City of Pueblo police officers. In order to put the statistical data in context and better understand the details involved in the relationship between crime and legal cannabis, talking to those individuals on the front line of crime in Pueblo was essential. Nineteen interviewees were male, and fourteen identified as Caucasian. The rest identified their race as either Black or Hispanic. Fourteen of the interviewees are originally from Colorado, and fifteen held an Associate’s Degree or higher. The average years of service in the Pueblo Police Department among interviewees was 11.7 years.

In the following sections, we outline four prominent themes we found during interviews with the officers. Each theme represents an issue or sentiment that consistently came up during the majority of the interviews. First, most expressed frustration with the idea that “Colorado is an island,” surrounded by states that do not allow recreational marijuana. This then leaves police in small to medium sized towns with the task of educating the influx of newcomers, enforcing the laws on a new population, and interpreting the rules and policies handed down from a variety of legislative bodies. Second, the theme of “complicated laws” was consistently broached during the interviews. Officers expressed frustration with the fact that laws and policies are unclear, constantly changing, and rarely enforced in the courts. Third, the theme of “bigger problems” was also a consistent. For most officers, despite their personal feelings about marijuana, it is not
currently the biggest threat to the community. They almost all agreed that property crimes (in particular motor-vehicle theft) and narcotic use (in particular heroin) were the biggest issues facing Pueblo. The fourth and final theme of “wants and needs” includes the officers’ discussions of the resources that are immediately needed, as well as what they would like the community to know about who they are and the job they do.

Theme 1: Colorado as an Island
When asked if they felt positively, negatively, or neutral about any type of legal cannabis, six out of the twenty officers answered that they felt negatively, two were neutral, two declined to answer the question, one felt positively about it, and nine were in favor of medical marijuana but feel that recreational cannabis has caused problems. For instance, one officer noted that: “there is so much money to be made. I’m 100% for medical marijuana” and would be “for recreational, if it was federal but we’ve cherry picked and that’s all our problem.”

This sentiment that Colorado has “cherry-picked” acceptable drugs while surrounding states did not causing Colorado to become an island for marijuana users came up in other interviews as well. One officer said that that “it reminds me of the gold rush; they [users] think it’s a free for all.” While another noted that Colorado being a lone state with legalized cannabis “will line people’s pockets and make Colorado look terrible” but he would be in favor “if it was legal everywhere.” Another noted that “Colorado weed is wanted worldwide” because the quality is so much better than product grown in other states, creating a high demand here. Finally, another officer said that the best thing would be to “get rid of recreational marijuana. Let’s enforce federal law.”

The fact that no other states surrounding Colorado have also legalized recreational cannabis leads the officers to experience frustration when people come from out of state but don’t familiarize themselves with marijuana laws. This sentiment in the interviews brought up a related issue: the complex laws and policies on the topic, and the failure of the other parts of the criminal justice system.

Theme 2: Complicated Laws
Most of the officers interviewed expressed deep concern over the complicated nature of laws and policies surrounding both medical and recreational marijuana. They feel the laws are constantly changing, making it difficult for them to keep up, let alone the rest of the population. Below are some of the concerns expressed by different officers during interviews about marijuana laws:

- “People think there’s no rules or laws. People call us because someone stole their drugs.”
- “Weed laws are so complicated.” We just stopped “10lbs of marijuana going to Kentucky. This is not what people were smoking in the 60s. They’re going through so much trouble to hide it; it’s unsafe.”
- “It doesn’t matter what you show lawmakers because they’re after own agenda.”
- “You’re [Colorado] selling your soul to the devil. It’s greed. Creating a problem in your own community.”
- “People from other states come here and there is some confusion because the law is constantly changing.”
- “People don’t research laws. The laws are complicated. It should be black and white. There’s probably a lot of people who do it medically, but those we don’t see.”
- You need to “have a court system that freaking does something.” Marijuana is taking up our time and resources and won’t be prosecuted. Heroin is [a] bigger” problem.

Officer also discussed their frustration with “top-down” changes to laws and a court system that frequently neglects to prosecute people who break marijuana laws in favor of focusing their attention elsewhere. So, overall, they felt that while they are out on the streets, enforcing the letter of the law, the court systems often then let those offenders go with a slap on the wrist.

While most officers expressed mixed personal feelings about individuals who wish to consume marijuana recreationally, almost all of the officers expressed frustration with the laws. This frustration came about
as a result of the “Colorado as an Island” sentiment, as well as the complicated wording and continually changing laws and policies handed down by the state. Combined with the notion that the court systems don’t do their part to uphold the law, these officers ended up feeling widespread frustration in their jobs. Despite the frustration that has developed for officers since the implementation of recreational cannabis laws, almost all agreed that marijuana is not the biggest problem or threat facing Pueblo.

**Theme 3: Bigger Problems**

When the officers were asked “what crime do you think is the biggest problem for Pueblo right now?” seven officers answered that property crime was the biggest problem, eleven officers answered that drugs other than marijuana were the biggest issue, and two answered that property crimes committed in order to get drugs was the problem. In particular, they noted that motor-vehicle thefts and heroin use were the two most problematic crimes facing the community.

Almost every officer agreed that marijuana, on its own, is not a great threat to the community and many indicated that they would much rather interact with a suspect who was only high on marijuana than one who was under the influence of alcohol or another drug. However, the majority of the officers also noted that the pull of legal marijuana has brought in a new population to the state who then commit property crimes to get money to buy drugs. Once they are here from out of state, they find that heroin is much less expensive than marijuana and, in many cases, easier to get. As one officer noted: “violent crimes makes news but the biggest problem is property crimes because of how many people it affects. It’s cheaper to buy from an individual than the [legal recreational cannabis] shops. The marijuana itself is not the problem, it’s the criminal element and the homeless.” Others expressed similar sentiments. When asked what crime they believed to be the biggest problem, they almost all agreed:

- “It all comes back to drugs. Heroin is an epidemic. 80–90% of property crimes involve getting money for drugs.”
- “Motor-vehicle theft... breaking into cars. Burglaries. Property crimes to get money for heroin.”
- “Motor-vehicle theft to get money to buy heroin and meth.”
- “Dope in general—all drugs lead to property crime.” We need to “double our narcotics unit.”
- “Burglaries, property crimes—getting cash to get heroin.”
- “Homelessness and heroin.”
- “The volume of property crimes and heroin.”
- “In this town, it’s addiction. Meth, but now heroin—now it’s both—so many poly-drug addicts. Marijuana is nothing more than a nuisance.”

The officers’ experiences that property crime and heroin are the biggest problems facing Pueblo are supported by the statistical data as well. Dangerous drug seizures (drugs other than marijuana), in general, have seen the largest increase of any other crime area (up 108% since 2010), while property crime has seen the second largest increase of any other crime (up by 82% since 2010). Of all recorded property crime incidents, motor-vehicle thefts have increased the most (by 218% between 2010 and 2016) and of all dangerous drug seizures, heroin incidents have also increased the most (by 448% between 2010 and 2016).

While most officers have experienced the rise in property crime and heroin incidents, it is important to note that they have also seized less marijuana (down by 34% over seven years) and that violent crime has risen less than expected (up by only 10% over the same time period). Almost all officers agree that their time and resources would be much better directed at criminal incidents other than those focused solely on marijuana. This sentiment leads to the fourth and final theme of officers’ wants and needs for themselves, for the department, and for the future of Pueblo.
Theme 4: Wants and Needs
The final theme that continually came up in interviews was that the most immediate and pressing need currently facing the Pueblo Police Department is the lack of resources. In particular, officers agreed that the one thing they needed the most are more officers. When asked the question: “what could be done to make your job easier?” their answers were simple, to the point, and consistent:

- “More patrol officers and more of a presence.”
- “More training.”
- “More man power, more funding, more community support.”
- “More personnel and an accountable court system.”
- “The number one thing is funding for more officers.”
- “A lot more cops—more trust from the community, but to do that we would have to double the size of the department.”
- “More officers—we did pro-active police work—now everything is reactive.”
- “More officers. On a good night we’ll have 5 cops on each side of town.”
- “More officers—we would have more time to patrol and do community outreach.”
- “I would want a psychologist on staff. Funding for more officers—it would free us up to help people who need it—we can’t be proactive. Our response time sucks. It is embarrassing to go to a case that is 14 hours old.”
- “Manpower—so officers can be more proactive and preventive.”
- “More officers, so that I can be more proactive—be seen in the community, talk to kids.”

By far, the vast majority of the interviewees indicated that the department is desperately in need of more patrol officers. Currently, there are 88 full-time patrol officers on staff to serve a population of over 110,000 people, not including the new homeless and transient populations who are not included in the census. The officers expressed their frustration with the lack of resources by acknowledging the long response times and reactive (rather than proactive) policing they are now forced to do.

When asked a final question, most interviewees took longer to answer it than any of the previous questions. They thought about their answer and seemed genuine in their sentiments. They were asked: “what is one thing you wish the community understood better about the job you do?” and they answered:

- “They [citizens] only see what they read in the paper—they don’t see what we have to deal with psychologically. I don’t know—I want to help people.”
- “The stuff that we hold inside. We took the job because we want to help people. We are not heartless.”
- “Be patient with us—it may seem like we’re doing nothing—but we are always shorthanded.”
- “They don’t have to be afraid of the cops. We’re not here to hurt or harm anyone—we’re here to protect and serve the community.”
- “It feels like us vs. them. Sometimes the negative stuff you see is because they forget we’re people and we care about our community. We need an open discussion.”
- “How hard some of these guys are trying. We live here, raise kids in this city, we care, and we are trying.”
- “That we’re human. You can’t see all our wounds, the stuff we’ve seen—no other human being should have to see. You can’t see my scars or my battle wounds.”
- “That we’re all human. Some think we think we’re better than them. I wish the media would put out more good stories.”
- “That we’re human beings at the end of the day; I’m just like anyone else in the community. We are 100% a reactive department... we want to be a community policing department.”

All sentiments expressed by these officers can best be summed up in the following quote: “We are doing the best we can, trying to make it a safe place for you to live and work. I know that I am just a uniform in that
The common theme is that they all want to do good work in the community; they want to be pro-active, involved, and understood. Ultimately, these officers want the people to remember that they live and work in Pueblo as well, and that most of them joined the force to do good work and help the community.

In the next section we summarize primary findings and offer recommendations based on those findings for the City, County, and future researchers.

**Discussion and Recommendations**

While statistics and quantitative data are interesting, they are incomplete. Both the City of Pueblo and Pueblo County have no reliable way to keep track of exactly how or in what ways marijuana is involved in other crime incidents. A first recommendation is that both agencies develop a system that will allow responding officers to track if and how marijuana was involved in the incident. This will allow future researchers and policy makers to more accurately analyze the direct relationship between crime and marijuana.

Developing such a system, however, requires resources. While the City of Pueblo is able to employ a crime data analyst, Pueblo County is unable to do so at this time given the tight funding and manpower issues they face. Both agencies should be given the resources to develop better data tracking systems including the personnel necessary to gather, analyze, and disseminate information. If the state truly wants to better understand how crime and marijuana are related, they will focus more financial resources on making these information-gathering systems available to local law enforcement.

Resources are also woefully lacking when it comes to employing patrol officers. In 2010, the population of Pueblo was approximately 106,000 and the Police Department employed 108 patrol officers. In 2016 the population had grown to approximately 110,000 while the number of patrol officers on staff dropped to 88. Census statistics do not, of course, account for the individuals who have immigrated to Pueblo County but remain undocumented due to their transient or homeless status. In the city, crime has gone up in all areas and in the county, it has increased in the areas of marijuana seizures and dangerous drug seizures.

Interviews with city patrol officers also strongly support the conclusion that the department is in desperate need of more personnel. Almost every interviewee stated that the department needs more officers patrolling the streets if they want to improve response times and engage in more proactive community policing. Interviewees also agreed that employing more officers would improve relations between the department and the community. While we were unable to interview officers from the Sheriff’s Department due to time constraints, informal conversations with staff and administrators echo the concerns of the city PD. The Sheriff’s Department is also extremely limited in funding and personnel and would greatly benefit from the hiring of more deputies, as well as a dedicated crime analyst.

According to both the quantitative and qualitative data, the two most pressing issues facing Pueblo are motor-vehicle thefts and the heroin epidemic. If and when resources are allocated to local law enforcement, it should be with these issues in mind.

**Conclusion**

This report represents a pilot study; one that establishes a base line of the current situation and works to direct future research. The original research question was: what is the relationship between the legalization of recreational marijuana and crime in the City and County of Pueblo, CO? Given the available data, we can conclude that:

1. Marijuana seizures have decreased in the City of Pueblo, but not in the County, likely due to the larger volume of illegal marijuana grows present in the County.
2. Overall crime has increased in the City, but it has done so on trend with expected averages given the increase in population and decrease in police personnel.
3. The largest increases in crime have been property crime incidents (particularly motor-vehicle theft) and dangerous drug seizures (particularly heroin). Violent crime has risen only marginally in the City and it has decreased in the County.

4. The legalization of recreational marijuana has put more perceived pressure on patrol officers who associate it with an influx in the transient population, which they then associate with the increase in property and other drug crimes.

5. Police struggle with enforcing complicated and changing marijuana laws and perceive that citizens also struggle to keep up with confusing policy.

6. Both the City of Pueblo and Pueblo County are extremely understaffed. Resources should be made immediately available to recruit and retain more officers to deal with the increase in property crime.

There has been very little scholarly research conducted on the relationship between recreational marijuana laws and crime. In fact, there are only a handful of current studies examining this issue, which leaves plenty of room for future researchers to fill in the gaps. This study was conducted in response to a request by the County to investigate the social impacts of cannabis on the local community. Given the limitations of these data, it is essential that more research (both quantitative and qualitative) be conducted to understand the full picture. Scholars should seek out funding sources to help supplement the time and financial needs that undertaking this type of research requires.

The question regarding the relationship between recreational marijuana and crime is not one that is easily answered. There are a number of moving parts to consider including missing information, unclear policies, time, resources, and the privileging of individual experiences. However, we are confident that this research is important and relevant. We are on the cutting edge of cannabis policy and other states are looking to us for guidance. Our thoughtful and in-depth investigation into the issues facing our own community is an essential starting point for the future of all cannabis research.

Acknowledgments
We would like to extend sincerest thanks to the men and women of the Pueblo County Sheriff’s Department and the City of Pueblo Police Department. Their cooperation, resources, interest, and generous time commitments are what made this report possible at all.

References


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Pueblo County, Colorado Sheriff’s Department. Numerical data received July, 2017.


Social Impacts 6A: Pueblo County impact study—health

Information concerning cannabis is being collected through research in Colorado since legalization. These three studies specifically look at some of the questions that have come up since recreational cannabis became available in January of 2014 in Pueblo County. The first study examines information with the obstetric population. The second study examines the relative-risk as it relates to drug screens in the emergency department. The third study is a pilot to gain information why individuals utilize cannabis. These three studies give some benchmark information as a starting point for further research and support the idea that cannabis indeed does have impacts to health in Pueblo County.

Part 1: Pregnant women—impact of cannabis legalization

Abstract

The National Survey on Drug Use and Health (NSDUH) 2002–2014, revealed the use of marijuana in pregnant women increased from 2.37% in 2002 to 3.85% in 2014 (as cited in Brown et al., 2017). The current availability of reputable research on the effects of legalization is limited, especially use during pregnancy. The current study was a retrospective cohort analysis of pregnant woman, in both an inpatient (Section 1) and outpatient setting (Section 2), to determine use of cannabis before and after recreational legalization. The research question was the following: How has the use of cannabis by pregnant women, and consequential exposure to the fetus/neonate, in Pueblo County been affected as compared before and after recreational legalization? The results revealed there was an increased occurrence of mothers testing positive for cannabis for the acute care, inpatient population ($X^2=4.070, p=0.0437$). A statistically significant increase of cannabis use was revealed. However, results showed there was not a statistically significant change in cannabis use for subjects in the outpatient setting ($p=0.89$). Tobacco use of those who tested positive for cannabis did increase slightly in both populations ($p=0.059$ for Section 2). The inpatient population that tested positive for marijuana were more likely to have public health insurance, both prior to recreational legalization of marijuana and after legalization. This intent of this study was not to reveal birth outcomes in the exposed fetus/neonate population, but rather to determine if the number of unborn babies exposed to cannabis/THC has changed. Future studies to determine long-term effects in this population is recommended.

Key Words: marijuana use during pregnancy, prenatal cannabis exposure, cannabis and pregnancy

Introduction

In January 2014, recreational marijuana was made legally available for purchase in Colorado. The current availability of reputable research on the effects of legalization is limited, especially use during pregnancy. Effects of cannabis use during pregnancy on pregnancy outcomes and fetal development is not clear due to the limited research with this vulnerable population (Gunn et al., 2015). Cannabis use during pregnancy is prevalent world-wide and over the last 50 years, there has been an increase in the potency of cannabis (Calvigioni, Hurd, Harkany, & Keimpema, 2014; World Health Organization, WHO, 2016). The increased potency could potentially lead to adverse outcomes for the unborn fetus or the newborn that was exposed in-utero to cannabis. Mehmedic et al. (2010) stated that the THC content in marijuana was on average 3.4% in 1993 and 8.8% in 2008 (as cited in Day, Goldschmidt, Day, Larkby, & Richardson, 2015). The US Drug Enforcement Administration (DEA) found THC content to be 20% or more in the confiscated cannabis in 2015 (WHO, 2016). According to the National Survey on Drug Use and Health (NSDUH) 2002–2014, the use of marijuana in pregnant women was 2.37% in 2002 and had increased to 3.85% in 2014 (as cited in Brown et al., 2017).

The current study was a retrospective cohort analysis to obtain preliminary measures of association which
will allow for development of future studies and/or interventions. The PICO question was the following: How has the use of cannabis by pregnant women, and consequential exposure to the fetus/neonate, in Pueblo County been effected as compared before and after recreational legalization? The goal of this study was to identify trends of cannabis use in Women’s Health and Obstetrics by comparing pre- and post-legalization using positive urinalyses (U/A). The two datasets used in this study were from two different healthcare institutions, one being an inpatient setting and the other an outpatient facility. The inpatient population will be discussed in Section 1, and the outpatient population will be Section 2 in this study. This research will assist in filling the research gap on the topic of legalization of marijuana.

**Review and Summary of Relevant Literature**

In the United States, 3% of all babies are born with a birth defect (Barker & Foo, 2017). These researchers stated that in Colorado, 8% of babies are low birth weight, putting them at risk for health problems. Smoking during pregnancy increases risk of miscarriage, preterm birth, low birth weight, and birth defects (Barker & Foo, 2017; Brown et al., 2016). The researchers stated that due to known problems from tobacco use during pregnancy, there is an increased concern regarding marijuana use during pregnancy. Brown et al. (2016) completed a cross-sectional population-based survey between June of 2011, and June of 2013, of 344 women between the ages of 15 and 43. They found that 3.6% of the woman reported using cannabis only during pregnancy, 20.5% reported using cannabis with or without cigarettes, and 51% reported adverse perinatal outcomes. Shu, Huang, Menezes, and Faisal-Cury (2016) stated that in Brazil, cannabis was the most common illicit drug that was used during pregnancy and could potentially cause risks to the growing fetus. The researchers completed a cross-sectional analysis of 831 women, ages 16 or older, using a structured self-report questionnaire during the 20th to 30th week of pregnancy from May 2005 to March 2007. They found that 2.3% of the non-tobacco users used cannabis during pregnancy while 14% of the tobacco users used cannabis, and the statistical findings revealed a correlation between cannabis use, tobacco use, and mental health issues in these women. Mark, Desai, and Terplan (2016) found an association where marijuana use during pregnancy was strongly correlated to use of cigarettes ($p < 0.001$).

The National Academy of Sciences (NAS, 2017) stated that smoking marijuana during pregnancy has been linked to lower birth weights. The NAS (2017) conducted a literature review of retrospective cohort studies published since 1999. Their findings revealed that overall, the only significant association is lower birth weight babies for women who smoked marijuana during pregnancy. There was limited evidence that smoking cannabis can cause pregnancy complications or an increased risk of Neonatal Intensive Care Unit (NICU) admissions. Mark et al. (2016) completed a retrospective cohort comparative study of a total of 396 pregnant patients where 116 of these patients used marijuana during pregnancy. Their results revealed that there was no difference found between prenatal care or birth outcomes when comparing the groups. They also stated that marijuana use decreased throughout the term of the pregnancy with their sample population.

THC crosses the placenta barrier, exposing the fetus during pregnancy, and it is also found in breastfeeding (Barker & Foo, 2017). During the prenatal period, the central nervous system is continuously being developed. Calvigioni, Hurd, Harkany, and Keimpema (2014) conducted a literature review of animal and human studies of exposure to cannabis during pregnancy to look at “neurobiological effects at the molecular, cellular and systems neuroscience levels” in the exposed offspring (p. 933). The researchers concluded that fetal exposure to cannabis will disturb fine-tuned signaling pathways at the molecular level, leading to alterations in brain circuit formation, causing long-term behavioral and psychological alterations. Jacques et al. (2014) conducted a literature review of cannabis use during pregnancy in Western communities and found that smaller head circumferences in the newborn have been associated with cannabis use during pregnancy. The researchers stated that “it must be noted that head growth, especially during the first month of life, is significantly associated with future intelligence quotient” (p. 420). Jacques et al. (2014) concluded that cannabis exposure during critical brain development can have a negative effect on fetal growth, behavior, and neurodevelopment. Barker and Foo (2017) found
through their literature review that later in life, children exposed during pregnancy had decreased growth, impaired cognitive function, decreased educational ability, and increased symptoms of depression. Similar findings were revealed through a prospective study on children, aged 10, that were exposed to marijuana during the prenatal period (Goldschmidt, Day, & Richardson, 2000). Goldschmidt et al. (2000) found that if the children were exposed during the 1st and 3rd trimester, the findings revealed that they were more likely to have behavioral problems such as increased inattention, hyperactivity, and impulsivity.

The literature review revealed that marijuana use during pregnancy can cause negative effects to the fetus and newborn, such as behavioral problems, low birth weight, small head circumferences, delayed growth, and decreased neurodevelopment. There was a correlation between smoking cigarettes and use of marijuana during pregnancy (Barker & Foo, 2017; Brown et al., 2016; Shu et al., 2016; Mark et al., 2016; NAS, 2017). Research was limited to unknown use of type of marijuana being consumed, whether it was smoked or ingested through additional routes, or the potency of the marijuana (Barker & Foo, 2017). There was also lack of research on legalization of marijuana and the impact to pregnant women and their unborn child. Therefore, the researchers concluded that there was a need for conducting this retrospective cohort study.

Section 1: Research Methods
The inpatient setting for the research study was at a local healthcare serving institution serving perinatal patients at an acute-care, inpatient facility. Datasets were gathered retrospectively through the electronic medical record systems. This research study was a retrospective cohort study to obtain preliminary measures of association which will allow for development of future studies and/or interventions. Permission to conduct this research was obtained through the Institutional Review Board (IRB) at this institution. Patients were identified through the electronic medical record database by a contributor employed at the healthcare facility. A sequence was written for the electronic medical record systems and the outcome measures listed below were extracted through the program. The data that was obtained by the researchers was de-identified. The researchers only dealt with data in this study, not human subjects. The contributor extracted the data and downloaded the data to an excel spreadsheet. Anonymity was maintained since the co-investigators only had access to de-identified data.

The common characteristic of all participants was that they had delivered their newborn at the inpatient facility. Inclusion criteria for the acute-care, inpatient facility was women testing positive for cannabis and/or THC who also sought perinatal care in Pueblo County. Data was further divided into the year of delivery, age, gender, ethnicity/race, type of healthcare insurance, tobacco use, and total number of babies delivered (per year).

The retrospective design allowed for the contributor(s) to pull data from 2013, prior to legalization of recreational cannabis, and data after legalization from January 2014 to June of 2017. Descriptive statistics were analyzed to summarize the sample population characteristics and to answer whether there was a difference between the variables, as listed above, before legalization of recreational cannabis and after legalization of recreational cannabis. For the 2013 year, only nine months of data was available; therefore, a relative risk (RR) was calculated to estimate the total number of visits. Chi-square tests were also calculated for an association between this time period and THC positive testing.

Section 1: Results
The statistical analyses were completed to answer the following research question: How has the use of cannabis by pregnant women, and consequential exposure to the fetus/neonate, in Pueblo County been effected as compared before and after recreational legalization?

Acute-Care Inpatient Facility
The sample size for the patients seen at the acute-care inpatient healthcare setting consisted of a convenience sample of 6,467 subjects. There were a total of 176 mothers that tested positive for cannabis and/or THC at this healthcare setting. Demographic data was only available on mothers who tested positive for cannabis
and/or THC. The subjects were divided into two groups: those with a delivery date on or before 12/31/2013 and those with a delivery date on or after 01/01/2014. This lower confidence bound equals 1.113 and shows that the increase in THC positive drug screens observed after the legalization of marijuana is at least 11.3% relative to the rate of THC positive drug screens prior to legalization. In addition, a chi-square test for an association between the time period and THC positive testing rate was performed. Similar to the relative risk approach, the test also showed that the rate of occurrence of positive THC outcomes was significantly different between the two time periods ($X^2=4.070, p=0.0437$).

<table>
<thead>
<tr>
<th>TABLE 1: Distribution of Marijuana Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>THC positive</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>2014 &amp; later years</td>
</tr>
<tr>
<td>Before 2014</td>
</tr>
</tbody>
</table>

* As THC positive results were available only for a nine-month period in 2013, the total number of deliveries during that period was estimated as follows: yearly visits * 9/12 = 1078 * 0.75 = 1059. Some of the summary statistics on the subjects of the study are as follows.

<table>
<thead>
<tr>
<th>TABLE 2: Distribution by Type of Insurance for THC Positive Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
</tr>
<tr>
<td>Private</td>
</tr>
<tr>
<td>Uninsured</td>
</tr>
</tbody>
</table>

Table 3: Distribution by Race for THC Positive Subjects

<table>
<thead>
<tr>
<th>Race</th>
<th>2013</th>
<th>2014 &amp; later years</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indian / Alaska Native</td>
<td>10.53%</td>
<td>3.18%</td>
</tr>
<tr>
<td>Asian</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Black or African American</td>
<td>5.26%</td>
<td>1.91%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0%</td>
<td>1.91%</td>
</tr>
<tr>
<td>White</td>
<td>68.42%</td>
<td>78.98%</td>
</tr>
<tr>
<td>Unknown</td>
<td>0%</td>
<td>4.46%</td>
</tr>
<tr>
<td>Refused to Answer</td>
<td>15.79%</td>
<td>9.55%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 4: Distribution by Ethnicity for THC Positive Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic/Latino</td>
</tr>
<tr>
<td>Not Hispanic/Latino</td>
</tr>
<tr>
<td>Unknown</td>
</tr>
<tr>
<td>Refused to Answer</td>
</tr>
</tbody>
</table>
TABLE 5: Distribution by Age for THC Positive Subjects

<table>
<thead>
<tr>
<th>Age</th>
<th>2013</th>
<th>2014 &amp; later years</th>
</tr>
</thead>
<tbody>
<tr>
<td>14–19</td>
<td>8.33%</td>
<td>5.36%</td>
</tr>
<tr>
<td>20–24</td>
<td>33.33%</td>
<td>25.00%</td>
</tr>
<tr>
<td>25–29</td>
<td>16.67%</td>
<td>25.89%</td>
</tr>
<tr>
<td>30–34</td>
<td>12.50%</td>
<td>8.93%</td>
</tr>
<tr>
<td>35–39</td>
<td>8.33%</td>
<td>3.57%</td>
</tr>
<tr>
<td>40–49</td>
<td>0%</td>
<td>1.34%</td>
</tr>
</tbody>
</table>

TABLE 6: Distribution by Tobacco Use for THC Positive Subjects

<table>
<thead>
<tr>
<th>Tobacco use</th>
<th>2013</th>
<th>2014 &amp; later years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco use</td>
<td>5.26%</td>
<td>17.83%</td>
</tr>
<tr>
<td>No tobacco use</td>
<td>0%</td>
<td>5.73%</td>
</tr>
<tr>
<td>Unreported/refused to answer</td>
<td>94.74%</td>
<td>76.43%</td>
</tr>
</tbody>
</table>

Section 1: Discussion

The purpose of this study was to determine how the use of cannabis by pregnant women, and consequential exposure to the fetus/neonate, in Pueblo County has been effected as compared before and after recreational legalization. However, for the women seeking healthcare in the inpatient setting, initial calculations using relative risk did reveal that after legalization of marijuana the increase in THC positive drug screens was at least 11.3% relative to the levels of THC positive drug screens prior to legalization. The chi-square test also confirmed statistical significance ($X^2=4.070, p=0.0437$). There was an increased occurrence of mothers testing positive for cannabis after legalization of marijuana for the acute care population. Tobacco use of patients in the inpatient setting also increased after legalization of recreational marijuana. Prior to legalization, only 5.26% were using tobacco, whereas after legalization, 17.83% used tobacco.

Results also revealed that those in the inpatient population that tested positive for marijuana were more likely to have public health insurance, both prior to recreational legalization of marijuana and after legalization. Prior to legalization, 84.21% had public insurance and after legalization 91.08% had public insurance. The percentage of those with private insurance decreased after legalization from 10.53% down to 6.37%. This increase in public insurance correlates with the national increase of those eligible for Medicaid with the passing of the Affordable Care Act in 2010 (Gaffney & McCormick, 2017). “Of the 22 million who gained insurance as a result of the ACA, 13 million were insured through Medicaid” which is one form of public insurance (Gaffney & McCormick, 2017, p. 1445).

The results of this study may have a significant impact on our society by providing statistical evidence that legalization of recreational cannabis did change use of marijuana in the inpatient sample population. As noted in the review of the literature, the availability of reputable research on the effects of legalization of recreational marijuana use is limited, especially use during pregnancy and the effects to the unborn fetus. National Survey on Drug Use and Health (NSDUH) in 2002, revealed that marijuana use in pregnant women was increasing (as cited in Brown et al., 2017).
Section 1: Limitations
A limitation of the current study was only having a sample of those living in the local region, which decreases the ability to generalize the results of this study to a larger population. Another limitation was the retrospective design, which eliminated the researchers’ control of extraneous variables such as how it was determined to whether a drug screen would be collected on the patients. The researchers relied on provider judgment of screening for drug use. Another limitation was that after legalization of cannabis, the contributors revealed that the healthcare facility determined it was more cost-effective to not run a drug test if the patient admitted to drug usage. Those that admitted to drug use were not included in the sample size. This affected the sample size for this retrospective study and there may be more individuals who were using marijuana. Additionally, there was no documentation on the frequency of marijuana use and whether marijuana was used throughout all three trimesters of pregnancy.

Section 2: Research Methods
The outpatient setting for the research was at a different healthcare serving institution than was discussed in Section 1 of this study. This facility serves perinatal patients throughout their pregnancy and postpartum periods. Participants were gathered retrospectively through the electronic medical record systems. Permission to conduct this research was obtained through a different Institutional Review Board (IRB) than discussed in section one. Patients were identified through the electronic medical record database by a contributor employed at the healthcare facility. A sequence was written for the electronic medical record systems and the outcome measures listed below were extracted through the program. The data that was obtained by the researchers was de-identified. The contributor extracted the data and downloaded the data to an excel spreadsheet. Anonymity was maintained, since the co-investigators only had access to de-identified data. Inclusion criteria for the outpatient clinic setting was testing positive for cannabis and/or THC during prenatal care. Data was further divided into maternal age at delivery, year and date of delivery (if already delivered), ethnicity, race, tobacco use, and marijuana use.

The retrospective design allowed for the contributor(s) to pull data prior to legalization of recreational cannabis, year of 2013, and data after legalization up to June of 2017. Descriptive statistics were analyzed to summarize the sample population characteristics and to answer whether there was a difference between the variables, as listed above, before legalization of recreational cannabis and after legalization of recreational cannabis. Chi-square tests were calculated to compare the association of cannabis use, before and after the legalization of recreational cannabis, to additional variables such as age of mother, race, ethnicity, tobacco use of patients negative for cannabis and/or THC, and tobacco use of patients positive for cannabis and/or THC.

Section 2: Results
The statistical analyses were completed to answer the following research question: How has the use of cannabis by pregnant women, and consequential exposure to the fetus/neonate, in Pueblo County been effected as compared before and after recreational legalization?

Outpatient Clinic Setting
The sample size for the patients seen at the outpatient clinic healthcare setting consisted of a convenience sample of 2,072 subjects. There were a total of 163 subjects that tested positive for cannabis and/or THC at this healthcare setting. The subjects were divided into two groups: those with a delivery date on or before 12/31/2013 and those with a delivery date on or after 01/01/2014. Several variables were compared between these two groups.
The comparison of proportions of tobacco users in the population showed a significant difference between the time period ending with 12/31/2013 and time period starting with 01/01/2014 \( (z=3.79, p<0.001) \). Further analysis with the use of relative risk methodology showed that relative to pre-2014 level there was an increase in the rate of tobacco use in the population by at least 27.3% with 95 percent confidence. A similar analysis was performed on marijuana users to determine any trends in their use of tobacco. There were 163 marijuana users in the study and their distribution by tobacco use was as follows.

### TABLE 7: Distribution of Subjects by Tobacco Use

<table>
<thead>
<tr>
<th>Tobacco use among all subjects</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time period</td>
<td>Yes</td>
</tr>
<tr>
<td>12/31/2013 &amp; before</td>
<td>52</td>
</tr>
<tr>
<td>01/01/2014 &amp; after</td>
<td>332</td>
</tr>
</tbody>
</table>

Unlike the general population, the increase in the use of tobacco beginning with 2014 was only weakly significant among the users of marijuana \( (z=1.89, p=0.0586) \). The overall proportions of marijuana users before and after its legalization were compared as well.

### TABLE 8: Distribution of Tobacco Use among Marijuana Subjects

<table>
<thead>
<tr>
<th>Tobacco use among marijuana users</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time period</td>
<td>Yes</td>
</tr>
<tr>
<td>12/31/2013 &amp; before</td>
<td>8</td>
</tr>
<tr>
<td>01/01/2014 &amp; after</td>
<td>54</td>
</tr>
</tbody>
</table>

The comparison did not reveal any significant difference in proportions of marijuana users before and after its legalization \( (z=0.135, p=0.8926) \).

### TABLE 9: Distribution of Marijuana Use

<table>
<thead>
<tr>
<th>Marijuana use among all subjects</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Time period</td>
<td>Yes</td>
</tr>
<tr>
<td>12/31/2013 &amp; before</td>
<td>35</td>
</tr>
<tr>
<td>01/01/2014 &amp; after</td>
<td>128</td>
</tr>
</tbody>
</table>

The results using the outpatient population did reveal statistical significance that tobacco use in the local community is increasing. Prior research has already shown that tobacco use has detrimental health effects to a growing fetus. Barker and Foo (2017) and Brown et al. (2016) stated that due to known problems from tobacco use during pregnancy, there is an increased concern regarding marijuana use during pregnancy. The current study results revealed that tobacco use during pregnancy has increased, which is concerning, but the increase was noted at a much higher rate in those who do not use marijuana.
Section 2: Limitations
A limitation of the current study was only having a sample of those living in the local region, which decreases the generalizability of the results of this study to a larger population. The results for the outpatient population of perinatal patients did not reveal a statistically significant change in cannabis and/or THC use during pregnancy, before and after recreational legalization. However, a limitation of this data is that the patients seen in this healthcare setting are considered a vulnerable population, which could have contributed to a higher incidence of pre-legalization recreational cannabis use. Another limitation was the retrospective design, which eliminated the researchers’ control of extraneous variables such as how it was determined to whether a drug screen would be collected on the patients. The researchers relied on provider judgement of screening for drug use. Again, there was no documentation on the frequency of marijuana use and whether cannabis was used throughout all three trimesters of pregnancy.

Overall Recommendations
This intent of this study was not to reveal birth outcomes in the exposed fetus/neonate population, but rather to determine if the number of unborn babies exposed to cannabis/THC has changed due to the legalization of recreational cannabis in Pueblo County. Future studies to determine what, if any, long-term effects are seen in this population of newborns is recommended. Until this research can be completed, the recommendation is to follow the current guidelines from the American College of Obstetricians and Gynecologists (ACOG, 2017), which state the following:

- Before pregnancy and in early pregnancy, all women should be asked about their use of tobacco, alcohol, and other drugs, including marijuana and other medications used for nonmedical reasons
- Reporting marijuana use should be counseled about concerns regarding potential adverse health consequences of continued use during pregnancy
- Who are pregnant or contemplating pregnancy should be encouraged to discontinue marijuana use
- Women or women contemplating pregnancy should be encouraged to discontinue use of marijuana for medicinal purposes in favor of an alternative therapy for which there are better pregnancy-specific safety data
- There is insufficient data to evaluate the effects of marijuana use on infants during lactation and breastfeeding, and in the absence of such data, marijuana use is discouraged (para. 5).

Conclusions
Whiting et al. (2015) discuss that marijuana is being used during chemotherapy treatment to decrease nausea and vomiting. In pregnancy, it is common that during the first trimester patients experience “morning sickness” resulting in nausea and vomiting. Due to the known reports of relief of these symptoms through marijuana use, some women may perceive marijuana as a safe remedy. Due to limited research on the topic of use of marijuana before and after legalizing recreational use, this study contributes to the current body of knowledge. This current study, comparing the inpatient population to the outpatient population revealed contradictory results. Results show that while use of marijuana in one population of perinatal patients seeking healthcare has not changed, use of marijuana in the other healthcare patient setting did increase after legalization of recreational marijuana. Tobacco use is increasing during pregnancy in the local healthcare perinatal and antenatal population. Results did reveal that those seeking antenatal care in the inpatient healthcare setting were more likely to test positive for THC after recreational use of marijuana in Colorado was legalized.

References

review on potential health effects of marijuana use. Retrieved from https://drive.google.com/file/d/0B0tmPQ67k3NVmJyYgW3Vg3V5FmWFE/view


Part 2: Positive urine drug screen for marijuana: relative risk in a Pueblo Colorado emergency department

Abstract

This study examines the relative risk of positive urine testing for tetrahydrocannabinol (THC) at an Emergency Room in Pueblo Colorado. The study purpose is to gain benchmark data specifically for Pueblo County. The retrospective study clearly identifies an increased relative risk with a 95% confidence interval at (1.108, 1.283).

Recreational marijuana was legalized in 2014 in Colorado and the need to understand its social impact has been identified as a priority for Pueblo County. This health related element of the social impact study posed the question: In Pueblo County how does recreational marijuana affect emergency department (ED) tetrahydrocannabinol (THC) positive urine drug screens from patient visits before recreational legalization compared to after recreational legalization over three years? The affect that marijuana specifically has on the ED is not clearly understood, but what is clear since the legalization of recreational marijuana is that there is a significant impact occurring.

In collaboration with a Pueblo County ED retrospective data were analyzed from the electronic health record
from April 2013 to July to 2017. Relative risk methodology was utilized to identify the trends. Summary statistics were analyzed by distribution of, gender, age, race, ethnicity, location and type of insurance.

**Review of Literature**

Prior research examining marijuana use is starting to be collected, however there is little information how the emergency room is being affected. In the Monitoring Health Concerns Related to Marijuana in Colorado: 2016 report from the Colorado Department of Health & Environment, Pueblo County was identified as the highest use of prevalence among high school students in 2013 and 2014. Additionally it was found that related ED visits by marijuana-related billing codes rate was 17 per 1,000, second to Summit County (21 per 1,000) in 2014. Data for this study were based on diagnostic codes specifically related to marijuana in that report (2016). In an attempt for a broader perspective this study looked at positive THC results from urine drug screens specifically excluding diagnostic codes.

Wang et al. (2016) examined rates for ED visits 2 years prior to recreational legalization compared to 2 years post legalization and reported that Colorado ED visits increased from 4.3 to 6.4 per 100,000 which was not considered significant. Hall (2014) evaluated research over 20 years for adverse effects of recreational marijuana use. The author’s conclusion was “The epidemiological literature in the past 20 years shows that cannabis use increases the risk of accidents and can produce dependence, and that there are consistent associations between regular cannabis use and poor psychosocial outcomes and mental health in adulthood” (p.1).

Positive urine drug screens in the U.S. workforce has increased annually. Quest Diagnostics’ Drug Testing Index report found in the federal-mandated and safety-sensitive workforce that utilizes urine drug screens there was an increase of nearly 10% from 2015 to 2016. This increase was the highest in the last five years. In Colorado overall all urine positive testing for marijuana outpaced the national average during 2016. The increase from 2015–2016 was 11% (2017).

“We have been tracking the trends in marijuana positivity in states that have passed medical and recreational marijuana use statutes for several years now. 2016 is the first year since Colorado and Washington approved recreational use that the rates of year-over-year change were sharply higher than the national average” (Sample, Quest Diagnostics, 2017). This supports the thought that there is an impact in Colorado but what that impact is in Pueblo County is not identified. There are thoughts in the literature that younger people seem to be the most affected but studies suggest that there is an increase in older age groups. The SAHMSA (2016) report found:

An estimated 22.2 million Americans aged 12 or older in 2015 were current users of marijuana. This number of past month marijuana users corresponds to 8.3 percent of the population aged 12 or older. The percentage of people aged 12 or older who were current marijuana users in 2015 was similar to the percentage in 2014, but it was higher than the percentages from 2002 to 2013. This increase in marijuana use among people aged 12 or older reflects the increase in marijuana use by adults aged 26 or older and, to a lesser extent, increases in marijuana use among young adults aged 18 to 25. (p.6).

In the Rocky Mountain High Intensity Drug Trafficking Area (2016) report it was found that Penrose Hospital had an increase in drug screens positive for cannabis, almost doubling from 2012 (n=1,189) to 2014 (n=2,042). Schipani (2016) from FactCheck.Org points out:

The data are not directly obtained from lab tests or physicians. The 2015 report primarily includes numbers crunched by the Colorado Department of Public Health and Environment, which used medical codes as a means of quantifying marijuana-related emergency room visits. Medical coding translates information from hospital charts, which could include lab test results and a physician’s notes, into alphanumeric codes used for billing and insurance purposes.

In other words, the “marijuana-related” information pertaining to emergency room visits goes through
at least one round of telephone before it’s translated into statistics by CDPHE and other groups. As we’ll explain, this is part of the reason why these codes don’t “necessarily prove marijuana was the cause of the emergency admission,” as the Rocky Mountain HIDTA report states.

It is apparent that the research is in early stages regarding the social impact of marijuana on U.S. society let alone how counties are specifically affected. The report from the Colorado Department of Health does suggest that Pueblo County appears to be experiencing more of an impact compared to most other counties since the legalization of recreational marijuana and this study attempts to add information regarding the relative risk with drug testing results.

Method
This retrospective study was completed utilizing data in the electronic health record from a Pueblo ED. The data collected were from 2013 and compared to data from 2014 through July of 2017. Institutional Review Board approval was obtained both from the collaborative hospital Parkview Medical Center and Colorado State University-Pueblo. THC testing rates were evaluated with the use of relative risk (RR) methodology and summary statistics for gender, age, race, ethnicity, location (Pueblo including Pueblo West, Pueblo County and other) and insurance (public, private and uninsured) were obtained.

Findings
The change in positive THC testing rate was evaluated with the use of relative risk (RR) methodology based on the following data summary. A patient visit total N of 60,050 with an N=826 positive urine drug screens for marijuana were reviewed from 2013 and compared to an N=309,506 patient visits with N=5,076 positive urine drug screens for marijuana from 2014 through 2017.

The resulting 95% confidence interval for the relative risk is (1.108, 1.283). This interval, in particular, shows that the increase in positive THC testing rate observed after the legalization of marijuana is between 10.8% and 28.3% relative to the rate of positive testing prior to legalization.

Some of the summary statistics of patients tested for THC in the study are as follows. The tables reflect that while the relative risk is significantly increased there is little change in the summary statistics. Gender (Table 1), Race (Table 2), Ethnicity (Table 3) and Location (Table 4) were not significantly different. This suggests that testing was consistent before and after legalization. The location findings suggest that there has not been a change in ED utilization since legalization of recreational marijuana from individuals that are transient or visiting from outside of Pueblo County.

<table>
<thead>
<tr>
<th>TABLE 1: Distribution by Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
</tr>
<tr>
<td>Males</td>
</tr>
<tr>
<td>Females</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLE 2: Distribution by Race</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
</tr>
<tr>
<td>American Indian / Alaska Native</td>
</tr>
<tr>
<td>Asian</td>
</tr>
<tr>
<td>Black or African American</td>
</tr>
<tr>
<td>Hispanic</td>
</tr>
<tr>
<td>White</td>
</tr>
<tr>
<td>Unknown</td>
</tr>
<tr>
<td>Refused to Answer</td>
</tr>
</tbody>
</table>
TABLE 3: Distribution by Ethnicity

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014 and later years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic/Latino</td>
<td>33.29%</td>
<td>33.39%</td>
</tr>
<tr>
<td>Not Hispanic/Latino</td>
<td>46.25%</td>
<td>51.81%</td>
</tr>
<tr>
<td>Unknown</td>
<td>17.68%</td>
<td>9.59%</td>
</tr>
<tr>
<td>Refused to Answer</td>
<td>2.78%</td>
<td>5.20%</td>
</tr>
</tbody>
</table>

TABLE 4: Distribution by Location

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014 and later years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pueblo (incl. Pueblo West)</td>
<td>84.02%</td>
<td>83.45%</td>
</tr>
<tr>
<td>Pueblo County</td>
<td>2.78%</td>
<td>2.01%</td>
</tr>
<tr>
<td>Other</td>
<td>12.71%</td>
<td>14.36%</td>
</tr>
<tr>
<td>Unknown</td>
<td>0.48%</td>
<td>0.18%</td>
</tr>
</tbody>
</table>

There was a slight shifting of the age demographics of those testing positive, particularly increasing in the age ranges of 30-years-old to 50-years-old (Table 5). This increase is consistent with the SAHMSA (2016) report of increase in use among those older than 26-years-old. There does not appear to be an increase in the percentage in the younger age groups related to the overall population. It should be noted that while the proportions have not changed the numbers of positives increased across all ages compared with prior legalization of recreational marijuana. Wang, Roosevelt and Heard found an increase in unintentional ingestions in those 12-years-old and younger (2013). The data here suggest a similar proportional increase. It is interesting that in the population greater than 70-years-old and 50 to 59 years-old the proportion decreased in those testing positive to cannabis use and was only slightly increased in 60–69 years old. Burns, Caulkins, Everingham (2013) found a shift in older adults using more cannabis in those older than 50 compared to ages 12–17 years-old from 2002 to 2011 by 2.5%.

TABLE 5: Distribution by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>2013</th>
<th>2014 and later years</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>0.24%</td>
<td>0.10%</td>
</tr>
<tr>
<td>5–9</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>10–14</td>
<td>3.27%</td>
<td>2.80%</td>
</tr>
<tr>
<td>15–19</td>
<td>14.41%</td>
<td>12.88%</td>
</tr>
<tr>
<td>20–24</td>
<td>15.62%</td>
<td>15.11%</td>
</tr>
<tr>
<td>25–29</td>
<td>16.46%</td>
<td>16.43%</td>
</tr>
<tr>
<td>30–34</td>
<td>10.77%</td>
<td>12.81%</td>
</tr>
<tr>
<td>35–39</td>
<td>9.20%</td>
<td>10.30%</td>
</tr>
<tr>
<td>40–49</td>
<td>12.11%</td>
<td>13.77%</td>
</tr>
<tr>
<td>50–59</td>
<td>13.56%</td>
<td>11.68%</td>
</tr>
<tr>
<td>60–69</td>
<td>3.51%</td>
<td>3.64%</td>
</tr>
<tr>
<td>70 +</td>
<td>0.85%</td>
<td>0.47%</td>
</tr>
</tbody>
</table>

Additionally, it is noted that there was a slight increase in the individuals with private and public insurance compared to the uninsured (Table 6). The change in insurance needs further evaluation but partially may be
explained by the increased enrollment of individuals for health care with the Affordable Care Act.

### TABLE 6: Distribution by Type of Insurance

<table>
<thead>
<tr>
<th>Type of Insurance</th>
<th>2013</th>
<th>2014 and later years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>58.60%</td>
<td>67.45%</td>
</tr>
<tr>
<td>Private</td>
<td>21.43%</td>
<td>26.24%</td>
</tr>
<tr>
<td>Uninsured</td>
<td>19.98%</td>
<td>6.30%</td>
</tr>
</tbody>
</table>

**Conclusion**

Since the legalization of recreational marijuana in Colorado in 2014 there is unmistakable evidence that it is impacting an ED in Pueblo, namely in the rate of positive THC urine drug screens. This is consistent with findings from Quest Diagnostic (2017). The relative risk impact appears to be consistent with increases across gender, reported residence, ethnicity and race. The number of pediatrics testing positive has proportionally increased but is not significantly different from other age groups.

A slight difference in age appears in the data with an increase in the middle age; this is consistent with other studies (SAMSHA, 2016). There does appear to be a difference when looking at types of insurance; one could speculate that with the privately insured, more individuals are consuming marijuana since legalization. With more individuals on public insurance from the Affordable Care Act it is possible this increase is reflected in the data. Further evaluation of this group from a socioeconomic perspective is warranted. Examination of diagnoses as related to positive THC testing would help identify if the increase is connected to different physical or psychological health concerns. Adding marijuana diagnosis data that is not connected to a positive THC urine screen would give a broader view of the impact that is occurring. Further research is needed to delineate what this impact means to Pueblo County. Certainly, the data demonstrate the increase in relative risk; now further research needs to be completed for understanding the ramifications of legalized recreational marijuana in the ED setting.

**References**


Part 3: Cannabis—A social use survey in Pueblo County, Colorado

Abstract

This study explored and described the consumer’s experience with the utilization of recreational and/or medicinal cannabis. This is a pilot survey intended to benchmark data from the consumer in Pueblo County and obtain feedback to formulate a national survey. Only one similar survey has been distributed; however the results had not been disseminated at the time of this survey was undertaken [CUSH Survey (CDPHE, 2016)].

Since the legalization of cannabis in Colorado, a survey of the consumers of cannabis in Pueblo County has never been accomplished. Consumers utilizing marijuana nationally have been minimally evaluated in the current literature. Given the increasing use rates of adult cannabis users, this qualitative analysis focused on the consumer’s purpose for consuming (recreational or medical), pattern of use, perceived outcome including awareness of social stigma and impact on health. What are the perceived benefits that are achieved when consuming marijuana by this sample of consumers? What are the negative effects or consequences? The data are intended to examine trends as consumers identify their experience in this area. Conducting the social impact study may assist in providing the knowledge for a framework of medicinal and recreational marijuana use. There is limited research on the combined areas of medicinal and recreational consumer use of marijuana. Gaps in systematic health strategies and whether cannabis use has a role are yet to be determined.

Method

The information utilized in this report was data obtained from an online Cannabis: Social Use Survey (2017). This report only covers preliminary data from the survey. The survey was developed as a collaborative effort of four faculty from two different states: three from Colorado State University Pueblo and one from University of Maine-Augusta. The Cannabis: Social Use Survey is currently available online. This survey utilizes a consumer’s perspective in describing medicinal and recreational cannabis use. The study has been approved by the Institutional Review Board at Colorado State University Pueblo.

Background of Social Use Study

History reveals that marijuana has medicinal benefits for numerous conditions and is currently being used for glaucoma, seizures, cancer, anxiety and anorexia (Gundersen, D.G., 2015 & Rubens, M., 2014). Current research is being conducted on the medicinal benefits and concerns of marijuana in order to provide scientific evidence to support the different applications. Colorado identifies nine medical conditions that meet one of three criteria for a Colorado Medical Marijuana Registry Card. These conditions include cancer, glaucoma, HIV or AIDS, cachexia, persistent muscle spasms, seizures, severe nausea, severe pain, and Post-Traumatic Stress Disorder (CDPHE, 2017).

In the past two decades the United States experienced a drastic change with approval and use of marijuana and Colorado leading state legislation with the approval of medicinal and recreational use of cannabis. Public endorsement is evident as voters’ approved laws in various states pertaining to the medicinal and/or recreational use of a previously illicit drug. The initial legalization, in most of these states, approved for only medicinal marijuana purposes. In 2012, Amendment 64 received approval from Colorado voters to approve marijuana for recreational use. On January 1, 2014 the commercial sale of marijuana to the general public for recreational use under the state’s regulatory framework began and has continued to expand.

In a short time the marijuana industry achieved economic heights with additional tax revenue for many states. Colorado generated almost a half billion dollars of tax revenue in the summer of 2017. The excitement and economic growth presents banking problems for this community because the cannabis industry is illegal at the federal level.

Even before the legalization of medicinal marijuana, an estimated sixty-five million Americans have used
the plant. (Annas, G. J., 1997). In a recent cannabis report about 13% of Colorado adults, eighteen and older, had used cannabis in the prior month with 6% of adults using every day (CDPHE, 2017, January). Marijuana use has increased throughout the country. (NIDA, 2017 & NIH, 2013). The report does not indicate if the increase is a result of the change in marijuana status with some states’ legislation.

The Colorado Department of Public Health and Environment (2017, January) reports that in 2014, 13.6% adults over the age of eighteen identify current use in the state of Colorado with Pueblo at 12.7% of adults. The results reflect that 48.9%, about half, of all adults have used cannabis some time in their life with the average adult reporting first time use at an average age of eighteen. Other state demographics from CDPHE reflect that more men use marijuana than women, Hispanic users indicate a decreased rate of use compared to white and African American users. The higher the education and income level the higher rate of marijuana use as compared to those with less education, or income. Gay, lesbians and bisexual adults reported the highest number of marijuana usage. And, since the legalization of marijuana, there appears to be a decline in adolescent use (CDPHE, January, 2017).

Method
This study is an exploratory study designed to capture data that describes the use of cannabis in the adult population, over the age of twenty-one. The survey tool models several areas of exploration identified in the literature (CDPHE, 2016, NSDUH, 2014). Presently, the Cannabis Social Use Survey is being piloted, and the survey is intended to collect information from consumers and provide data for trending analysis of perceived benefits or concerns of cannabis use. The Cannabis Social Use Survey will assist in collecting data and describing the consumer’s experience as it pertains to the medical and recreational use of cannabis. The data are collected from an online Social Use Survey.

Recruitment
A mass distribution of introductory flyers was randomly provided to a convenience sample of marijuana dispensaries in Pueblo County. The one-page flyer provides information about the study and a link to the online Cannabis: Social Use Survey. The online survey is currently available and proposed to remain until the end of the 2017. The flyer was the only formal method utilized to recruit participants for the study.

The Survey
The Cannabis Social Use Survey (2017) in Pueblo is the first step in developing a national online survey focusing on cannabis use. The target population is twenty-one years or older. The online survey is open to consumers from other locations. The pilot survey, Cannabis: Social Use Survey, was developed as a collaborative effort of four faculty; three from Colorado State University Pueblo; and one from University of Maine-Augusta. The main purpose of the survey includes three objectives: 1) to collect information from people that use recreational and/or medicinal cannabis and to examine the social use of cannabis with a focus on Pueblo County, Colorado 2) the second objective is to develop a comprehensive national social use survey and 3) to develop a national database. (Franta & Baca, IRB, July, 2017).

The survey, available online as a Google Docs link, is secure and anonymous. The respondent had to declare that they were twenty-one years or older to complete the survey. Additionally, no individuals are tracked, nor emails or IP numbers collected to protect the identity of the respondent (Franta & Baca). The estimated time to complete the survey is fifteen to twenty minutes. The survey is a fifty-item questionnaire with open and closed ended questions written in English. The survey prompts additional information, where a brief explanation may help clarification of a previously answered question or areas of inquiry that cannot be answered by “yes” or “no” response.
Participants
A purposeful sample is utilized in the selection of participants for this research project. The Cannabis Social Use Survey requires that the respondent to be twenty-one years or older and a consumer of marijuana to participate in the study. This report is based on sixteen respondents, from Pueblo County and three from other areas including one from out of state. Residence was used for this report with a desire to focus on the Pueblo community.

Data Analysis
Nineteen respondents were used for this preliminary review of the Cannabis Social Use Survey. This is a very low sample size and provides only anecdotal information. It has been online for three months and will continue to be available as a pilot survey tool until the sample size is sufficient for research analysis and trending. The limited sample size to date, provides a snapshot view of consumers and represents nineteen respondents who agreed to complete the survey. Three of the respondents indicated that they live outside of Pueblo County.

The following observations are based on emerging social themes, ideas, and concepts using the data from survey. This information may change as a larger sample is attained as the survey is currently online.

Age
Several questions pertain to age; this the initial process in order to continue with the survey and all participants indicated that they were 21 years and older and a requirement to proceed with the survey. Other age-related questions include age of first use for recreational and age for first use for medicinal. The scale for age of first use was in 10 increments up to age 70 and above. Modification in the categories for age is necessary as the survey moves forward to more accurately represent respondents, e.g. developmental age groups between under the age of ten, and 21–30 age category. The scale makes it difficult to draw conclusions about time of first use. For example, age associated with recreational use, two reported first use between the age of 0–10 and eight reported age 11–20. The age categories can provide a different prescriptive and interpretation of use. The same problem arises with the difference and perception of use at eleven as compared to first use at nineteen, or after high school. The CDPHE reports first age of use is generally eighteen and older. At this point respondents report that age of first use for medicinal cannabis use was older than recreational; one 61–70, and two 41–50. Four 21–30 and one 11–20. This is in line with the state legalization of medicinal cannabis. Age is an important demographic statistic that the current descriptors of age do not provide as they are too general to assess relevance to cannabis use. Generational age is important for an accurate perspective for this study. Current research in the field of marijuana use targets the “older marijuana users” as this is a population that shows significant increase in the past several years (Choi et al, 2016). Furthermore, it is projected that the rate of the older adult users, over the age of 50+, will continue to increase as this is a population base more willing to utilize medicinal cannabis, the baby-boomer marijuana users.

Geographical
Sixteen of the respondents indicated that they are residents of Pueblo, two from other areas in Colorado and one from out of state.

Economics
Currently, all but two respondents indicated that they were employed. The question regarding employment was a closed question with a “yes” or “no” response and did not allow for any other meaningful options; retired, unemployed or disabled. Information regarding monthly or annual income was not collected. However, one participant did indicate in a response to another question that they were retired.
Pattern of Consumption
All but three responses indicated that they purchased their marijuana, with five growing their own. And five respondents do both, purchase and grow their supply. The reported cost per month ranged from $0.-$1,000 a month impacting 0–40% of respondents' budget, with one reporting the monthly cost as 40% of income. One respondent does not spend any money on marijuana. Most of the responses indicate the marijuana cost has no or little impact on the household budget.

Marijuana appears to have replaced the cost of over-the-counter and prescriptions medication for a couple of respondents; as one shared instead of using Advil I use the salve. And another …we don’t buy prescription medications or insurance. The need to include marijuana in the budget was expressed with another indicating that marijuana is a primary part of the budget and based on need: My budget is built around my mmj [sic] needs.

Medical Use With or Without a Medical Card
Sixteen reported using cannabis for medicinal use with only three reported to have a medical card for cannabis officially the Colorado Medical Registry Card. One interesting observation is noted that one of the respondents, who indicated not using medicinal marijuana, yet possesses a cannabis medical card. The possession of a medical card may have an advantage with lower cost of medicinal marijuana at medical dispensaries. The medical card consumer can purchase their product for a reduced price as compared to the recreational consumer. Here are some reported reasons for not possessing a card for medical reasons:

I use cannabis for mental health issues and anxiety which you can not [sic] get a medical card for in the state of Colorado. And another response: it might make employment harder. One respondent stated: I never sought my medical card because of future opportunities.

All but two respondents indicated using cannabis for recreational use. The use of medicinal cannabis taken in lieu of over the counter and prescription medication was reported.

Intent to alleviate medical symptoms
The following area have been grouped into four areas that reflect the comments. The areas include effectiveness, relaxation and sleep, anxiety and depression and the fourth area is pain. How does cannabis address your symptoms and treatment?

- Effectiveness
  - Takes the pain away instantly
  - Pretty instantaneous
- Relaxation and Sleep
  - Helps with sleep
  - Cannabis allows me to slow down my active life daily life and relax to have a great nights [sic]sleep
  - Aids in restful sleep with fogginess, gogginess and/or other deleterious symptoms
- Relaxing
  - Decrease insomnia, and relieves stress
  - Calms my mind, helps me sleep, great for exercising and meditating
- Anxiety and Depression
  - Anxiety and depression not present while consuming
  - Treat my depression and anxiety with marijuana and when it does work it makes me feel somewhat euphoric and my anxiety quickly dissipates, it works better when I use it in conjunction with my antidepressants
  - It stops panic attacks, calms my mind, reduces anxiety, relieves stress
- Pain
  - Cannabis reduces frequency and severity of migraine headaches
• Reduces chronic pain, stimulates appetite
• Reduces muscle and joint pain
• Helps with nausea, back and leg pain, assist with sleep issues and a natural remedy for many problems without using chemicals

Overall, all the reported benefits identified are fairly positive.

Family
The answer for the question on family support is either a “yes” or “no” response. The closed-ended question was Does your family support your medicinal use? This item does not allow for clarification or provide the ability to identify mixed support within the family. One respondent indicates that marijuana has allowed her to be a better mother and partner, it has helped me become a better mother and partner because I can ‘step out of my head’ in order to deal a situation without emotionally escalating.

Consumer Identified Benefits
Numerous benefits from cannabis use indicated relief of pain, promotion of relaxation and sleep, and anxiety and depression. Some of the conditions may be eligible for the Colorado Medical Registry Card. Several do not meet the eligibility criteria as identified by the CDPHE (2017). It does appear that many of the medicinal cannabis users are self-medicating and using marijuana instead of over the counter and prescription medication, and with not possessing a medical card. This is an area that does need further research. The survey has twelve medical conditions listed and the respondent may “check all that apply.” Severe and persistent muscle pain was the prevalent choice. The previous open-ended question about symptoms of an illness that led to cannabis use was answered by several respondents stating joint pain, migraines, depression, and trouble sleeping.

Consumer Identified Concerns
One interesting question is on overconsumption of marijuana; almost half of the respondents indicated some level of overconsumption and experiencing feelings of fatigue, spinning, nausea, with most of them going to sleep and one had experienced some morning effect. None of those who reported over-consumption sought medical treatment. One respondent indicated mixing alcohol and marijuana produces the same effect. This question sparks further research to examine over-consumption of marijuana as well as the impact on mixing alcohol with cannabis use. Is this a typical reaction for mixing cannabis and alcohol used in combination? Previous studies show the phenomena of minimization by the consumer when they have experienced over-consumption. In those cases, the consumer fails to recognize a risk for toxicity, dependency, withdrawal or any causal relationships in adverse life situations (Choi et al, 2016).

Methods of Consumption
All methods of consumption as reported by NIDA (2017), include, oils, lotions, salves and tinctures and reflect areas shared by the respondents of the Survey. The variety of methods reported include smoking, salves, edibles, dabs, vapors and pipes with occasional, moderate and heavy users.

Discussion
Marijuana has been part of the social fabric of many cultures and societies throughout historical times. It is important to examine the recreational and medicinal use of marijuana and the positive and negative impact from the use of cannabis within Pueblo County. All participants at this point of the Cannabis Social Use Survey claim to have received benefits from marijuana. Consumers may be reluctant to participate due to the perceived social stigma associated with cannabis use. Likewise, the current participants may represent the selected few who endorse medicinal use over recreational. Several research findings describe poorer mental and physical health functioning in those individuals that use cannabis for medicinal use over those who use marijuana for recreational use. Contrary to what is perceived by several respondents in this survey, the perception that cannabis use effectively relieves depressive or anxiety symptoms is not substantiated.
by the research; those with depression who medicated with cannabis have a poor outcome (Bahorik, et al. 2017). This is an area in need of further research.

It is important to examine the social impact on the lives of the consumer. Their sample of respondents appear educated and employed. Large national surveys show 22.2 million Americans used cannabis within thirty days of the National survey on Drug Use and Health (2014) and reflects an increase in past-year marijuana on the rise for the age group of 45–64 and 65+. The comorbidity of declining health and loss of social support is also significant in this population of older users.

Discussions on marijuana need to continue and perhaps one can understand the desire to use cannabis. It is of great interest that the data will assist in the development of sociocultural understanding of marijuana use. Future research needs to continue in the examination of social use of medicinal and recreational marijuana.

Internal recommendations for updating the survey include the following: Increase questions to elicit more sociodemographic characteristic (the lack of demographics present problems in examining a sociocultural perspective of marijuana use); incorporate frequency of use and amount last used in thirty days and past-one year use; assess content validity for age (if the Survey is attaining the results that are being examined for age to be twenty-one or older to participate in the survey, one question, are you older than 21?, is a question that a twenty-one-year-old might identify “no” as their response); several questions require modification to provide clarity to better understand what family support means to the respondent (the question that makes an inquiry to family support of consumer use of medical cannabis? needs an option, to include the family members that support, and the numbers of those that do and do not support); address areas of age and revise to reflect an accurate perception of development (the question, when did you have your first experience with marijuana? allows several options for age that include too broad a range, i.e. categories overlap development age, and choices 0–10 and 11–20 presents concern for an accurate assessment, as it would be important to know if they had their first experience at the age of five or ten years of age, or eleven as compared to nineteen); evaluate recruitment strategies to increase the response rate [the Colorado Cannabis Users Survey on Health (CDPHE, 2016) used hand held devices for the participants to access the survey on site; expanding the convenience sample to include local Pueblo Medicinal Cannabis Group is another opportunity]. Moving forward, after sufficiently piloting of the current survey in 2017, a future survey will be updated and submitted to the Institutional Review Board at CSU Pueblo. Future research projects may target medicinal and recreational use of those under twenty-one. Several reports indicate that teen use has remained the same and the Colorado Department of Public Health and Environment reports a decline in adolescent use.

References


Social Impacts 6B: Pueblo Department of Social Services and the impact of legal cannabis

Introduction
In the past five years, laws centered around the possession, sale, and transfer of medicinal and recreational cannabis have changed drastically. Penalties for cannabis possession can include mandatory prison sentences and fines, drastically altering the lives of those caught with cannabis, and leaving a secondary impact on their families. When a parent is charged with a drug offense, the consequences that they face trickle down to their children and they risk Child Protective Service (CPS) involvement. CPS involvement could also occur from abuse or neglect issues that arise from the ingestion of substances that affect cognition or physical health. This social impact study looked at the effect of cannabis legalization within the CPS system in Pueblo County, Colorado. Data from the Pueblo County Department of Social Service (DSS) Trails system was analyzed and interviews with County caseworkers were conducted. The subject of cannabis legalization and child welfare is multi-faceted, and further complicated by issues such as poverty, unemployment, homelessness, availability of safety net benefits, and mental health challenges that are experienced by families referred to Pueblo County DSS for services.

Literature Review
In November of 2000, Colorado legalized medicinal use of cannabis. In 2016, Governor Hickenlooper signed legislation countermanding the prohibition of medical cannabis as a condition for probation (H.B. 16–1359). In November of 2012, Colorado voters passed Amendment 64, allowing the recreational use of cannabis, and the sale of recreational cannabis in Colorado began in January 2014. In 2015, twenty-nine states had passed similar laws that allow for the use of medicinal cannabis and eight states allowed for private recreational use of cannabis (Lloyd, 2015). The laws surrounding cannabis use and possession vary in each state and each state differs in the penalties for those who possess, sell, and use cannabis. Cannabis continues to be classified as a Schedule I substance federally, having “…no current accepted medical use in the United States and a high potential for abuse…” (Drug Enforcement Administration Museum, n.d., para 6). This creates a discrepancy between the state and federal legislation surrounding cannabis.

The impact of cannabis on children has been a driving force in the discussion of legalization of medical and recreational cannabis, and the subject of multiple studies regarding the use of cannabis. The Colorado Department of Public Safety (2016) conducted an impact study regarding the use of cannabis among youth in Colorado. They found that the trend for students reporting first use of marijuana has gradually declined in the past two survey administrations by about 6 percentage points from 2009–2013, but cautioned that the data should be interpreted carefully as the survey population and the administration of the survey has changed in the last two years (CDPS, 2016). Pueblo County had the highest incidence in Colorado of high school and middle school youth reporting using marijuana in the last 30 days, with 32.1% and 22.8% respectively (CDPS, 2016). While the Colorado Department of Human Services Trails data does not track specific drugs or alcohol issues experienced by families referred to the agency, the Child Health Survey found that “…of parents with children ages 1–14, 4% reported using marijuana in the past month, and 7% reported having marijuana in the household” (CDPS, 2016, p. 71).

The studies in this literature review focus on how children in the Child Welfare (CW) system are impacted by drug policies, cannabis legalization, and parental drug and cannabis use. The studies are both qualitative and quantitative studies, and utilized various population sizes and samples. The studies focus on parental use of drugs in the CW system, child and parental use of medical cannabis, and examine how current drug policies impact children in the CW system. Currently, there is a lack of research on the specific topic of the impact of legalizing cannabis has on children and families in the CW System, such as how referrals and investigations are affected, the availability of treatment options, the education and training of caseworkers.
handling cases involving legal cannabis, and how to manage CW cases when the primary caregiver is using legal cannabis. More research is needed on these important topics.

Medical Cannabis and Children

Medical use of cannabis has been legalized in many states throughout the US and many citizens have utilized this alternative form of medicine to help with various health problems. Medicinal cannabis can come in many forms such as oil, herb, hash, wax, and even in cannabis infused brownies and candy. Some states will only allow use of cannabis in certain forms. For example, a Minnesota law in 2014 restricted all medical cannabis patients to only using cannabis in liquid, pill or vaporized form (Nelson, 2017). In Colorado, doctors may recommend cannabis to Colorado residents suffering from cancer, glaucoma, HIV, seizures, severe pain and other debilitating medical conditions if the doctor deems it helpful to the patient (Colorado Revised Statutes, 2017). A medical cannabis card can be given to patients under 21 and is utilized by some children in need. This is the area of controversy that many doctors and parents disagree on involving medicinal cannabis. While medical cannabis is legal in some states, it is still illegal on a federal level and there have been no definitive long-term studies that measure how cannabis affects children who use it medicinally.

It has been suggested that cannabis is helpful for treating adults and children with self-diagnosed attention deficit hyperactivity disorder (ADHD). Pedersen (2015) used a qualitative narrative study to look at those who used cannabis to treat their ADHD. One third of the 100 participants interviewed were employed, one third were enrolled in school and the final third were incarcerated and/or received financial help from the state. The majority of participants were self-diagnosed or diagnosed as a child by a parent, had difficulty paying attention in school, and used the ADHD diagnoses to give context to their life history and choices (Pedersen, 2015). Among the benefits of smoking cannabis, those interviewed claimed it helped them remain calm, function more efficiently and socialize better. A few people stated that they prefer using cannabidiol (CBD) because it helped their symptoms without feeling intoxicated. Users also compared their experience with cannabis to treat their ADHD versus Ritalin. Several claimed they did not like the way Ritalin made them feel and preferred cannabis because it allowed them to feel more like themselves and less “numb” or “indifferent”. This is a crucial point because some children may benefit from taking cannabis supplements over Ritalin (Pedersen, 2015). Although this study suggests positive results from cannabis treatment, many of the ADHD patients in the study were self-diagnosed and there is still no definitive proof that this treatment is effective. There is also limited peer reviewed information on the long-term effect of adolescent cannabis use.

Yap, Easterbrook, Connors, and Koopmans (2015) systematically reviewed 103 studies in Australia related to cannabis and its treatment of childhood epilepsy. The results showed that some epileptic children’s conditions were positively impacted by cannabis treatment. Although there was a positive correlation shown, most studies were too small or poorly designed, which made the results inconclusive. There is a distinct lack of research on short- and long-term effects of cannabis treatment in children, which lead Yap, et al. (2015) to recommend close monitoring of children whose parents utilize cannabis treatment, and that these treatments be considered on a case-by-case basis due to the varied responses in children who are given cannabis treatment. In addition to the varied responses by children, Yap, et al. (2015) also discussed the lack of rigor regarding standardized formulations of cannabis products used in treatment. These raise safety concerns by themselves, but when coupled with possible environmental issues, such as those present in cases with CW involvement, there are significant safety and risk factors. Therefore, Yap, et al. (2015) recommended that medical professionals be able to consult with CW authorities regarding environmental issue concerns, as well as consider standards for reporting if parents continue to insist on using cannabis treatment despite a lack of medical evidence regarding the effectiveness of treatment.

Overall, the specific impact cannabis has on children with medical conditions is inconclusive and there are little data on the long-term effects. Doctors are advised to handle child use of medicinal cannabis on a
case-by-case basis. This can reduce unnecessary CPS involvement if there are no environmental or safety risks and the treatment is effective. However, medical professionals are not trained CW professionals, who receive specific training on assessing environmental risk factors, therefore a collaborative relationship between medical professionals and CW professionals is needed. Overall, medicinal use of cannabis for children is not nearly as common as parental cannabis use, however, and the thrust of this study focused on parental use of cannabis.

Protective Services Cases, Cannabis and Other Illicit Drugs
Stott and Gustavsson (2016) pointed out that parental drug use increases the risk for negative consequences in a child’s development due to negative disruptions in the social environment. Drug use is said to be a significant factor in at least half of all CW cases, however most of the data are centered around multiple drug use, and not cannabis specifically (Stott & Gustavsson, 2016). While time constraints prevented exploration of adolescent substance abuse in child welfare, the literature supported that mothers involved with child welfare and who reported substance use also reported substance use starting in adolescence (Saldana, Smith, & Weber, 2013). While Saldana et al. (2013) utilized a sample size of only 16 participants, the findings are supported by other studies (Casanueva, Stambaugh, Urato, Fraser, & Williams, 2014; Saldana, et al., 2013; Mericle, et al., 2015).

A study by De Bortoli, Coles, & Dolan (2014) examined the link between illegal substance use while pregnant and the risk of child abuse and neglect. This meta-analysis evaluated 21 previous studies that analyzed the correlation between substance misuse while pregnant and child protective service involvement and outcomes. Most studies positively correlated substance misuse during pregnancy (SMdP) and child protection involvement (De Bortoli, et al., 2014). However, it is mandatory that CPS be notified if a newborn has illicit drugs in its system, regardless of the situation, which increases the chances of an open CW case for the family. The article suggested that continued drug misuse after birth can impact the mother’s ability to parent and handle stress, which also increases their chances of CPS involvement if they have not already been referred before. Although the correlation of drug use while pregnant and risk of neglectful parenting has been well-established, there are almost no studies that specify the impact of cannabis alone in CW involvement. In fact, the studies Stott and Gustavsson (2016) looked at were focused more on cocaine, methamphetamines, prescription pills, and heroin as a possible risk to children. Additionally, the researchers pointed out that there are more significant factors such as neglect and poverty that contribute to child abuse and neglect, and that the impact of marijuana or other drug use is only one component of the factors that lead to CW involvement (Stott & Gustavsson, 2016).

Freisthler, Gruenwald, and Wolf (2015) looked at the relationship between medical and recreational marijuana and its correlation with abusive or neglectful parenting. This cross-sectional study used a telephone survey to look at 3,023 parents or guardians who had at least 50% custody of at least one child under the age of 12. Approximately 5% of respondents reported cannabis use in the past year and the survey found they were more likely to physically abuse their children than nonusers (Freisthler, et al., 2015). However, some respondents reported that they used cannabis to help them refrain from being physically abusive. Freisthler, et al. (2015) suggested that the survey did not differentiate between parents who used cannabis recreationally and those who used it for medicinal purposes, and that it is possible that parents who are in pain or have unmanaged medical conditions may be more likely to use physical discipline on their children or lack time for appropriate supervision due to the time required for managing their illness. Cannabis use was not correlated at all with supervisory neglect and users were less likely to be physically neglectful than parents who used other drugs (Freisthler, et al., 2015). However, the researchers suggested that their measurements were likely not sensitive enough to account for other factors, such as accidental child poisoning or inadequate parental supervision, which can be neglect issues. Another limitation of the study was that parents self-reported their drug use through telephone survey. This could have resulted in lower self-reporting of drug use due to social desirability bias (Freisthler, et al., 2015). Because this study was conducted in California only, which had legalized medicinal but not recreational cannabis at the time
of the study, the results of this study should be interpreted with caution when applied to Colorado. In fact, Freisthler, et al. (2015) suggested that researchers look at the method of procurement of cannabis by parental figures, as parents who procure from street-level dealers may differ significantly from parents who procure from a dispensary. Frithsler, et al. (2015) also suggested that further research is needed on how CW workers determine risk with medical cannabis, its correlation with other substances such as alcohol and prescription medication, and that the majority of cannabis users in the survey also reported using alcohol.

Researchers who study cannabis use in the CW system primarily rely on data from medical professionals and CW workers. Putnam-Hornstein, Prindle, and Leventhal (2016) looked at reports of prenatal substance abuse and whether one’s race or ethnicity contributed to their chances of being reported to child protective services. They compared the amount of times black and Hispanic moms were reported for child abuse by physicians versus white moms by compiling data from birth, hospital discharge, and records of reports and findings by CPS. Results of this study showed 1.6% of babies are born with prenatal substance exposure. Among black newborns, diagnoses of substance exposure was highest (4.1%), while white newborns accounted for 2.1%, and Hispanics accounted for 1.0%. Putnam-Hornstein et al. (2016) also found that younger mothers (20–24 years of age) were more likely to have babies exposed to substances than older mothers. The study found that white women have a slightly lower chance of being reported for prenatal substance use compared to black and Hispanic women, but this difference was statistically significant. Just over half of all infants (53.4%) were reported to CPS after a substance exposure diagnosis. The researchers did not study what services or referrals were made for those infants not reported to CPS. After adjusting for covariates of maternal age, insurance type, the trimester prenatal care was initiated, paternity establishment, birth order of the child, and infant birthweight, the differences between reporting and race disappeared (Putnam-Hornstein et al., 2016). Interestingly, there were significant differences between groups regarding substance use. Among white and Hispanic infants, amphetamine exposure was the most commonly diagnosed substance, followed by cannabis, while Black infants were most likely to have a diagnosis for cannabis exposure, followed by cocaine (Putnam-Hornstein et al., 2016). Reports to CPS of substance-exposed infants varied depending on the specific substance to which the infant was exposed. Only 36.1% of infants diagnosed with alcohol exposure were reported to CPS, while 72.1% of infants exposed to cocaine were reported to CPS (Putnam-Hornstein et al., 2016). This differential reporting from alcohol, a legal substance, and cocaine, an illegal substance, raises questions regarding implementation of policies and CPS investigations of legal and illegal substance use. Freisthler et al. (2015) also raised the possibility that as cannabis becomes legal, use that does not meet the clinical threshold for abuse or dependence may not be seen as criteria for intervention, or not considered as a contributor to abuse or neglect. Therefore, as cannabis is legalized, CW workers may need more policy guidance regarding screening and intervention.

Drug Policies and Impact on Children in CWS

To address the drug problems in our country, the United States has formed policies that serve to deter the public away from drug use and related crimes. This includes mandatory sentences for drug charges and loss of safety net benefits such as housing or Temporary Assistance to Needy Families (TANF). Although these policies are meant to remedy the problem, they can instead harm the children of those who commit drug related offenses.

Lloyd (2015) found that U.S. drug policy presents ten implications or “risks” to children in the child welfare system. It first found that the mandatory sentences for drug offenders uproot children’s lives and cause unnecessary separation between them and their parents. This process involves the child being involved with CPS for an extended period and many children have unstable living arrangements while their parents are incarcerated. Many of these parents do not get the opportunity to treat their drug addiction while in jail or upon their release, so their children are also at risk of being negatively impacted by their parent’s untreated drug use upon reunification. Additionally, parents lose safety net benefits immediately and long after they get out of jail, which hurts the child because they lose those benefits, too. Another risk to children is the difficulty that previously incarcerated parents face when reentering society. This adds to the already stressful
job of being a parent, maintaining sobriety, finding a job that will hire them with a criminal record, and providing for a household without any safety net benefits to assist them. The final risks include damages to the child’s education and mental health as well as the children experiencing increased risk of incarceration, and drug abuse themselves. This risk is especially higher when parents are left untreated (Lloyd, 2015).

Lloyd (2015) described five ways these risks can be alleviated by changing the current policies on drugs. First, taking away mandatory sentencing for certain drug charges. This reduces the child’s risk of parental separation, CPS involvement, and housing instability. Second, changing the punishments for possession of certain drugs, depending on the drug and amount. For example, in Colorado people can grow and have a certain amount of marijuana on hand if they are over 21. Third, having options and avenues for early release, especially for parents with children in the system. This could minimize the disruption for the child and encourage the parent to seek treatment for abuse or addiction. Fourth, opting for treatment for drug offenders instead of prison punishment or fines. This reduces the parents’ risk of relapse and the negative impact drug use has on children after a conviction for drug possession or use. It also gives the parent more opportunity to learn valuable parental skills and coping mechanisms without the use of drugs. Fifth, keeping safety net benefits available to parents, despite drug charges. Implementation of these policy changes should occur simultaneously, as only two of these changes address treatment while the rest address social and environmental supports (Lloyd, 2015).

Stott and Gustavsson (2016) assert the federal policies on cannabis and state policies can conflict with each other, and this is especially true in Colorado. They suggest CPS change their policies and procedures involving client and employee cannabis use to reflect state law and that CPS needs to start viewing marijuana use as a possible risk to a child’s safety rather than a crime that warrants child removal. This change would require additional education and training for CW workers. Stott and Gustavsson (2016) concluded by suggesting CPS develop assessment tools that determine what cannabis use patterns present a risk to children and provide treatment for addiction and assistance in parenting skills.

Research Methods
The study was originally a mixed method, exploratory study. However, as mentioned by CDPS (2016) the data available through Colorado Trails do not differentiate between different types of drugs used by clients involved in the CW system. Therefore, data analysis was very limited. The number of CW referrals and amount of Core Services Program money (County funds) spent on substance abuse treatment were collected for the years 2012–2017, and four CW workers were interviewed regarding their experience with families who use cannabis as compared to families who do not, and the challenges experienced when working with families who are cannabis-involved. Each CW worker came from a different unit within the Department of Social Services (ie., intake, adolescent services, foster care, truancy) in order to include the largest client population possible. While not ideal, it is hoped that the number of investigative referrals and dollars spent on substance abuse treatment will help shed light on the impact of legal cannabis in Pueblo County. Because the quantitative data were not ideal, the interviews with caseworkers will provide a deeper understanding of how legal cannabis has impacted the Department of Social Services (DSS). After IRB approval of the research, the Director of the Pueblo County Department of Social Services was contacted in order to facilitate access to the data and interviewees. The Pueblo County Department of Social Services was very cooperative and quickly made arrangements for data access and scheduling of interviews with caseworkers. Each interview took approximately 30–45 minutes, with one of the interviews consisting of two caseworkers while the rest were single interviews. Interviews were recorded and transcribed, then analyzed for themes.

Results
The data indicated that initial referrals for investigative services have increased about 36% from 2012 to 2016. Referrals are initiated through hotline calls to DSS from the public or from professionals who have reason to believe a child is experiencing neglect or abuse. These referrals must be screened for investigation
and then require a caseworker to visit the parent(s) and child(ren) to assess the situation, screen for risk and imminent danger, and offer referrals for services or initiate removal of the child(ren) from the home. While an increase of 36% is large, it should be noted that the largest increase in referrals occurred from 2014–2015, during which time referrals increased by 25.15%. Table 1 lists the referrals numbers by year, and the increase from year-to-year. It should be noted that this data represent the number of referrals, not the number of families, as families could have multiple referrals. The increase from 2014–2015 is concerning considering the Department actually experienced a very slight decrease in referrals from 2013–2014 (-1.87%), only to experience a significant increase from 2014 to 2015 (25.15%). Overall, from 2012 to 2016, there has been a 36.32% increase in referrals, with the major increase occurring in 2015.

### TABLE 1: Number of Referrals by Year

<table>
<thead>
<tr>
<th>Year</th>
<th>Referrals</th>
<th>Increase</th>
<th>% Increase 2012–2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>2,051</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>2,139</td>
<td>4.29%</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>2,099</td>
<td>-1.87%</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>2,627</td>
<td>25.15%</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>2,796</td>
<td>6.43%</td>
<td>36.32%</td>
</tr>
</tbody>
</table>

* Denotes percent change from 2012–2016 only

Core dollars spent for substance abuse treatment is relevant in this research because Core dollars are spent “when children/youth are at imminent risk of out-of-home placement, in need of services to return home, or to maintain a placement in the least restrictive setting possible” (Colorado Department of Human Services, 2017, para 1). The substance abuse expenses for Core Services were analyzed from fiscal years 2013–2017. Table 2 shows the applicable years, dollars spent, average cost per client, and percent change in 2017 dollars (accounting for inflation). The largest increase in spending per client occurred in 2014 as compared to 2013. Core dollars expended increased almost 50% from 2013 to 2014. Further, overall there has been an almost 75% increase in Core dollars expended for substance abuse treatment from 2013 to 2017. It should be noted that the number of clients served in substance abuse treatment from 2013 to 2017 has decreased by 63 clients. With the exception of one spike in 2015, the number of clients being served through the use of Core dollars for substance abuse treatment has been declining since 2013.

### TABLE 2: Substance Abuse and Core Dollars Expended

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount Used</th>
<th>Clients Served</th>
<th>Average Expended per Client</th>
<th>2017 Equivalency</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>$143,586.60</td>
<td>196</td>
<td>$732.58</td>
<td>$760.65</td>
<td>N/A</td>
</tr>
<tr>
<td>2014</td>
<td>$174,029.80</td>
<td>156</td>
<td>$1,115.58</td>
<td>$1,138.97</td>
<td>49.74%</td>
</tr>
<tr>
<td>2015</td>
<td>$220,310.40</td>
<td>179</td>
<td>$1,230.78</td>
<td>$1,254.14</td>
<td>10.11%</td>
</tr>
<tr>
<td>2016</td>
<td>$188,390.70</td>
<td>140</td>
<td>$1,345.65</td>
<td>$1,356.77</td>
<td>8.18%</td>
</tr>
<tr>
<td>2017</td>
<td>$176,863.70</td>
<td>133</td>
<td>$1,329.80</td>
<td>$1,329.80</td>
<td>-1.99%</td>
</tr>
</tbody>
</table>

For children removed from the home, data were analyzed regarding the reason for removal. While the scope of this research was too narrow to fully explore child substance abuse issues, Colorado Trails data does include this category as a reason for removal. Therefore, the data are presented here. The largest increase in children removed from the home because of the child’s substance abuse issues occurred in 2012. This increase cannot be attributed to the legalization of recreational cannabis, since legal cannabis was available
beginning only in 2014. However, removal from the home due to parent’s substance abuse issues does show an increase from 2012–2013, 2013–2014, and 2015–2016. There was a decrease in removals for parental substance abuse from 2014–2015. Again, because Colorado Trails data does not provide the specific drug or drugs which necessitated the removal, it is impossible to determine if legal cannabis was the reason or had some influence in the increase of removals. Interestingly, during this time period, the number of removals for abuse remained relatively stable, with under 30 removals per year for physical abuse of children. Table 3 shows the applicable years and reasons for removal.

<table>
<thead>
<tr>
<th></th>
<th>Drug Abuse (child)</th>
<th>Drug Abuse (parent)</th>
<th>Physical Abuse (alleged/reported)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>17</td>
<td>75</td>
<td>24</td>
</tr>
<tr>
<td>2012</td>
<td>33</td>
<td>54</td>
<td>20</td>
</tr>
<tr>
<td>2013</td>
<td>22</td>
<td>126</td>
<td>26</td>
</tr>
<tr>
<td>2014</td>
<td>32</td>
<td>138</td>
<td>17</td>
</tr>
<tr>
<td>2015</td>
<td>27</td>
<td>116</td>
<td>14</td>
</tr>
<tr>
<td>2016</td>
<td>24</td>
<td>137</td>
<td>16</td>
</tr>
</tbody>
</table>

Discussion of Quantitative Data
The data presented here should be interpreted with caution. Because of the way data are collected through Colorado Trails, there is no way to tell if the increase in referrals, Core dollars spent, or reasons for removal are related to legalization of cannabis, increased drug or alcohol use in clients involved with Pueblo DSS, increased costs for substance abuse treatment services, or longer periods of care in treatment. The decrease in the number of clients served with Core dollars from 2013–2017, coupled with the increase in Core dollars expended during those years, bears further research. The decrease in clients served could indicate fewer families with substance abuse issues, fewer treatment facilities to which to refer clients for substance abuse treatment, improved screening techniques which reduce the number of families referred for treatment, increase in the cost of treatment or the span of treatment days, or some other reason. The scope of this research project is unable to answer that question, as this was an unexpected finding.

The interviews conducted with caseworkers resulted in the identification of three major themes: increased client honesty about their use of cannabis, increased needs of clients who lack support systems within the state, and lack of guidance regarding when to require clients to stop use of cannabis or when to intervene when caregiver(s) are actively using cannabis.

Client Honesty
The caseworkers interviewed for this study described clients who were open about their use of cannabis, sometimes to the point of being defiant and challenging the workers to do something about their cannabis use. One worker stated, “…it’s almost like it’s minimized. ‘Well, its legal, why can’t we use it? Why would they legalize it if we can’t use it?’…[t]he lawyers say ‘at least she isn’t using meth’.” This creates a problem for DSS when they attempt to ensure the parents are substance-free and able to appropriately supervise and care for their children. As this same worker stated, “They need a clean mind to work towards getting their children back.” However, the caseworkers also reported that clients were more likely to report the cannabis use and describe how they are ensuring their children do not have access to smokable or edible products in the home.
Increased Needs for Support

All of the caseworkers interviewed for this study reported working with families who were homeless or moving into the area for either cannabis use or hoping to find work within the cannabis industry. Further, the low cost of living in Pueblo also appeared to be a factor in the decision of families to move to this city. One worker stated,

“This is the third cheapest town in the country, and that’s getting around…I went home for Thanksgiving, I drove back, I stopped at a rest stop in Kansas. I see this on the wall, ‘Go to Pueblo for free stuff.’ On I-70, that’s the reputation that Pueblo has.”

When these families move into Pueblo, they rarely bring their household goods or ensure they have a job or a place to live. Most end up living in their cars and relying on social services within the community. Because these families come from out-of-state, there is a lack of informal support systems, such as family, church, or community members for these families to rely on. DSS must then help the families establish these informal support networks while providing services to stabilize the families. The extent of the population is difficult to define, due to historical difficulty in counting the population who are homeless and Colorado Trails not collecting data on whether parents have recently moved into Colorado. However, caseworkers reported anywhere from 60%-90% of their cases involve families with cannabis use, either medicinally or recreational, and it is often mixed with other drugs. This has had an impact on caseloads, as one respondent reported, “I would say some people would say our caseloads have doubled because of this, because it indirectly increased because of this because of the type of people moving to town.” Posada, a local shelter in Pueblo that provides services for the homeless population sees the increase in the out-of-state population important enough that they include a webpage on their website, stating, “Many families and individuals are relocating to Pueblo for legal marijuana, benefit acquisition (as Colorado is a Medicaid Expansion State) and the perceived affordability of housing” (Posada, 2016a para 1).

Lack of Guidance and Information

All of the caseworkers reported lack of structure regarding when to intervene when caregiver(s) were recreationally using cannabis, confusion from clients regarding why they could not use a legal substance, and lack of awareness regarding the longer-term effects of cannabis use in children and adults.

Use of cannabis remains illegal at the federal level, but legal in the state of Colorado. This creates a conflict in trying to determine when to intervene with families. One worker stated,

“No, you get to where it is okay. And you have to turn a blind eye to it, a lot of times you have to turn a blind eye to it. And you have to look at it in terms of a safety issues, but it’s really tough to prove it’s a safety issue just because someone is on the couch all day smoking…”

The lack of research on the effects of cannabis leads to less specificity in training on the effects of cannabis for caseworkers, leading to less guidance regarding when to intervene with clients. This is a pressing issue because the caseworkers reported anywhere from 60–90% of their cases included the use of cannabis is some form. One caseworker stated, “There’s no clear-cut boundaries for us or them in regards to so many of the different laws and restrictions we have to follow. It’s really hard to explain and enforce something that’s this big huge grey area for us.” The caseworkers reported frustration with explaining to clients that even if the substance is legal, they can be court-ordered not to use it when caretaking for their children. For clients, it is confusing to have a court order prohibiting them from using a legal substance. This makes it more difficult for caseworkers to work with clients, as the clients resist orders to stop using substances that they view as legal, and possibly safe, as the research on the long-term effects of cannabis is lacking. Caseworkers reported that cannabis use is different from alcohol use. There is a body of research describing the effect of alcohol on the human body. Additionally, when people imbibe alcohol excessively, there are generally behavioral signs, such as slurring words, unstable gait, loud talking, and loss of balance, which are fairly easy for caseworkers to recognize and respond to. This is not always the case with cannabis. One
caseworker reported,

“And the longevity with alcohol, it’s been around a long time. And here we [have a] new thing and so everyone’s personalities are different. I might react to someone using marijuana differently than [name redacted], and different than the person around the corner who’s very against it, or someone whose family grew up and used it. There so many perspectives and it’s so new. It’s hard to say. I’m going to react different than the next caseworker anyway, so then we collaborate when there something with no data or very little data.”

Discussion

Unfortunately, because Trails data does not differentiate between referrals based on type of drug(s) involved in these cases, it is impossible to determine if the increase in referrals and removals from the home occurred because of the impact of legal cannabis. It should be noted that the County of Pueblo has also experienced an increase in population size since 2010. In 2010, the population of Pueblo County was 159,063, and in 2016 the population was estimated at 165,123 (U.S. Census Bureau, n.d.). This represents an increase of about 3.8%, which does not explain the increase of 35% more referrals to DSS for abuse or neglect. There are a number of reasons why referrals may have increased, from greater public awareness of child abuse and neglect to economic or social factors. It is beyond the scope of this study to delve more deeply into these issues, but further research should be conducted to gain insight into this increase.

The increase in referrals and removals from the home in Pueblo County began occurring after 2014, with a much smaller increase in 2015, based on the data through Colorado Trails. Likewise, the increased costs of substance abuse expenditures increased from 2014 to 2015, but has steadily decreased since 2015. The substance abuse expenditures are also confounded by costs of substance abuse treatment changing from year-to-year, new treatment methods being incorporated, which could result in an increase or decrease in the total cost of treatment, and the type of drug dependence being treated, as different drugs may require different lengths of treatment. Without a clear idea of the type of drug being used by clients involved with DSS, it is impossible to draw any conclusion about the influence of legal cannabis.

The interviews with the caseworkers, however, paint a picture of legal cannabis complicating work with families. On the one hand, caregivers appear to be more open and honest about their use of cannabis, but also less likely to comply with court orders to stop using due to the legal status of cannabis in Colorado. This leads to stress in the relationship between caseworkers and caregivers, which could reduce the effectiveness of services provided. The issue of the long-term effects of cannabis and the connection between cannabis and the child welfare system is not well-researched, and leaves caregivers, caseworkers, and legal professionals to make decisions based on personal values or policies that were developed for substances such as methamphetamines and opioids instead of research-based policies focused specifically on the effects of cannabis. In fact, the one peer-reviewed research study that could be located by the researchers regarding cannabis and child welfare suggested that cannabis use was more likely to result in child abuse rather than child neglect (Freisthler, et al., 2015). If this is confirmed, then the issue of the number of removals for child abuse remaining relatively stable from 2011–2017, despite the legalization of cannabis in Colorado should be explored. Regardless, the lack of research on cannabis and the child welfare system and the long-term effects of cannabis is concerning. More research in this area could help caregivers, caseworkers, and legal professionals make better informed decisions about the use cannabis, and could help provide better information for the creation of policies to guide the child welfare and legal systems.

Another issue that developed from caseworker interviews was the number of people arriving in Pueblo from out-of-state. Caseworkers report that these families have unique issues regarding lack of housing, social supports, and economic opportunities. Several of the caseworkers reported that Pueblo, in particular, may be experiencing the out-of-state arrivals at a higher rate than other communities in Colorado due to the perceived lower cost of living in Pueblo. These families may not always be reflected in the population of homeless persons, as they may have obtained housing, no matter how inadequate, and then come to
the attention of DSS due to inability to properly care for the children in the home. It should be noted that the increase of out-of-state families is based on anecdotal evidence of caseworker perceptions of their caseload, but this perception should be taken seriously as it affects the caseworker’s abilities to provide services to these families and increases the workload of caseworkers who must help the families build social supports in addition to providing services for the referral issue(s). The caseworkers interviewed expressed frustration with families arriving without household goods, no job offer, lack of social supports, and lack of information about the Pueblo community. Recently, Posada of Pueblo has attempted outreach on their website, providing information to people from out-of-state who are considering moving to Pueblo (Posada, 2016b). This type of information campaign is vital to inform the public of what to expect when relocating from out-of-state, and may be helpful in curbing the number of people arriving with families without social and economic supports in place.

The Colorado Trails data and caseworker interviews appeared to raise issues and concerns about the impact of legal cannabis in Pueblo, but are unable to provide definitive answers. Further research into this area is needed, but better data collection procedures are needed before such a study can provide the answers sought regarding the impact of cannabis on the child welfare system in Pueblo.

Conclusion

The scarcity of research on cannabis and the child welfare system is concerning in light of the caseworker interviews regarding the impact of cannabis on their case- and workloads. This issue is further complicated by the fact that the Trails system does not allow coding for specific drug use in referrals, removals, and treatment provision. This initial exploratory study did reveal the need for an update in Trails to provide more relevant information for future research. While the state of the Trails program negates the ability to collect baseline data for CW clients prior to the legalization of cannabis in Colorado, an update could provide a current snapshot of client presenting issues and needs, and provide clarity regarding the role of cannabis in child welfare services and allow DSS to adjust services, if needed, to better serve families in Pueblo County. Additionally, this study also revealed the need for specific policy guidance for CW workers and a need for substance abuse assessments at intake to more quickly move families into treatment in order to ensure compliance with federal permanency planning guidelines. Finally, this study revealed a need to educate the public in two ways: 1) out-of-state populations need to better understand the possible consequences of moving to Pueblo without social and economic supports in place, and 2) Pueblo County residents could benefit from more information about the effects of cannabis biologically and sociologically. It is hoped that this study will serve as a starting point to better document, understand, and act upon the consequences resulting from the legalization of cannabis in Pueblo County.

Recommendations

The first major recommendation is that Colorado Trails be updated to allow for more specific coding on intake. This is not a simple task, and will require funding for staff time and expertise. However, a more specific coding could allow better analysis of the reasons why families are referred to the CW system and specific issues that need to be addressed. Rather than substance abuse or use, it would be helpful for the Trails system to allow selection of drugs such as opioids, methamphetamines, cannabis, heroin, polydrugs, alcohol, and others. This could provide better data in the future and help the DSS compare their population with national trends in substance use or abuse.

Another recommendation is that the County DSS develop specific policy guidance surrounding caregiver use and misuse of cannabis and how caseworkers should proceed. While cannabis is currently a legal substance, like alcohol, its misuse can cause child welfare issues, like alcohol. Cannabis, however, does not affect people like alcohol, and therefore caseworkers should be given additional guidance to help them in decision-making with child welfare-involved families. By creating internal policies, the Pueblo Department of Social Services will have the opportunity to personalize the policies in a way that makes the most sense for the County of Pueblo, rather than waiting for generic policies to be dictated on a state level.
A third recommendation concerns the intake process within the Pueblo Department of Social Services. The data clearly show initial referrals and substance abuse treatment spending have increased since 2012. As noted in the interviews, sometimes families are reluctant to disclose substance use or misuse, leading to a delay in diagnosis of the problem and initiation of treatment. Assessing for substance use or misuse is a specialized field, and requires much training and supervision. The DSS intake workers have worked hard to identify these issues in families, but their primary assessment duty is the health, safety, and well-being of children. It would be helpful if Pueblo DSS were able to employ a full-time worker to complete initial assessments strictly for substance use and misuse. The substance abuse assessment worker could accompany the intake caseworker during initial investigations, increasing the safety of workers and allowing the intake worker to focus on the health, safety, and well-being of any children in the home. The substance abuse assessment in initial investigations would facilitate faster referrals for treatment, helping ensure federal guidelines for permanency of children are met and increase the safety and well-being of children in Pueblo County. In some cases, if treatment is initiated quickly, children could be maintained in the caregiver’s home instead of being placed into foster care. This would minimize the disruption of children’s living environments and possibly enable clients to view the Department of Social Services as a partner in ensuring the health of the family rather than being viewed with hostility.

A final recommendation is for the community of Pueblo to embark on a collaborative public information campaign to ensure the community has scientific information on the effects, whether positive or negative, of using cannabis in all its forms, as well as specific information about how cannabis hinders or promotes human development physically, emotionally, and mentally. The public information campaign should not be reliant on any one agency or group, and ideally should include medical professionals, social workers, youth workers, spiritual advisors and faith leaders, community leaders, law enforcement, education professionals, business owners, industry growers, and laypersons who are impacted by cannabis use or misuse. Granted, this coalition would not always agree or see eye-to-eye, but the conversations need to happen and could vastly improve the community’s understanding of the impact of legal cannabis in the area.

References


Social Impacts 7: Attitudes regarding cannabis' impact on community

Part 1: Parenting practices, attitudes, and marijuana education

Abstract
Since the legalization of marijuana and cannabis products in the state of Colorado in 2012, parents and caretakers of underage children have been concerned with the health and social risks associated with children’s exposure to marijuana. This study presents data from qualitative interviews with parents of teenage child/ren who reside in Pueblo County in order to document some of these concerns and to illustrate how parents choose to educate their child or children about marijuana. The findings demonstrate that many parents are distancing themselves from traditional “scare-tactic” approaches and rather, that parents are embracing rational and informed approaches to discussing marijuana usage with their child or children.

Introduction
Abstinence-based approaches are the prevailing ideology behind many drug education programs and mainstream messaging about illicit substances. Given that more than half of high school students are likely to experiment with drugs of any type, according to a 2014 survey, abstinence-based educational approaches are clearly not working (MTF 2014). The United States has some of the higher drug-taking behavioral patterns when compared to other industrialized Western nations, which is particularly paradoxical given our prohibitive tendencies that have resulted in a war on drugs and an increase in our jail and prison populations (Reinarman and Levine 1997; The Sentencing Project 2009). Moreover, when identifying drug use trends in terms of onset and desistance, it is apparent that the vast majority of teenage use of drugs and of cannabis is experimental and will not persist into adulthood past the age of 24 (Room 2012). Though this report is not an endorsement of teenage cannabis use, it does borrow from the latest drug education literature that attempts to stray from scare tactics and zero-tolerance approaches and to adopt instead a reasonable and “smart” framework that will make sense to a teenager who will inevitably encounter alcohol, cannabis, and/or drugs.

The history of marijuana criminalization provides a salient example of how scare tactics are, at best ineffective and at worst even harmful. Explicit propaganda campaigns, as exemplified in Reefer Madness, made horrific claims that Mexican bandits were “corrupting” and “polluting” white America with their “loco weed” and causing chaotic accidents, suicides, reckless sex orgies, and even homicides (Schlosser 1994). Though efforts to demonize marijuana became more sophisticated, borrowing more scientific rhetoric, programs such as D.A.R.E., a well funded and widespread drug education program, continued the claim that marijuana could “lead to a life of ruin,” without properly contextualizing how that might be or in what contexts that might be possible (ibid.). As Martha Rosenbaum puts it, “We need to talk about alcohol, marijuana, and other drugs in a sophisticated manner and distinguish between use and abuse. If not, we lose credibility” (2014:11).

The following study starts with the research question: How are parents in Pueblo County talking to their teenage children about marijuana in a state that has legalized marijuana? This research intends to explore what parents’ general views on marijuana and cannabis products are, while additionally documenting what—if anything—parents teach their teenage child or children about marijuana. The study explores whether parents are adhering to an abstinence-only model, or if they are choosing to stray from traditional educational tactics.
Methods

Participants
The sample consisted of nine (9) adults of at least one teenage child who reside in Pueblo County and have at least joint custody of their teenage child(ren). The sample ranges in ages, from 35 to 46 years old, with the median age of 40 years old. Research participants’ racial and ethnic compositions are: three (3) of the nine adults are Latino (33%), five (5) of the nine adults are White (56%), and one (1) of the nine adults is multiracial Latino, American Indian, and White (11%). Of the nine (9) participants, seven (7) are female (78%) and two (2) are male (22%). The annual household incomes ranged from $25,000 to $125,000, with the median annual household income ranging between $40,000 to $80,000. Seven (7) of the nine participants have two teenage children and two (2) of the nine participants have one teenage child; the ages of the teenaged children range between 13 to 17, with the median age being 16 (see Table 1). The sample notably over-represents mothers over fathers; with this exception, the sample is fairly representative of the greater demographics of Pueblo.

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Race/Ethnicity</th>
<th>Sex</th>
<th>Household Income Range</th>
<th>Age of Child(ren)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athena</td>
<td>44</td>
<td>White</td>
<td>F</td>
<td>$25,000 - $40,000</td>
<td>Son, 14 and Daughter, 17</td>
</tr>
<tr>
<td>Holly</td>
<td>39</td>
<td>Multiracial</td>
<td>F</td>
<td>$40,000 - $80,000</td>
<td>Son, 13 and Daughter, 17</td>
</tr>
<tr>
<td>Julie</td>
<td>35</td>
<td>White</td>
<td>F</td>
<td>$40,000 - $80,000</td>
<td>Son, 15 and Daughter, 17</td>
</tr>
<tr>
<td>Manny</td>
<td>36</td>
<td>Latino</td>
<td>M</td>
<td>$40,000 - $80,000</td>
<td>Son, 15 and Daughter, 17</td>
</tr>
<tr>
<td>Marie</td>
<td>43</td>
<td>White</td>
<td>F</td>
<td>$80,000 - $125,000</td>
<td>Daughter, 16 and Son, 17</td>
</tr>
<tr>
<td>Michelle</td>
<td>38</td>
<td>White</td>
<td>F</td>
<td>$80,000 - $125,000</td>
<td>Daughter, 16</td>
</tr>
<tr>
<td>Mona</td>
<td>46</td>
<td>Latina</td>
<td>F</td>
<td>$40,000 - $80,000</td>
<td>Son, 14 and Son, 17</td>
</tr>
<tr>
<td>Randi</td>
<td>45</td>
<td>White</td>
<td>F</td>
<td>$25,000 - $40,000</td>
<td>Daughter, 14 and Son, 16</td>
</tr>
<tr>
<td>Toby</td>
<td>40</td>
<td>Latino</td>
<td>M</td>
<td>$80,000 - $125,000</td>
<td>Daughter, 16</td>
</tr>
</tbody>
</table>

Recruitment
This qualitative study employed a snowball sample to gain access to the target population—which were adult parents of teenage children. Snowball sampling is also known as “chain sampling” in which participants refer the researcher to other qualified participants who may be willing to participate (Handcock & Gile 2011). Given the time constraints of this research project, this sampling process offers a simple and efficient way of reaching a particular subpopulation. Though this recruitment strategy gave the researcher a time and cost-savings advantage, it does have the limitations of providing a nonprobable sample that is not guaranteed to be representative of the parent population. Though this study admittedly offers conclusions based on parents of teenagers who share similar social circles, it does offer a glance into the beliefs and attitudes of a population not studied previously, and therefore offers a jumping off point for future research.

Interview Procedure
The author met with participants in their homes, in libraries, or coffee shops for an average of 35 minutes per interview. After informing participants of what they might expect of this study and reviewing the consent form with them and all associated risks and benefits, the author commenced the interview. Each interview was audiotaped with consent, which was then transcribed at a later date to use in this research report. With the research stipend from the Institute of Cannabis Studies, the author was able to compensate participants 25 dollars each for their time, energy, and willingness to contribute to the study.

The author asked participants to withhold actual names for confidentiality purposes and additionally asked that participants did not disclose personal use or their children’s use (if known) to eliminate potential legal
liabilities. This procedure is informed by the fact that marijuana remains a federal offense and there are numerous prohibitive state laws about parental use.

Results and Discussion

Though there was some variance, overall this sample overwhelmingly represents parents who expressed hesitation, if not outright disapproval at the thought of allowing their teenage children to use marijuana. Interestingly, the sample also overwhelmingly expressed support of the marijuana industry in Pueblo County because of the actual and potential benefits of legal marijuana sales to the economy and local infrastructure. Though the abstinence-only framework might view these attitudes as contradicting each other, most of the parents interviewed for this research explained that you can be both against personal use—particularly because of the effects on teenage brain development—and for an industry that is regulated, age-prohibitive, informed, and financially beneficial. Moreover, the overall thematic conclusion of this sample was that parents sought to be open and communicative with their teenagers, rather than shutting off conversations about difficult topics such as marijuana. The parents in this sample generally expressed a desire for a more rational approach to understanding marijuana and its effects, while additionally desiring to communicate informative messages to their teenagers, rather than using traditional “scare tactics.” Below, reoccurring themes are highlighted and sorted for readability.

General Views on Marijuana and Perceived Effects on Pueblo

The research participants generally approved of the marijuana industry and spoke of the many actual and perceived effects on Pueblo County and its residents. A total of seven (7) spoke of the medical benefits, others highlighted the financial advantages that the industry has provided to an economically depressed region of Colorado, and others stressed that removing legal consequences for possessing or using marijuana was important to marginalized and poor communities. For example, Holly, a 39-year-old multiracial Latina and Native American mother of two teenagers stated that:

I appreciate the direction that it’s going in. I really appreciate the medical benefits. I will never advocate for people to smoke it because it’s so damaging, but the health benefits with just topical or edible use are amazing. I have seen so many people benefit greatly from medical marijuana use. It’s changed lives. I’ve seen amazing things. People who are on a ton of pharmaceuticals because of a medical condition, just a ton of medications, and I’ve seen them switch over to CBD oil or whatever type of medical marijuana and then I can observe the transformation and the amazing difference that they experience. So I really hope that the research becomes more publicly available.

Holly later speaks to one of the contemporary issues facing Pueblo. Its relatively high rate of opioid use and abuse and, more specifically, its high rate of heroin overdoses (fatal and otherwise) when compared to other counties in Colorado. The problem is so severe that many politicians, public health officials, and the general public are calling it an epidemic; since 2012, deaths related to heroin have increased 85% in Pueblo County (Sikora 2017). In the context of this public health issue, some parents paralleled Holly’s sentiments and noted the health benefits of marijuana, or at least the relatively few health risks associated with marijuana.

Noting marijuana’s health benefits—or relatively few health risks associated with the substance—two parents additionally noted that legalizing marijuana, and effectively decriminalizing the possession and use of it, would be socially and economically beneficial to Pueblo County. For example, Randi, a 45-year-old white mother of two teenagers thinks that:

By having [marijuana] legal, you put it out in the open. If you want it, you can go get it. You don’t have to go score over in Dogpatch [neighborhood in Pueblo] in some sketchy situation. The government takes a little hit off of that, and then schools are doing better in terms of financing, and the state has never done better financially. So it’s bringing in tourist dollars into Pueblo County that have never been able to, you know what I mean? And so, I think it’s a straight up
win. I see no negative. I think prohibition is a bad idea. The mandatory minimums have not worked out. The impact on minority populations, especially, has been horrible. Thinking about people serving 15 to 20 in federal prisons for 2 ounces of weed, it’s shocking to me. And I think it’s a waste of enforcement dollars, it’s a waste of prison dollars, it’s just a huge social waste when the consequences of people using, buying, or engaging in marijuana lifestyle, even before it was legalized were so low. So when I think of the cost that the state was willing to spend to stop it, it’s just bad math.

In pointing out the overall advantages of legalizing marijuana, Randi points to the economic boost to the government and additionally removing the legal and social consequences of enforcing prohibitive marijuana laws that adversely affect communities of color and low-income communities. Randi’s views reflect a nationwide attitude shift about marijuana and an increasing skepticism of mass incarceration; in the past 47 years of gauging public opinions on legalizing marijuana across the U.S., the Gallup Polls have recorded the highest level support ever—as of 2014, 60% of U.S. residents are now supporting the legalization of marijuana (Swift 2016). Additionally, public support for “tough on crime” policies has been steadily decreasing since 1990 (Enns 2016).

The last reason that parents gave for supporting the marijuana industry was that, through the taxing structure and varying policies that divert a percentage of dollars from marijuana sales to schools and local infrastructure, the legalization of marijuana provided an economic boom. Given that Pueblo County is among one of the poorest counties in Colorado, this concern is one that was strongly asserted by all seven (7) parents who supported the marijuana industry. Marie, a 43-year-old white mother of two teenagers, speaks to this strength.

Our unemployment rate is shockingly low—and I don’t know that it’s ever been this low. I think it’s brought in—like, the huge symposium that just happened in April [CSU-Pueblo’s Institute of Cannabis Research Conference 2016]—it’s brought in people from all over and I felt like it was a very elevated, academic conversation that Pueblo hasn’t really had at this scale or scope before. I think there’s a vision that legalized marijuana brings in stoners and homeless people and I just don’t think that’s the whole truth of it; I think it’s a mythology. I think it actually elevates our community. It’s brought a heightened sense of science to this community, and it’s brought a lot of jobs. And I know a lot of people who have moved here who have come to work in this industry or work as electricians for some aspect of this industry, or people who move here because they view us as progressive while also being affordable. I just think it’s been a huge win for this community.

Marie caveats her praise for the financial benefits and intellectual richness that both the marijuana industry and the Institute of Cannabis Research bring to the community by saying that she appreciates how Pueblo County thoughtfully established guidelines and regulations on the legalized sales of marijuana. It is clear that parents would not be happy with any type of financial surge from the industry, but rather that the economic boost is happening within the context of the state implementing age-prohibitive laws, policies on dispensaries being located outside of the city limits (but within the county limits), and taxing a certain percentage of the sales for schools and local infrastructure projects.

Though seven (7) of the nine (9) parents interviewed spoke of the positive benefits of the industry, two (2) noted that they saw no benefit to the legalization of marijuana in Pueblo or in the state of Colorado. One of these parents, Mona, is a 46-year-old mother of two teenage children, and states that, because of her negative experiences with family members who chronically use marijuana, she does not want the substance legalized in Pueblo:

We have a couple of family members who have used it since they were young, and honestly they’re kind of the same. Like, they haven’t really grown up and their mentality is the same. And so I tell my son, do you really want to be like that? Like a teenager your whole life? And really, those family members are doing the same stuff now that they were when they were in high school....
It can affect your mentality and it can lead to other things, seeking a bigger high and using other drugs. And I want my son to make better life decisions.

Mona is repeating a fear that many parents outside of this sample have of marijuana, in that it may stunt brain development and social growth. Indeed, there is some basis to hold concerns for the ways in which marijuana may affect the adolescent brain; researchers have found that chronic and consistent use may result in a decline in neuropsychological functioning, which is equivalent to about six IQ points (Meier et. al 2012). However, there is additional research that conclusively finds that other socioeconomic factors, such as poor nutrition, education, poverty, and alcohol consumption have more of an influence on neuropsychological functioning than marijuana use (Rogeberg 2013). However, because there is a correlation between chronic marijuana usage and low socioeconomic status, Mona additionally comments on her observations from her vocational experience in the medical field:

We’re seeing a lot of people with poor health who are also using marijuana. What led them to have poor health I’m not exactly sure, but they are definitely the ones reporting more marijuana use. There is no positive effect that I can see for those who are using it recreationally.

It is clear that the two parents who disapprove of the marijuana industry, Mona included, are drawing from real, lived experiences. It is also the case that most marijuana users are not experiencing poor health, or frequenting the hospital because of marijuana-related issues, or causing the many social ills that occur in Pueblo. Yet, these social ills exist in Pueblo and cause community members a lot of strife. This paradoxical issue necessitates those within the research community to do more work on providing accessible information to community members in order to better contextualize the root causes of social problems and the ways in which marijuana is connected—or not—to these issues.

**Parental Education on Marijuana**

A focal point of this research is to document whether or not the parents in this sample educate their teenage child or children about marijuana, and whether or not they adhere to or stray from an abstinence-based model of education. Overall, parents are asking that their teenagers abstain from marijuana use until they are of age, but they are also adopting approaches that prioritize open communication and honest information. For example, Athena, a 44-year-old white mother of two teenagers, states that:

They know that it’s not okay and if they know someone who does it, I mean, it’s ok. I get it. But don’t let others pressure them… They don’t know how it’s going to affect them cognitively or in terms of their brain development. I don’t want anything bad to happen to their little brains or to experience any long-term consequences. And once they’re 21, I hope they have enough information and are careful enough to make a wise decision in the right environment.

Athena, like many of the parents in this sample, cite a concern about cognitive consequences from using marijuana, but also speaks to the importance of setting them up for success once they turn of age and are able to access marijuana. She spoke of the need to give her teenagers honest information about marijuana, including the risks to brain development, so that when they are 21 they can make informed decisions. Paralleling Athena’s sentiments, Marie, a 43-year-old white mother of two teenagers, also discusses these risks. Marie was one of the more vocal proponents of the marijuana industry and additionally said that, though she has never used marijuana, she views it as a traditionally medicinal plant that can be used in conjunction with other herb and plant medicines. Despite her adamant support of the marijuana industry in Pueblo County, she is careful to draw a distinction between being a supporter and a user:

Yea, I mean, we’re a pretty strict household. And we’ve always been really open and talk to the kids about any sort of alcohol or drug use, especially in their teen years. You know, we’ve done readings and we’ve listened to podcasts about how when your teenage brain is in a certain stage of development, drugs and alcohol can really create long-term problems. So we’ve tried to approach it from a scientific angle with the kids. And I personally have been pretty blunt; like, just
because we support the marijuana industry does not mean we support you using marijuana in your youth. But, to me it’s the same way in which we drink a beer during dinner; we are clear that they cannot drink until they’re of age.

Many parents preferred to take the “scientific angle,” as Marie puts it, and attempt to normalize the industry as a benefit to Pueblo while not endorsing it to the point of familial or household use. When asked about how their teenage children responded to the scientific angle, nearly all of the research participants said they saw a great reception from their children.

There is a rich and growing literature on the positive benefits of parents speaking truthfully and rationally with their children about alcohol and licit and illicit substances. Research suggests that after receiving rational and informative education, youth make better and more well informed decisions when compared to fear-based, highly moralistic styles of education (Midford et al. 2012). Toby, a 40-year-old Latino father of one teenager, embraces a rational education model in educating his child:

I think it’s better to be open about drug conversations. I think for the most part, being open about it is the better approach because giving someone the expectation of what might happen is informative. As opposed to drug education in say, high school, where they say, don’t do this it’s bad. But they only ever tell you negative anecdotes, and that’s all they ever tell you.

Toby states that he relays a lot of his college experiences to his teenage daughter to demonstrate both the reasons for and risks of using various drugs, including marijuana. Likewise, Holly, a 39-year-old multiracial Latina and Native American mother of two teenagers, states:

I will give it to my kids straight. Marijuana is a drug, just like alcohol. It is going to alter your perception and experience of things, no matter what you are doing. It’s going to affect you. I’ve educated them as far as what the repercussions are and educated them about the dangers of smoking and damaging your lungs or of eating too many edibles because you didn’t metabolize it quickly enough. I emphasize that their health is the most important thing and that they should be careful about what they do and to avoid taking health risks.... Kids know how to get their information, they have access to the internet now, and so we really have to start getting honest with them.

There was a general consensus among the research participants that parenting in an information age has necessarily changed the shape of parent-child communication; namely, that parents ought to be frank and honest with their children, because they are prone to getting a “second opinion” (or third, or fourth) on the internet.

**Gaining Information on Marijuana**

The last theme in this study regarded information access and critical consumption of media. As stated in the introduction, there have been many misperceptions and blatantly falsified information about marijuana propagated by media outlets, politicians and political reports, drug education programs, and pop culture. When asked if they needed more information on the risks and benefits of legalized marijuana, most parents stated that they already knew where to look. Just as the internet has allowed youth to access information more readily, parents have likewise turned to electronic sources for their information. But, some parents did state that it is important to be a critical consumer of information found online. For instance, Michelle, a 38-year-old white mother of one teenager, states that:

In terms of getting good knowledge, it depends on the source. There are a lot of smear campaigns about it being a gateway drug and I think a lot of that is being dispelled in Colorado, but that false information is still out there. There are always going to be political debates about it. I know there’s a group in Pueblo that is very anti-marijuana and they are saying that marijuana is driving heroin use, for instance and that marijuana is degrading our schools and things like that. And that it is driving up our crime rates. There are statistics out there that disprove those claims and
that those issues are not caused by legalizing marijuana. I mean, there are good things and bad things, but gaining good information is important.

Michelle speaks to the importance of seeking out nonbiased information that is not influenced by moralistic or political agendas; as a reader of local newspapers and periodicals, Michelle highlights the fact that marijuana in particular is gaining better press in the state of Colorado, though Pueblo has certain actors and groups that espouse an explicitly anti-marijuana campaign and propagate untrue or misleading statistics.

In addition to Michelle’s sentiments, Manny, a 36-year-old Latino father of two teenagers, explains that he doesn’t trust the internet and that he needs more scientific information:

I just think that some of the sites about marijuana are still using that old-school mentality, and I don’t trust it. I mean, I think a lot of the stuff out there is still just people lying and covering up their opinions with numbers and statistics. I wish I had more scientific information about how intoxication affects the brain. Yes, I would definitely like more truthful information to give to my kids and actual facts that aren’t politically influenced. But, not a lot of the science is available online.

Though there are numerous websites devoted to youth and marijuana and other drugs—many of them documenting the actual or potential harms, and strategies on how to talk to youth about marijuana and other drugs—Manny expresses a hesitation about fully trusting some of the information. In the United States, we unfortunately have a sordid history when it comes to truthfully talking about drugs. Misinformation campaigns and propaganda have influenced our drug education programs, to the point that parents like Manny are now distrustful of most things they read. Moreover, Manny points to a flaw in the research community—that the unbiased scientific research on drugs is not made publicly accessible, and instead often remains hidden in the annals of academic journals made available to affiliates of the university. This study therefore eagerly advocates for a stronger and more communicative relationship between the university and the community, which the Institute of Cannabis Research at Colorado State University—Pueblo, is poised to foster.

Conclusion and Tips for Parents of Teenage Children

Borrowing from Rosenbaum’s widely acclaimed report entitled Safety First: A Reality-Based Approach to Teens and Drugs, the following will explore common areas of concern for parents and reasonable approaches to talking to teenagers about marijuana and drugs. Providing accessible information was a common request from participants, as they recognized the prevalence of news outlets that are more interested in ratcheting up fear than they are in disseminating factual information.

Teenagers are incredibly capable of rationalizing their decisions and coming to reasonable conclusions when given truthful and honest information. The importance here is to emphasize the distinction between use and abuse and to know the signs of when substances are negatively affecting the teenager. Moreover, properly understanding the legalities about cannabis can provide a more honest foundation for a parent to educate their teenager(s). Since marijuana and marijuana products are illegal for those under the age of 21 in Colorado, and still illegal on the federal level, it is important for parents to learn about the legal consequences and to relay those facts to their teenage child/ren. Particularly for youth who are disproportionately policed at school or in their neighborhoods (i.e. youth of color, queer youth, low-income youth), they need to understand how to navigate and avoid the school to prison pipeline and various mechanisms that set up greater obstacles to them (Allen and White-Smith 2014).

With the following information, it is important that parents also understand the value of listening to their teens and establishing open lines of communication. Though it is a difficult exercise in remaining nonjudgmental and open, parents will see greater benefits in the relationship when they are able to withhold punishment, when appropriate, and to instead to offer advice when solicited and to hear their teenagers out (Kelly et. al 2002). Further, it is important for parents to think about how to take effective preventive action.
Expanding children’s prosocial networks through constructive extracurricular activities and community programs better equips teens with positive relationships that are not centered on drugs, alcohol, marijuana, or deviant behavior (Feldman and Matjasko 2005).

**Just the Facts**

**Marijuana Potency**

As technologies devoted to growing marijuana have advanced, there has been a simultaneous rise in THC levels, corresponding to the scientific and business interests devoted to “enhancing” cannabis products for their medicinal and recreational aspects. For example, a recent 2016 study found that THC—tetrahydrocannabinol, the main psychoactive ingredient—was at a low level of just 4% in 1995 and has since increased to 12% as of 2014 (ElSonly et al 2016). Though we can affirmatively conclude that marijuana on the marketplace or that which is unregulated and grown illegally generally has higher potency than in decades past, there are no documented instances of fatal or near-fatal overdoses and users can adjust their doses accordingly to ensure they do not experience negative effects (Earleywine 2005). Many users report successful use when reducing their dose, but users also report that it is more difficult to do so when consuming edible cannabis products; first, because edible products take longer to metabolize than smokeable products, and second, when eating, the liver metabolizes THC as 11-hydroxy-THC, which enhances the psychoactive effects of THC (Zimmer and Morgan 1997).

**Gateway Theory**

Beginning in the 1970s, the medical and scientific community began to popularize and promote the “gateway” theory—stating that use of any psychoactive drug (and sometimes including alcohol and tobacco) results in an increased probability of using other psychoactive drugs, usually from “soft” to “hard” drugs, though not always (Vanyukov et al. 2012). The misuse of this term and concept has been widespread and particularly influential in the drug educational arena, for example in D.A.R.E. messaging. This has been particularly insidious considering the fact that the overwhelming majority of people who have consumed marijuana or cannabis products do not ever try any other psychoactive drug (SAMHSA 2014). In fact, “out of the 114 million Americans who have tried marijuana, just 4 percent report having tried the most addictive illegal drug—heroin” (Rosenbaum 2014: 15). Many cessation studies find that most marijuana users desist in their usage by the age of 30 for an assortment of life and career choices (ibid.). Yet, despite many statistics countering the gateway theory, the concept continues to persist based on studies that show crack-cocaine, methamphetamine, and heroin users reporting marijuana to be the first illicit drug that they have used (not including alcohol). Drug scholars have identified other variables to have a more statistically significant role in causing “hard” drug use: factors such as poverty, mental health disorders, family history of substance abuse, incarceration, and childhood abuse have proven to drive illicit substance abuse and to be the gateway factors to problematic drug use (Kandel and Yamaguchi 1984).

**Developing Brain**

The possible impacts of marijuana on youths’ developing brains are a topic of debate among researchers in the literature and in policy circles. Most researchers agree: marijuana increases the possibility of long-term consequences on neuropsychological functioning and emotional development (Cermak & Banys 2011). The most common concern is that, while the frontal cortex is still developing, youth are more susceptible to impulsive behaviors, risk-taking, and a lack of foresight or thought about consequences. Because marijuana is a psychoactive substance, this can certainly alter normal brain functioning and heighten the risk of impulsivity. As stated previously, researchers have found that chronic marijuana usage may result in declining neuropsychological functioning, which is equivalent to about six IQ points (Meier et al 2012). There is additional research that complicates this, however. In New Zealand, a study of 2,600 young people conclusively found that other socioeconomic factors, such as poor nutrition, education, poverty, and alcohol consumption have more of an influence on neuropsychological functioning than marijuana use (Rogeberg
Despite the mixed results, the unanimous agreement in the research community is that protecting youth is a top priority, and with mixed research results, deferring to the safer option of having youth wait until the age of 21 to engage in marijuana use is the best practice.

References
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Part 2: Religion and marijuana

Abstract
Individual attitudes toward the relationship between religion and marijuana were studied. Focus group results indicate that individual perceptions about both legalized recreational and medicinal marijuana usage appear to be independent of any religious belief system. The only phenomenon that appears to be related is treating the body as a temple, as indicated biblically. Neither sex nor age appeared to influence the attitudes displayed. Much of the research in this area is old, so there is a need for more current work.

Over the last few years, many states have changed their laws regarding the use of medicinal and recreational marijuana. These changes in legislation have increased the legal availability of marijuana. The purpose of this study is to examine whether or not a person’s religious beliefs and background have any correlation with their views on the use of medicinal and/or recreational marijuana.

Literature Review

Security in Religious Beliefs
A review of literature reveals that multiple studies have secured findings that support the notion that regular church attendance and a sense of security in religious beliefs were factors that contributed to whether or not an individual was likely to participate in the consumption of marijuana and other substances. One study (Lorch & Hughes, 1985) focused on the likelihood of individuals (youth in grades 7–12) using substances (cocaine, marijuana, amphetamines/barbiturates, tobacco) or drinking alcohol out of moderation found that members of a church were less likely to do so than individuals who were not church members. The data in this study (n=13,878) showed that 38% of church members reported trying marijuana, and 18% of church members reported using the substance more than six times in a month. In comparison, 47% of nonmembers reported trying marijuana at least once, while 25% reported using the substance more than six times in a month. This same study found that members of the Church of the Latter Day Saints had the lowest percentage of young members trying or being heavy users of all substances. Participants who were from the Episcopal and Presbyterian churches had the next lowest percentage of using marijuana heavily.

The study showed that the fundamentalist religions and the most proscriptive of religions proved to be most effective in preventing the use of alcohol and substances, such as marijuana. The more liberal and prescriptive religions proved to be next most effective in preventing the use of marijuana. The authors concluded that although there were significant findings, the relationship between religion and substance use was weak.

Dudley, Mutch, and Cruise (1987) examined religious factors and drug usage among Seventh-Day Adventists from 71 churches in the North American region (n=801). They found that youth (ages 12–24) in this religion reported a significantly minimal frequency of using marijuana, tobacco, and alcohol. One reason that was provided to help explain the findings was that many of the participants may be influenced by the religious belief that God wants them to take care of their bodies and not defile them. This reasoning could also be applied to the findings of the previously mentioned study by Lorch and Hughes, where the most fundamentalist and proscriptive religions were deterrents for drug and alcohol usage. Another factor provided by Dudley, Mutch, and Cruise showed that youth who participated in private devotions and were active in their church were also less likely to use drugs or drink alcohol. The researchers also mentioned that other behaviors of the youth studied were protective as well. Contrary to the study conducted by Lorch and Hughes, the study conducted by Dudley, Mutch, and Cruise showed that religious factors did impact an individual’s likelihood to use drugs such as marijuana.

A more recent study (Horton, Ellison, Downey, & Barrett, 2012) examined the attachment college students had to God and how the attachment affected their tendency to participate in behaviors carrying health risks. The researchers found that students who had an anxious attachment to God were 12.3 times more likely to report usage of marijuana than individuals who did not have an anxious attachment to God. An anxious
attachment is defined as fearing abandonment but desiring a relationship (Zastrow & Kirst-Ashman, 2016). The researchers discovered that those who were secure in their attachment to God and attended religious services frequently were up to 0.62 times less likely to report marijuana usage in the last 30 days. The authors concluded that having a strong religious faith often deterred individuals from participating in behaviors that carry health risks.

Religion in Rural Areas
McIntosh, Fitch, Wilson, and Nyberg (1981) examined the effect of religious social controls on teen drug usage in rural areas. Their findings demonstrate that teens from rural areas were more likely to have stronger religious faith than teens from more urban areas. In agreement to the findings of the studies examining religion and the likelihood of individuals to use drugs such as marijuana, this study concluded that the area in which an individual lives does not affect their likelihood to use drugs. Urban religious teens were just as likely as religious rural teens to use or abstain from drugs.

Religious Leaders and Marijuana Policy
With the current political climate and changes in marijuana legislation, religious leaders have taken a stand on both sides of the argument. A 2007 article published by the Los Angeles Times described the initiative taken by several Illinois clergy members to advocate for the legalization of medical marijuana. The clergy members petitioned the state senate to show compassion and decriminalize the use of medicinal marijuana. Clergy members were in support of this movement because they wanted doctors to have the ability to prescribe or provide the necessary tools to help ease the pain of the extremely sick (Huffstutter, 2007). The religions represented included Protestant, Jewish, Unitarian, and other faiths.

An article published in October 2012 (Tooley) describes the beliefs of one United Methodist clergy member from Denver, Colorado. The reverend expressed his belief that marijuana should be legalized in order to end marijuana prohibition. He did not support the use of marijuana, but wanted to put a stop to sending individuals to prison for marijuana possession and usage. This pastor was one of nearly two dozen who were in support of legalizing marijuana. United Methodist, Protestant, Jewish, and Unitarian clergy members made up the two dozen publicly endorsing this legislation.

An October 2012 article details certain clergy members’ opposition to endorsing the legalization of marijuana in Colorado (Roberts). This article recognized the argument of the two dozen clergy members previously mentioned who endorsed Amendment 64. According to a leader of those opposing the movement, legalizing marijuana would send the wrong message to members of their church. Clergy members speaking out against the legalization of marijuana represented Agape Christian Church, New Faith Christian Church, and New Hope Ministries (Roberts, 2012). The leaders from these churches were a part of a larger organization known as the Greater Metropolitan Denver Ministerial Alliance.

In February, 2014, Bailey wrote about the ongoing debate among religious leaders about the morality of legalizing marijuana. This article reported findings of a survey that was taken in 2013 by the Public Religion Research Institute. The survey found that 58% of white mainline Protestants and 54% of black Protestants support the legalization of marijuana. On the other hand, 69% of white evangelical Protestants were opposed to the legalization of marijuana. This same survey found that those of the Catholic denomination were the most divided group with 48% favoring the legalization of marijuana and 50% opposing it. The findings of this survey support some of the other findings from the research studies looking at how religions influence abstinence from marijuana usage.

The literature on views of marijuana and the usage of marijuana shows that religion does have some impact on an individual’s stance. While there are few peer reviewed articles available on how religion affects a person’s view on marijuana, the few that are available have looked at the variables and factors that may have influenced their findings. Across the board, it can be stated that the more liberal a religion is, the more likely its members will support the legalization of marijuana. The more conservative a religion is, the less
likely its members will support the use of marijuana, both recreationally and medicinally.

**Methodology**

Focus groups of individuals from various religious backgrounds were held with participation being voluntary. A total of four focus groups were held. The length of each group was approximately one hour. Both males and females participated, and a variety of age groups were present. A total of 17 people participated. Among these were 7 males and 9 females; one person’s sex was indeterminate. Ten individuals identified as Hispanic; six identified as Caucasian; and one person’s ethnicity was not revealed. Thirteen participants ranged in age from 50–86; one participant was in the late 40s; and three were under 35 years of age. Religious denominations represented included Catholic (2), Jehovah’s Witnesses (7), Lutheran (4), and nondenominational fundamentalist (4). A set of 14 interview questions with probes were created and asked of three of the four groups. The fourth group was asked a different set of questions that contained the core questions from the other groups. Please see Appendix A for the questions used.

Notes from the focus groups were analyzed and coded using open and axial coding.

**Findings**

Open coding revealed that a majority (9) of the participants were opposed to recreational marijuana use. When discussing its legalization in Colorado, one person indicated that though they are opposed to legalized marijuana in any capacity, the possibility of increasing school funding caused a supportive vote for the state amendment. No other comments supporting its use were identified.

There was some opposition to the use of medicinal marijuana. Jehovah’s Witnesses were uniformly opposed to its inhaled use. They were supportive of topical applications and edibles, if they helped the person find relief. The congregants from the nondenominational church were primarily opposed to medical marijuana, but one congregant had some flexibility. No one from the other denominations was opposed to the use of medicinal marijuana.

Interestingly, only two Lutherans linked their positions regarding use of marijuana to their religious beliefs. No Catholics did so; all Jehovah’s Witnesses did so; and all nondenominational fundamentalists did. Neither Lutheran quoted any scripture or particular reason for this link between religion (which was categorized as faith) and marijuana. The participants who are Jehovah’s Witnesses referred to scripture repeatedly, including not defiling the body, having a healthy respect for life, and finding other ways through the Bible to relieve stress, as did the members of the nondenominational church. Themes identified through axial coding follow.

**Grounds for Opposing Recreational Marijuana**

“**Kids!”**

Of those opposed to the use of recreational marijuana, the greatest single reason was children. People do not like to have children exposed to more drugs, including exposure to smoke. This was a powerful response and echoed through statements about medical marijuana and social and cultural changes in the area. People are truly concerned about the effects on children. In fact, this response was so frequent that it was a surprising finding.

“**Have you Seen What’s Happened to the City?”**

Secondly, people are extremely concerned about the social and cultural impacts from the legalization of marijuana. Even though there appears to be a positive financial impact on the city and county (state), people believe that crime has increased because people steal to buy drugs. They also believe that motor vehicle accidents have increased as a result of driving under the influence. There is a general concern that changes are being made in the culture of this region that cannot be undone. They are concerned that addictions are increasing, and the move to use of harder drugs is going to increase.

“**It’s a Gateway.”**
Another reason for opposing recreational marijuana is that people considered it a gateway to other drug use. Heroin and methamphetamine were mentioned most commonly. Several people revealed they had addictions and began with marijuana; thus, from personal experience, they felt that it was the source of their drug abuse. Included in this category of opposition are those folks who were uncertain about the current state of research about marijuana, including its ability to spur usage of other drugs.

“It’s Illegal.”
Several people took the position that regardless of what their personal opinion might be, according to federal law, marijuana use is illegal. Therefore, it is still illegal in Colorado. To use it for any reason is to break the law.

“The Bible says it’s Sorcery.”
Eleven participants referred to any kind of use of marijuana as something the Bible would not condone. Even other prescription drugs were identified as something not supported by the Bible. Any manipulation of the physical or mental state of the human being is considered to be akin to sorcery.

**Opposition to the Use of Medical Marijuana**

“It’s Still a Drug.”
A significant number of people thought that although the marijuana plant is just a plant, it is being used as a drug, and it should be controlled as a drug. They were uncertain of the actual effects of the drug, and they thought that its effects on the body and mind should not be minimized.

“It’s Illegal.”
Respondents also realized the duality of legal status between state and federal laws in Colorado, similar to those opposed to recreational marijuana recognized. If something is illegal at the federal level, it should be illegal at the state level.

“Unsure of Research.”
People were very concerned about the increased potency of marijuana and the lack of long term scientific study of its effects. There is concern about the effects on children, the lungs, the brain, and the body, in general. They do not trust the research that has been done in the past because they think that today’s marijuana differs from the drug from the past 20 years. Coupled with this, respondents identified specific negative effects of which they were aware, including Alzheimer’s disease, memory loss, and addictive behaviors. Again, respondents cited their concern for the social and cultural changes use of this drug is causing.

“It’s Abused.”
Having friends go to a medical marijuana distributor to get a card because “my back hurts” is a story from one of the respondents, but the feelings of potential abuse were generalized. Whether by ingestion or smoking, respondents were very concerned about the potential for abuse.

“It Messes with your Mind.”
While some agreed that taking away pain would be a good thing for a person who needs such a thing, there was still concern that the only thing marijuana does is remove pain, temporarily. People thought that use has the potential for people to think things that are not real, for example, that they are in charge, when in reality, the marijuana takes over. Some believed that thinking is distorted by the drug. They would urge other ways of pain management, such as meditation and prayer.

**Supporting the use of Medical Marijuana**

“I’ve seen the Benefits.”
Respondents have seen the benefits for friends and family members who have used marijuana. One person’s brother has epilepsy, and marijuana use has decreased the number of seizures his brother has. One person’s wife was vomiting continually, and marijuana caused cessation of the vomiting. Several people reported having used it themselves, in topical and ingested form, with positive outcomes, such as pain reduction. Also
cited as a benefit was the economic growth of the state and area.

**Marijuana Beliefs Tied to Religious Beliefs**
The respondents who identified their opposition to marijuana usage as emerging from their religious beliefs identified three primary links: 1) “the body is a temple and God says not to defile the temple;” 2) God knows what is or is not profitable for me;” and 3) “just because God created it doesn’t mean that I should use it.” When asked if the healing oil used by Jesus in the Bible might have been marijuana, responses ranged from “that’s crazy” to “I’ve never thought about it” to “maybe.” One person said that the oil in the Bible was probably olive oil and that it was the faith in the oil that caused the miracle, not the oil itself. One person said that he had been an addict for 20 years. He said he used to smoke a joint and think about God, but that was just marijuana messing with his mind. Now that he is a Christian, he sees the word of God as the way to live his life, and that means he must abstain from anything that would hurt his body or his mind.

Finally, it seems clear from this study that what emerged for respondents were two categories of concern: the concern about the effects on children and the concern for social and cultural changes they thought they saw.

**Limitations of the Study and Further Research**
Perhaps most obvious among the limitations of the study are the small number of the participants and the fact that one group was asked questions that differed from the other three. These two facts made coding the data quite difficult. In addition, probes for the type of marijuana usage were not uniformly applied. Thus, some respondents mentioned topical use; some mentioned smoked; some mentioned oils; and some mentioned edibles.

Further research should be done to probe the relationship between religious beliefs and marijuana usage. As in previous studies, this study found that the more conservative the belief system, the greater the opposition to marijuana use in all its forms. In the future, the type and form of marijuana used should also be identified. Respondents may have had different responses if the interviewers had prompted for edibles or oils. In addition, probing for the specific social and cultural changes that respondents identify would seem to be quite important to understanding the social impact of marijuana use. There is not enough research on religion and marijuana use that is recent, so study should continue.

**References**


Appendix A

Questions about Religion and Marijuana

1. How many of you are opposed to the use of recreational marijuana?
2. How many of you are opposed to the use of medicinal marijuana?
3. How many of you support the use of recreational marijuana?
4. How many of you support the use of medicinal marijuana?
5. If you are opposed to the use of recreational marijuana, on what grounds are you opposed?
6. If you support the use of recreational marijuana, on what grounds do you support it?
7. If you are opposed to the use of medicinal marijuana, on what grounds are you opposed?
8. If you support the use of medicinal marijuana, on what grounds do you support it?
9. Would you say that your belief about marijuana usage stems from your religious beliefs? For example, if you believe that God created everything, and therefore created marijuana, how do you support being opposed?
10. Is it possible that the healing oil used by Jesus, told to us in the Bible, might have been marijuana oil? If you agree that it’s possible, for what reasons are you opposed to its use today?
11. What are the harmful effects of marijuana usage that you know about?
12. What are the potential benefits of marijuana usage that you know about?
13. What if you or a loved one begins to suffer from a serious illness and the medical literature says that marijuana can lessen pain and relieve symptoms, would you be inclined to use it? Would you recommend it for your loved one?

Probe: If you were opposed before thinking about this scenario, what about this scenario causes you to change your mind?

14. If needed probe: The Bible refers to the body as a temple and dictates that we not defile the temple. Would use of marijuana be considered defiling the temple to you? Reason?
Economic impact of adult use retail cannabis in Pueblo County

This study explores the costs and benefits of retail adult use cannabis in Pueblo County, and offers 5 year projections for this industry in Pueblo County.

On January 1, 2014, the legalization of recreational marijuana for personal use, and commercial cultivation, manufacture, and sale commenced as provided under the ballot measure Colorado Marijuana Legalization Amendment (Amendment 64). After this initiated constitutional amendment was approved, it was enacted as Article XVIII, Section 16 of the Constitution of the State of Colorado.

Amendment 20 legalized the use, possession, and cultivation of marijuana for medical purposes, and is codified in Article XVIII, Section 14 of the Constitution of the State of Colorado. The effective date of Amendment 20 was June 1, 2001. Both HB 1284 and SB 109 were signed into law with the effective date of June 7, 2010. These bills addressed regulatory frameworks, fraud, and abuse of medical marijuana.

Direct benefits of retail cannabis sales include:

- Tax receipts
- Job creation
- Real estate inflation
- New commercial construction

Indirect, secondary benefits of retail cannabis sales include:

- Cannabis tourism
- Related business economic growth, particularly retail cannabis supply chain businesses.

Direct costs of retail cannabis can include:

- Governmental oversight
- Law enforcement

Indirect, secondary costs include:

- Child and family services
- Medical care
- Welfare assistance
- Higher insurance costs
- City and County detention
- Other government/social areas of oversight

The research focus of this initial economic impact study applies to the investigation of the economic impact of adult use cannabis distributed through approved legal outlets. This study does not purport to investigate any economic impact associated with medical use cannabis, hemp (cannabis containing less than 0.3% THC), hemp derivatives, or illegal black market activities. Similarly, related black or gray market activities that might arguably be attributed to adult use cannabis will not be explored in this study. Data reported by third parties that does not differentiate between adult-use, medical, or illicit cannabis is evaluated to determine if a pattern pre and post legalization for adult use can be discerned.

Methodology

To investigate the question “what is the economic impact of legalized retail adult use cannabis sales in Pueblo County,” we gathered information and data from a variety of sources. To the greatest extent possible, we sought publicly available information from reliable secondary sources. Other data gathering techniques can include interview, observation, or data acquired by organizations.

For the economic benefits portion of the economic impact question, we use primarily county tax receipts,
interviews with business owners, and secondary data reports.

For real estate values, we use data from Zillow to compare Pueblo County with two other Colorado counties (Weld and Chaffee), three Washington State counties (Grant, Lewis and Cowlitz) similar in size to Pueblo, and three counties of similar size and demographic metrics in states that have not legalized cannabis use in any form (Carroll County, GA; Etowah County, Alabama, and Hunt, TX). Zillow was selected because it is a free data source that has captured market value data in most regions of the U.S., including smaller communities that are similar in size to Pueblo. Colorado and Washington State counties are considered to verify proportional consistency in real estate price values, and counties from completely non-legalized states are used as control. We examine data for a period of at least 3 years prior to Colorado adult-use cannabis legalization to present, if data are available. Significant differences between real estate values in legalized and non-legalized states can be attributed, at least in part, to increased land and property use of adult use cannabis production and distribution.

To gather relevant information on the economic costs side of the economic impact question, we considered publicly available secondary data, data gathered and reports generated by organizations, and interviews. As expected, some information was difficult, or even impossible to acquire, due either to lack of record keeping, unwillingness to share confidential information, or legal restrictions requiring withholding of sensitive, private information. In such cases, attempts to extrapolate and infer costs using known information to cover the breadth and depth of costs tied to the adult use retail cannabis industry were made. However, exclusive connections to adult use retail cannabis can be tenuous in determining most secondary costs. For example, if a patient is admitted to an emergency room, and they have admitted cannabis use, it may be difficult to determine if the cannabis was from a legal retail source or an illegal black- or gray-market source. Exacerbating the tenuous nature of the relationship between cannabis use and admission to emergency is the possibility of co-presence of other illicit drugs. Similar, although different, tenuous relationships can identified in all of the secondary cost assessments, whether in the category of public education, welfare, child services, or homeless services.

For both benefits and costs associated with the adult use retail cannabis, we considered primary and as many secondary influences as possible. Where industry multiplier effects can be applied, impact from job creation and all supply chain relationships are represented.

**Results**

*Direct and Indirect Economic Benefit Resulting From Sale of Adult Use Cannabis Products*

This section details the positive economic benefits to Pueblo County. Pueblo County retail tax receipts are used to determine overall sales, to which an economic multiplier will be applied to determine positive economic impact from the sale of initial product, supply chain impact, and impact of cannabis tourism. Total gross retail sales of cannabis per year is calculated based upon sales tax of 2.9% using the formula: (Sum of monthly sales per year)*100/2.9. All tax revenues associated with adult use cannabis are displayed in TABLE 1*.

In most industries, there are direct and indirect economic impacts when goods and services are sold. Direct impact can be the profit retained by the business that makes the sale. The economic impact of cannabis industries is considered to be one of the more robust in Colorado, due to the indirect, secondary impacts on the economy. Some of the secondary impacts of the cannabis industry include nutrients, growing medium, containers, watering, lighting and ventilation systems, packaging materials, direct labor, taxes, and cannabis tourism. Suppliers of material and equipment are engaged in production, and the compensation

*Excise tax of 2% is levied on cultivation and manufacturing products. The following would be excluded from a multiplicative effect for the purposes of this study: medicinal products, cannabis sold to medicinal dispensaries, or products sold within Pueblo County, since the multiplicative effect would be captured under the retail sales amount. It was not possible to determine at the time of this study the amount of cannabis product, if any, that is free of these restrictions. Therefore, any impact from excise tax collected is not included in this report.*
their employees receive are recycled again in the local economy. Cannabis business employees spend significant portions of their income with local businesses, extending the impact in the local economy. Taxes collected are reinvested in designated areas, further stimulating the economy. Finally, cannabis tourism infuses money from out of the region when the sale is made, and some customers may use local lodging and restaurants, visit local attractions, or purchase souvenirs, increasing the impact upon the local economy.

Light, Ownes, Rowberry, Saloga (2016) identified economic multipliers for gross sales applied to different activities related to cannabis production and sales. An economic multiplier is typically applied to the gross sales of a product or service and expressed in a dollar amount. Another way of stating this effect would be how many jobs are supported for every one hundred jobs in the industry. A multiplier of 1.88 indicates 188 jobs are supported for every job in the sector of interest, or $188 of economic activity occurs for every $100 generated in the same sector. Economic impact multipliers vary by industry, and industries that export goods or services, or bring generally bring in revenues from outside the region enjoy higher economic impact. Comparison multipliers are offered for the following industries: manufacturing = 2.91; health services = 1.18, and; retail = 0.88 (Bivens, 2003). The multipliers identified for gross sales of cannabis by Light, et. al (2016) in each area related to cannabis are: MJ Retail: $2.40; MJ Manufacturing: $2.34; MJ Cultivation: $2.13. The average of these three is $2.29. Many cannabis businesses in Pueblo County are vertically integrated. Moreover, many retailers purchase from local cultivators. It is decided that the average multiplier of $2.29 will be applied to gross retail sales. The table below identifies the 2.9% tax collected annually, the calculated gross sales, and the economic multiplier applied to gross sales amount. Data regarding collected general tax, calculated gross sales for 2017, and calculated economic impact are presented in TABLE 2. Projections for 2017 are based on average monthly sales for the first seven months of 2017. TABLE 2 also indicates annual percent change compared to the previous year’s values. The average growth rate for three years, including the projection for 2017, is 36.32%.

Based on these calculations, direct and indirect economic impact from the sale of adult use cannabis products, including taxes collected, supply chain impacts and cannabis tourism amounts to a projected $80.874 million in calendar year 2017.

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>10% Tax Retained by CO</th>
<th>10% Tax Distributed</th>
<th>Total Special Tax - 10%</th>
<th>State Sales Tax - 2.9%</th>
<th>Total Tax Collected</th>
<th>Annual Total Collections</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>Jan</td>
<td>69,969</td>
<td>12,347</td>
<td>82,316</td>
<td>15,262</td>
<td>$97,578</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feb</td>
<td>101,662</td>
<td>17,940</td>
<td>119,602</td>
<td>51,330</td>
<td>$170,932</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mar</td>
<td>97,137</td>
<td>17,142</td>
<td>114,279</td>
<td>32,603</td>
<td>$146,882</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Apr</td>
<td>115,826</td>
<td>20,440</td>
<td>136,266</td>
<td>41,559</td>
<td>$177,825</td>
<td></td>
</tr>
<tr>
<td></td>
<td>May</td>
<td>125,155</td>
<td>22,086</td>
<td>147,241</td>
<td>50,988</td>
<td>$198,229</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jun</td>
<td>171,037</td>
<td>30,183</td>
<td>201,220</td>
<td>53,501</td>
<td>$254,721</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Jul</td>
<td>106,498</td>
<td>18,793</td>
<td>125,291</td>
<td>41,625</td>
<td>$166,916</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aug</td>
<td>142,744</td>
<td>25,189</td>
<td>167,933</td>
<td>56,126</td>
<td>$224,059</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sep</td>
<td>104,345</td>
<td>18,413</td>
<td>122,758</td>
<td>32,693</td>
<td>$155,451</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oct</td>
<td>101,119</td>
<td>17,845</td>
<td>118,964</td>
<td>39,350</td>
<td>$158,314</td>
<td>$1,750,907</td>
</tr>
<tr>
<td>2015</td>
<td>Jan</td>
<td>111,687</td>
<td>19,709</td>
<td>131,396</td>
<td>38,458</td>
<td>$169,854</td>
<td></td>
</tr>
</tbody>
</table>
### Table 2: Collected General Tax, Calculated Gross Sales, Economic Impact Using $2.29 Multiplier

<table>
<thead>
<tr>
<th>Year</th>
<th>2.9% Tax Collected</th>
<th>Calculated Annual Gross Sales</th>
<th>% Change from previous year</th>
<th>Economic Impact Using Multiplier = $2.29</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>$415,037</td>
<td>$14,311,621</td>
<td></td>
<td>$32,773,611</td>
</tr>
<tr>
<td>2015</td>
<td>$468,083</td>
<td>$16,140,793</td>
<td>12.78</td>
<td>$36,962,416</td>
</tr>
<tr>
<td>2016</td>
<td>$726,319</td>
<td>$25,045,483</td>
<td>55.17</td>
<td>$57,354,156</td>
</tr>
<tr>
<td>2017 (Through July)</td>
<td>$597,438</td>
<td>$20,601,310</td>
<td></td>
<td>$47,177,001</td>
</tr>
<tr>
<td>2017 (Projected)</td>
<td>$1,024,179</td>
<td>$35,316,532</td>
<td>41.00 (est)</td>
<td>$80,874,859</td>
</tr>
</tbody>
</table>
**Impact of Real Estate Development and Real Estate Appreciation**

Several counties from different regions within the United States are compared to find counties similar to Pueblo County. To verify appropriateness of comparison, factors identified are income, jobs per person, and county population indexes to compare the counties. Two counties in addition to Pueblo County were selected from the state of Colorado, along with three counties from Washington State, and three counties from states where neither medical nor adult use cannabis has been legalized. In some cases, due to incomplete data one of the counties is replaced with the next most similar county. Data were collected from several different sources, including the Federal Reserve Economic Data (FRED) published by the Federal Reserve Bank of St. Louis, Bureau of Labor Statistics, Bureau of Economic Analysis, etc. TABLE 3 compares GDP per capita values collected for 9 different counties including Pueblo County (GDP per capita: the value of Gross Domestic Product divided by the population of the county is one of the most important measures of Economic Growth).

<table>
<thead>
<tr>
<th>Carroll, GA</th>
<th>Etowah, AL</th>
<th>Hunt, TX</th>
<th>Grant, WA</th>
<th>Lewis, WA</th>
<th>Cowlitz, WA</th>
<th>Pueblo, CO</th>
<th>Weld, CO</th>
<th>Chaffee, CO</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-2015</td>
<td>13.6%</td>
<td>15.5%</td>
<td>15.5%</td>
<td>27.8%</td>
<td>18.2%</td>
<td>20.8%</td>
<td>22.0%</td>
<td>26.4%</td>
<td>25.9%</td>
</tr>
<tr>
<td>2011-2013</td>
<td>3.9%</td>
<td>2.5%</td>
<td>3.4%</td>
<td>6.8%</td>
<td>5.0%</td>
<td>6.5%</td>
<td>3.6%</td>
<td>8.8%</td>
<td>8.0%</td>
</tr>
<tr>
<td>2013-2015</td>
<td>6.4%</td>
<td>7.6%</td>
<td>7.6%</td>
<td>9.3%</td>
<td>8.9%</td>
<td>6.3%</td>
<td>9.5%</td>
<td>13.7%</td>
<td>12.3%</td>
</tr>
</tbody>
</table>

The years 2008 and 2013 are used as main time references. The year 2008 is when the most recent recession started in the United States, and 2014 is the year cannabis was legalized in Colorado. Since the data values collected are at the end of each time period, 2013 values may be used for the start of 2014 as a point of reference.

The first row in TABLE 3 describes the percentage in GDP per capita since the time of recession until the latest data period (2015). Grant County, WA (27.8%), and Weld County, CO (26.4%) show the highest percent increase in GDP per capita for this time period. The lowest growth rate is shown by Carroll County, GA (13.6%). Pueblo County has grown at a rate of 22% which is the 4th highest in the group.

**TABLE 3: Percentage Change in GDP per Capita**
During the two year time period prior to Cannabis legalization, most counties show single digit growth rate where Weld County, CO shows the highest growth rate at 8.8%. Since the legalization of cannabis, Weld and Chaffee counties from Colorado have shown the highest growth rate. Pueblo County is the third with a growth rate of 9.5% in this group. Growth rate of GDP per capita of all cannabis producing counties in this example outperformed the U.S. average growth rate of GDP per capita, while the counties comparable to Pueblo where cannabis is not legal in any form underperformed the U.S. average growth rate of GDP per capita. GRAPH 1 corresponds to the values that were used in calculating the growth rates described in TABLE 3.

**Real Estate Values**

Single family home prices were collected and analyzed from Zillow between 2010 and 2016. TABLE 4 shows a comparison of the percentage changes in real estate values for 9 different counties that are comparable to Pueblo County. Among the 9 counties, Weld County, CO shows the highest percent increase in real estate values. Since the legalization of cannabis, Pueblo County shows a 23.5% increase in real estate values which is the third highest in our group of counties and ties with Lewis County, WA. It is interesting to note that Carroll County, GA shows the 2nd highest percent increase in real estate values where this county belongs to the group of counties where cannabis for both medical and adult use has not been legalized. The mixed performance of real estate values in cannabis producing and non-cannabis producing states offer inconclusive results. It is difficult to say whether the increase in real estate values in Pueblo County is the result of legalization of cannabis or not.

**TABLE 4: Percentage Change in Real Estate Values**

<table>
<thead>
<tr>
<th>Carroll, GA</th>
<th>Etowah, AL</th>
<th>Hunt, TX</th>
<th>Grant, WA</th>
<th>Lewis, WA</th>
<th>Cowlitz, WA</th>
<th>Weld, CO</th>
<th>Otero, CO</th>
<th>Pueblo, CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010–2016</td>
<td>46.9%</td>
<td>11.6%</td>
<td>25.8%</td>
<td>9.1%</td>
<td>22.0%</td>
<td>-2.6%</td>
<td>67.3%</td>
<td>7.3%</td>
</tr>
<tr>
<td>2013–2016</td>
<td>29.0%</td>
<td>11.6%</td>
<td>16.8%</td>
<td>14.4%</td>
<td>23.5%</td>
<td>4.9%</td>
<td>45.7%</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

GRAPH 2 below shows the trend of home prices in these 9 counties since 2010. As shown in the graph, Weld County, CO has seen the most significant increase in residential real estate values. For Pueblo County, real estate values seem to be showing an upward trend going into the future.
Construction Spending
Construction data from nine counties are explored to determine how cannabis may play a role in a change in construction spending. Once again, three counties are used in the analysis that do not have medical or adult use cannabis legalized. TABLE 5 shows the percent change in construction spending between 2008 and 2015 and also between 2013 and 2015, the latter being the range where cannabis was legalized in some counties, including Pueblo County.

<table>
<thead>
<tr>
<th></th>
<th>Carroll, GA</th>
<th>Hunt, TX</th>
<th>Etowah, AL</th>
<th>Grant, WA</th>
<th>Lewis, WA</th>
<th>Cowlitz, WA</th>
<th>Weld, CO</th>
<th>Pueblo, CO</th>
<th>Chaffee, CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008–2015</td>
<td>-6.8%</td>
<td>13.7%</td>
<td>-58.9%</td>
<td>-0.9%</td>
<td>-38.0%</td>
<td>-34.7%</td>
<td>7.2%</td>
<td>14.4%</td>
<td>-1.1%</td>
</tr>
<tr>
<td>2013–2015</td>
<td>11.5%</td>
<td>-10.8%</td>
<td>5.1%</td>
<td>3.5%</td>
<td>20.9%</td>
<td>0.5%</td>
<td>8.9%</td>
<td>16.1%</td>
<td>31.9%</td>
</tr>
</tbody>
</table>

With the exception of Hunt County, TX, all counties have seen an increase in construction spending in the last few years. Chaffee County, CO shows the highest percent increase in this group, while Pueblo County shows a 16.1% increase in construction spending, which is third highest in our group of counties. The top three counties all belong to states where cannabis has been legalized. However, Grant and Cowlitz counties in Washington State where cannabis is legalized show a very low percentage increase in construction spending. Although results are mixed, it does seem to suggest that legalized cannabis may play some role in real estate prices and construction spending.

GRAPH 3: Construction Spending

GRAPH 3 shows the construction spending trends since 2001. Although Weld County, CO shows the highest dollar amount spending on construction, the percentage change is smaller than Pueblo County.

Employment by Industry
In this section, nine counties are compared in terms of employment growth over the past 10 to 15 years. These counties include three counties from Colorado and Washington each, where cannabis is legalized and three counties from other states where cannabis is not legal either for medical or adult use.
TABLE 6 shows how wage and salary employment numbers changed over the past few years in these 9 counties. "Wage and salary employment" refers to any jobs that either offer wages or salaries as opposed to being self-employed or employed by a family business with no pay. From 2001 to 2015, the biggest percentage change took place in Weld, CO at 40% with Lee, AL at 34% at second place. Pueblo County has only seen a 7% increase since 2001. For the time period since the legalization of cannabis, Weld, CO once again shows the highest percent growth of 11% while Pueblo County has only shown a 3% increase in employment that earns wages and salaries. The three counties in our group where cannabis is not legalized have either done better or similar to Pueblo County in terms of wage and salary employment change.

TABLE 7 shows the percentage change in compensation to farm workers over a range of time periods. Between 2001 and 2015 Hunt, TX saw the greatest increase of nearly 400% in farm compensation. The greatest decline is observed in Lee, AL County at -77%. Among the counties where cannabis is legalized Grant, WA saw the greatest increase at 101.6%. Pueblo County saw a 50.2% increase which is relatively high. However since the great recession of 2008, Pueblo, CO has only seen a 23.7% increase in farm compensation and it has since been declining. From 2013 to 2015 (end of each period,) when cannabis was legal in Pueblo County there was a 9.6% decrease in farm compensation. Other counties in Colorado have shown a similar decline in farm compensation for this post-legalization time period. The highest increase in farm compensation during this time is in Cowlitz, WA at 52.9% where cannabis is legal.
TABLE 7: Percentage Change in Farm Compensation

<table>
<thead>
<tr>
<th></th>
<th>Lee, AL</th>
<th>Carroll, GA</th>
<th>Hunt, TX</th>
<th>Cowiltz, WA</th>
<th>Grant, WA</th>
<th>Lewis, WA</th>
<th>Chaffee, CO</th>
<th>Pueblo, CO</th>
<th>Weld, CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001–2015</td>
<td>-77.0%</td>
<td>67.3%</td>
<td>399.3%</td>
<td>30.6%</td>
<td>101.6%</td>
<td>31.5%</td>
<td>64.0%</td>
<td>50.2%</td>
<td>31.8%</td>
</tr>
<tr>
<td>2008–2015</td>
<td>-76.4%</td>
<td>58.0%</td>
<td>100.6%</td>
<td>60.9%</td>
<td>28.4%</td>
<td>14.3%</td>
<td>97.1%</td>
<td>23.7%</td>
<td>9.6%</td>
</tr>
<tr>
<td>2013–2015</td>
<td>27.2%</td>
<td>25.1%</td>
<td>43.5%</td>
<td>52.9%</td>
<td>8.9%</td>
<td>4.0%</td>
<td>-9.8%</td>
<td>-9.6%</td>
<td>-9.7%</td>
</tr>
</tbody>
</table>

GRAPH 5: Farm Compensation

GRAPH 5 demonstrates that only Grant, WA has shown a significant increase in farm compensation with an increasing trend. The 2nd highest compensation is shown by Weld, CO but the trend seems to be going down. All other counties including Pueblo, CO are showing relatively flat and low levels of farm compensations.

TABLE 8: Percentage Change in Overall Wages and Salaries

<table>
<thead>
<tr>
<th></th>
<th>Lee, AL</th>
<th>Carroll, GA</th>
<th>Hunt, TX</th>
<th>Cowiltz, WA</th>
<th>Grant, WA</th>
<th>Lewis, WA</th>
<th>Chaffee, CO</th>
<th>Pueblo, CO</th>
<th>Weld, CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001–2015</td>
<td>91.9%</td>
<td>83.5%</td>
<td>91.3%</td>
<td>45.4%</td>
<td>95.0%</td>
<td>43.0%</td>
<td>72.8%</td>
<td>60.2%</td>
<td>118.9%</td>
</tr>
<tr>
<td>2000–2015</td>
<td>24.3%</td>
<td>17.4%</td>
<td>21.3%</td>
<td>20.8%</td>
<td>29.2%</td>
<td>13.0%</td>
<td>28.6%</td>
<td>19.4%</td>
<td>44.7%</td>
</tr>
<tr>
<td>2013–2015</td>
<td>13.0%</td>
<td>7.8%</td>
<td>10.0%</td>
<td>9.0%</td>
<td>10.7%</td>
<td>12.6%</td>
<td>12.9%</td>
<td>9.5%</td>
<td>19.0%</td>
</tr>
</tbody>
</table>

According to TABLE 8 Weld, CO has seen the greatest percentage increase in overall wages and salaries from 2001 to 2015. Since the end of 2013 until the end of 2015 when cannabis was legalized in the States of Colorado and Washington, once again Weld, CO has seen the most percentage increase on overall wages and salaries. The lowest percentage gain is shown by Carroll, GA where cannabis is not legal, however, Cowiltz, WA is only about 1.2% higher than Carroll, GA at 9% increase for this time period. Pueblo County has also seen a less than 10% percentage gain in overall wages and salaries for the post-legalization time period. Pueblo County did see a 19.4% percent increase in wages and salaries between 2008 and 2015. Legalization of cannabis does not appear to have a significant effect on wages and salaries.
GRAPH 6: Overall Wages and Salaries

GRAPH 6 shows Weld, CO as the clear leader in this nine county group for the percent increase in overall wages and salaries with the line moving upwards showing a positive trend for the foreseeable future. Pueblo, CO shows an increase in wages and salaries but the trend much flatter than for Weld, meaning that it is hard to predict if wages and salaries will continue to rise at the same level.

<table>
<thead>
<tr>
<th></th>
<th>Lee, AL</th>
<th>Carroll, GA</th>
<th>Hunt, TX</th>
<th>Grant, WA</th>
<th>Lewis, WA</th>
<th>Cowlitz, WA</th>
<th>Chaffee, CO</th>
<th>Weld, CO</th>
<th>Pueblo, CO</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001–2015</td>
<td>38%</td>
<td>67%</td>
<td>57%</td>
<td>13%</td>
<td>26%</td>
<td>30%</td>
<td>49%</td>
<td>30%</td>
<td>23%</td>
<td>40%</td>
</tr>
<tr>
<td>2008–2015</td>
<td>10%</td>
<td>31%</td>
<td>5%</td>
<td>27%</td>
<td>28%</td>
<td>20%</td>
<td>12%</td>
<td>8%</td>
<td>12%</td>
<td>15%</td>
</tr>
<tr>
<td>2013–2015</td>
<td>7%</td>
<td>6%</td>
<td>10%</td>
<td>-6%</td>
<td>-2%</td>
<td>1%</td>
<td>10%</td>
<td>8%</td>
<td>3%</td>
<td>4%</td>
</tr>
</tbody>
</table>

TABLE 9 describes the growth of jobs in healthcare and social assistance industries. We observe that in two out of three counties from the state of Washington where cannabis is legal, there is a decrease in job growth in this industry. Weld, CO shows the highest growth since legalization of cannabis which is matched by the growth in Hunt, TX at 10%. However, when looking at the change since 2001, Carroll, GA shows the biggest change in job growth in this industry at 67%. Pueblo County has grown 23% since 2001 which is the second lowest rate compared to other counties in this group and has grown 3% jobs in this industry since the end of 2013.
The change in actual job numbers since 2001 can be seen in GRAPH 7. Pueblo County seems to be above all other counties in our group which could mainly be due to the fact that we have two large hospitals in the county.

<table>
<thead>
<tr>
<th>TABLE 10: Percentage Change in Construction Compensation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lee, AL</td>
</tr>
<tr>
<td>2001–2015</td>
</tr>
<tr>
<td>2008–2015</td>
</tr>
<tr>
<td>2013–2015</td>
</tr>
</tbody>
</table>

TABLE 10 describes the percentage change in Construction compensation for nine counties. Between 2001 and 2015, the greatest change took place in Weld, CO with 142.9% increase. The second most significant increase took place in Grant, WA with 134.3%. Between 2008 and 2015, once again Weld, CO seems to outpace other counties with 36.7% increase. All three Colorado counties in our group show a positive change in construction compensation since the recession in 2008. However, Pueblo County shows the lowest percentage increase since 2008 with 3.4%. Most other counties have either seen a decline or a smaller increase in construction compensation since the recession with the exception of Carroll, GA.

Since 2013, all counties seem to have seen an increase in construction compensation with Lewis, WA leading with 22.4% increase. Pueblo, CO also seems to have experienced a significant change, since 2013, in construction compensation with 19.3% increase. The legalization of cannabis may have a role in this significant increase in construction compensation in Pueblo and Weld counties, however, a much smaller increase of 3.9% in construction compensation in Chaffee County makes it difficult to relate the two. Also the fact that the three other counties have also seen a double-digit percentage increase in construction compensation since 2013 suggesting that the positive change in compensation in this industry is happening at the national level regardless of whether cannabis is legalized or not in that region.
As seen in GRAPH 8, Weld, CO seems to be ahead of all other counties but the recent trend seems to be negative (going down.) Pueblo, CO appears to be the second highest in the graph and the trend seems to be positive suggesting that construction compensation may continue to increase in the future time periods.

| TABLE 11: Percentage Change in Level of Health Care and Social Assistance Compensation |
|-----------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Lee, AL            | 72.2%          | 18.6%          | 11.5%          |
| Carroll, GA        | 161.8%         | 51.7%          | 9.0%           |
| Hunt, TX           | 122.9%         | 23.9%          | 16.2%          |
| Cowlitz, WA        | 108.3%         | 46.1%          | 8.2%           |
| Grant, WA          | 77.2%          | 45.6%          | 13.1%          |
| Lewis, WA          | 98.7%          | 41.0%          | 11.4%          |
| Chaffee, CO        | 103.8%         | 30.3%          | 9.2%           |
| Pueblo, CO         | 108.7%         | 40.1%          | 9.8%           |
| Weld, CO           | 106.2%         | 31.4%          | 12.1%          |

TABLE 11 and GRAPH 9 describes the changes in compensation in health care and social assistance industries. Between 2001 and 2015, it is interesting to note that Carroll, GA has shown the highest increase in compensation with 161.8% increase. However, among the six counties where cannabis is legal, Pueblo CO shows the highest increase between 2001 and 2015 with 108.7%. Since the time of recession in 2008, once again Carroll, GA shows the highest increase with 51.7% increase with Pueblo, CO about in the middle of the group.

Hunt, TX has shown the highest increase in compensation in these industries since 2013 with 16.2% The increase in Pueblo, CO is also significantly high with 9.8% but is lower than most other counties where cannabis is legal. Two out of three counties where cannabis is not legal show a higher percentage increase in compensation in these industries compared to Pueblo, CO. It is therefore difficult to relate the increase in compensation in these industries to legalization of cannabis.
With two big hospitals, Pueblo, CO seems to be ahead of all other counties in terms of the dollar amount of compensation. The trend also seems to be positive however, the percentage change in compensation over the past few years is not as significant as other counties.

**TABLE 12: Percentage Change in Finance and Insurance Employment**

<table>
<thead>
<tr>
<th></th>
<th>Lee, AL</th>
<th>Carroll, GA</th>
<th>Hunt, TX</th>
<th>Grant, WA</th>
<th>Lewis, WA</th>
<th>Cowlitz, WA</th>
<th>Chaffee, CO</th>
<th>Weld, CO</th>
<th>Pueblo, CO</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001–2015</td>
<td>74%</td>
<td>14%</td>
<td>39%</td>
<td>42%</td>
<td>7%</td>
<td>-7%</td>
<td>0%</td>
<td>50%</td>
<td>-16%</td>
<td>24%</td>
</tr>
<tr>
<td>2008–2015</td>
<td>21%</td>
<td>-25%</td>
<td>18%</td>
<td>7%</td>
<td>-9%</td>
<td>-14%</td>
<td>-5%</td>
<td>0%</td>
<td>-15%</td>
<td>6%</td>
</tr>
<tr>
<td>2013–2015</td>
<td>1%</td>
<td>-9%</td>
<td>-4%</td>
<td>-9%</td>
<td>-4%</td>
<td>-7%</td>
<td>-19%</td>
<td>-3%</td>
<td>-11%</td>
<td>-2%</td>
</tr>
</tbody>
</table>

As shown in TABLE 12, the job market in the finance and insurance industry has seen an overall decline in the U.S. between 2013 and 2015 with 2% decline. Pueblo County has seen the second most decline in job growth in this industry at -11% since 2013. However, the change from 2001 to 2015 suggests that Pueblo County has lost the most jobs in this industry as suggested by -16% change. The largest increase in jobs in this industry is shown by Lee, AL with 74%. All Colorado and Washington counties have seen a negative change exceeding the U.S. average in jobs in this industry since 2013.

GRAPH 10 shows high employment numbers in the finance and insurance industry in Weld, CO. This graph shows that the number of jobs available in this industry in Pueblo County have been steadily declining. It is possible that most of the jobs in this industry have moved to the coasts and therefore most counties we compare have seen a declining trend in this industry for the number of jobs offered with some exceptions like Lee, AL.
TABLE 13: Percentage Change in Labor Force

<table>
<thead>
<tr>
<th></th>
<th>Carroll, GA</th>
<th>Etowah, AL</th>
<th>Hunt, TX</th>
<th>Cowlitz, WA</th>
<th>Grant, WA</th>
<th>Lewis, WA</th>
<th>Pueblo, CO</th>
<th>Weld, CO</th>
<th>Chaffee, CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005–2016</td>
<td>5.4%</td>
<td>-6.1%</td>
<td>4.1%</td>
<td>4.4%</td>
<td>16.8%</td>
<td>4.8%</td>
<td>5.3%</td>
<td>34.5%</td>
<td>7.3%</td>
</tr>
<tr>
<td>2013–2016</td>
<td>3.0%</td>
<td>0.3%</td>
<td>4.9%</td>
<td>3.7%</td>
<td>2.0%</td>
<td>2.5%</td>
<td>-0.8%</td>
<td>7.1%</td>
<td>5.4%</td>
</tr>
</tbody>
</table>

**Labor Data**

Labor force refers to the portion of population who are willing and able to work, some of whom are employed and some are unemployed. All counties in our group (TABLE 13) have seen a growth in labor force which refers to the portion of population who is either employed or unemployed except for Pueblo County and Etowah, AL. However, Etowah, AL has shown a small 0.3% increase in labor force since 2013 however, Pueblo County has seen a 0.8% decline in the size of its labor force.
GRAPH 11 shows how Weld, CO has seen a steady increase in the size of its labor force. Pueblo County is the second highest in numbers based upon our graph and has shown some increase in its labor force when compared with 2005 numbers but since 2013, these numbers have been going down. TABLE 14 and GRAPH 12 depict the percentage change in the number employed in Pueblo and comparison counties.

<table>
<thead>
<tr>
<th>Table 14: Percentage Change in Number of Employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carroll, GA</td>
</tr>
<tr>
<td>2005–2016</td>
</tr>
<tr>
<td>2013–2016</td>
</tr>
</tbody>
</table>

**Benefit from Cannabis Tourism**

Included in the multiplier amount is economic benefit from cannabis tourism. More than one retail establishment invites patrons to mark U.S. and global maps with a pin indicating their city of residence. The impact of these maps is visually stunning, as depicted in IMAGE 1.

**IMAGE 1**
Capturing exact numbers of cannabis tourists is problematic. Although stores scan driver’s licenses of all customers entering their stores to verify age, most claim that they do not store data, and are unwilling to share any data that they may have accumulated, due to privacy concerns. Nor would stores allow interviewing of their customers due to concerns about violations of privacy, possibly causing disruption to business. According to TWB (2016), a 2016 Colorado Department of Revenue study showed that more than half of sales in Denver, and up to 90% in mountain communities, were to out-of-state visitors. In an interview with a greeter at a local retail store in Pueblo West, he asked everyone entering where they were from. He has kept a tally for nearly three years for this data, but the management of the store has not shared this data after numerous requests. The greeter did indicate that out of state customers represent approximately 60% of the total in-store traffic. This amount is consistent with the values cited by TWB. Since this store is not on a main thoroughfare, but is a fairly well known store and rated well on various websites, the 60% proportion of out-of-town customers is applied to cannabis tourism calculations. The contribution of tourism to total taxes, sales and overall impact is presented in TABLE 15. Additional contributions to economic impact are impossible to measure at this time. Although some customers may stay overnight, some may just be stopping for the day, such as a young couple from Indianapolis on an auto tour of the Western U.S. who joined the research team on a cannabis grow facility tour at The Spot.

**TABLE 15: Portion of Cannabis Sales and Multiplier Effect Attributed to Cannabis Tourism**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Tax Collected</th>
<th>60% Tourism Base</th>
<th>Calculated Annual Gross Sales</th>
<th>60% Tourism Base</th>
<th>Economic Impact Using Multiplier = $2.29</th>
<th>60% Tourism Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>$415,037</td>
<td>$249,022</td>
<td>$14,311,621</td>
<td>$8,586,973</td>
<td>$32,773,611</td>
<td>$19,664,167</td>
</tr>
<tr>
<td>2015</td>
<td>$468,083</td>
<td>$280,850</td>
<td>$16,140,793</td>
<td>9,684,476</td>
<td>$36,962,416</td>
<td>$22,177,450</td>
</tr>
<tr>
<td>2016</td>
<td>$726,319</td>
<td>$435,791</td>
<td>$25,045,483</td>
<td>15,027,290</td>
<td>$57,354,156</td>
<td>$34,412,494</td>
</tr>
<tr>
<td>2017 (Through July)</td>
<td>$597,438</td>
<td>$358,463</td>
<td>$20,601,310</td>
<td>12,360,786</td>
<td>$47,177,001</td>
<td>$28,306,201</td>
</tr>
<tr>
<td>2017 (Projected)</td>
<td>$1,024,179</td>
<td>$614,507</td>
<td>$35,316,532</td>
<td>21,189,919</td>
<td>$80,874,859</td>
<td>$48,524,915</td>
</tr>
</tbody>
</table>

**New Commercial Construction Permits**

TABLE 16 shows the construction permits (new and remodel) issued per year to known cannabis industry firms, and the claimed value of construction. The multiplier for the construction industry in the state of Colorado has been determined to be 3.05 times the construction cost.

**TABLE 16: Construction Permits For Cannabis Businesses by Year Total Value (Pueblo Regional Building Department, 2017), And Construction Multiplier of 3.05**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of permits</th>
<th>Value</th>
<th>Value X 3.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>6</td>
<td>$73,200</td>
<td>$223,620</td>
</tr>
<tr>
<td>2013</td>
<td>4</td>
<td>$210,000</td>
<td>$640,000</td>
</tr>
<tr>
<td>2014</td>
<td>12</td>
<td>$865,048</td>
<td>$2,638,396.4</td>
</tr>
<tr>
<td>2015</td>
<td>8</td>
<td>$588,500</td>
<td>$1,794,925</td>
</tr>
<tr>
<td>2016</td>
<td>7</td>
<td>$493,200</td>
<td>$1,504,620</td>
</tr>
<tr>
<td>2017</td>
<td>2</td>
<td>$7,350</td>
<td>$22,417.5</td>
</tr>
<tr>
<td>TOTAL:</td>
<td>39</td>
<td>$2,237,298</td>
<td>$6,823,758.9</td>
</tr>
</tbody>
</table>
Economic Costs
Economic costs include direct and indirect costs.

Direct costs of retail cannabis can include:

- Governmental oversight
- Law enforcement—cannabis violations

Governmental Oversight:

- Office to collect taxes
- Enforcement personnel

Indirect, secondary costs can include:

- Child and family services
- Medical care
- Welfare assistance
- Higher insurance costs
- City and County detention
- Other government/social areas of oversight
- Ability to attract and retain businesses in the Pueblo region

Direct Cost Data and Analysis
Direct costs incurred from enforcement activities along with related data about cannabis activity were obtained from the Pueblo Police Department (PPD), published in their 2013–2015 Marijuana Study (Magann, 2015). All data in this study referencing the PPD originates with this study, and graphs and tables are presented are consistent with those that appear in the report, some with minor changes. The PPD does not distinguish between medical use and adult use retail cannabis. Additionally, in reports, keyword screening looks for the word “marijuana,” and does not identify whether the cannabis is from a legal source or an illegal source. There are also included reports where citations were issued for illegal marijuana activities. The police department has divided the city into quadrants:

GRAPH 13: City of Pueblo Quadrants 1–4
**Calls for Service**
The graphs below show the total number of police calls for service that involved marijuana for the full years 2011, 2012, 2013, 2014, and 2015. Calls for service are the most common method for determining the police workload in a given jurisdiction.

**GRAPH 14: Calls for Service Including "Marijuana" In Call Narrative (Does Not Include Restraining Orders)**

2011: 260  
2012: 226  
2013: 220  
2014: 412  
2015: 498

**Calls for Service—Priority 1 with Reports**
The same search parameters ("no marijuana" and "marijuana") were used as they applied to high priority calls for service that included the following call types:

- Domestic Fight with Weapons
- Fight with Weapons
- Found Bomb
- Home Invasion
- Homicide
- Man with a Weapon
- Personal Injury Accidents
- Shooting
- Stabbing
- Unknown Injury Accidents

**GRAPH 15: Police Reports from Calls that Include "Marijuana" In Call Narrative (Does Not Include Restraining Orders)**

2011: 64  
2012: 84  
2013: 60  
2014: 141  
2015: 198

**TABLE 17**

<table>
<thead>
<tr>
<th>Year</th>
<th>Priority 1* Calls for Service with Reports</th>
<th>Included &quot;marijuana&quot; in call narrative</th>
<th>&quot;No Marijuana&quot; Restraining Orders in Call Narrative (includes &quot;marijuana&quot; numbers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>1,516</td>
<td>39</td>
<td>36</td>
</tr>
<tr>
<td>2014</td>
<td>1,284</td>
<td>33</td>
<td>30</td>
</tr>
<tr>
<td>2013</td>
<td>1,271</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2012</td>
<td>1,295</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>1,300</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

The City of Pueblo is divided into four (4) quadrants by the Pueblo Police Department. A map depicting these quadrants can be found in GRAPH 13.

<table>
<thead>
<tr>
<th>QUAD</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>QD1</td>
<td>78</td>
<td>79</td>
<td>97</td>
<td>138</td>
<td>174</td>
</tr>
<tr>
<td>QD2</td>
<td>73</td>
<td>91</td>
<td>73</td>
<td>116</td>
<td>108</td>
</tr>
<tr>
<td>QD3</td>
<td>79</td>
<td>79</td>
<td>67</td>
<td>132</td>
<td>147</td>
</tr>
<tr>
<td>QD4</td>
<td>96</td>
<td>82</td>
<td>97</td>
<td>122</td>
<td>197</td>
</tr>
<tr>
<td>TOTAL</td>
<td>326</td>
<td>331</td>
<td>334</td>
<td>508</td>
<td>626</td>
</tr>
</tbody>
</table>

**GRAPH 16: Marijuana Related Criminal Offenses by Quadrant**

**GRAPH 17: Marijuana DUIs by Year**

*Code Enforcement*

In 2015, the average time spent per Code Enforcement Officer on marijuana issues was 4.0 Hours per complaint (TABLE 19).
TABLE 19: Code Enforcement Officer Hours Per Complaint Type

<table>
<thead>
<tr>
<th>Complaint Type</th>
<th>Number Of Complaints</th>
<th>Hours Spent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complaint Illegal Plants</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Lg Scale MJ Process</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>MJ Business Inspection</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>MJ Business Plan Approval</td>
<td>9</td>
<td>9.5</td>
</tr>
<tr>
<td>MJ Donation Ctr</td>
<td>3</td>
<td>48.5</td>
</tr>
<tr>
<td>MJ Follow Up</td>
<td>12</td>
<td>31</td>
</tr>
<tr>
<td>MJ Grow Unspecified</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>Outdoor MJ Grow</td>
<td>35</td>
<td>139.5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>67</strong></td>
<td><strong>266.5</strong></td>
</tr>
</tbody>
</table>

**Juveniles**

Marijuana related offenses for ages 0–17 for the full years 2013, 2014, and 2015 are depicted below. No offenses were found for ages 0–9.

**GRAPH 18: Juvenile Violations by Age and Year**

**Suspects and Arrestees**

Information regarding those people who were listed in 2015 as suspects or were arrested in the city for marijuana related offenses was also studied to determine the impact of non-residents upon the quality of life of Pueblo citizens. Data were gathered on the address listed by the suspects/arrestees at the time of the report which is detailed in GRAPH 19.
2015 Police actions for marijuana related activity included:

- 67 code enforcement (each took an average of 4 hours)
- 74 juvenile offenses
- 30 MJ DUIs

Total MJ related offenses in all quadrants (assumes code enforcement, juvenile offenses and DUIs are included): 626

Potential time spent on MJ police action in 2015:

(Some activities may take longer than the code enforcement average of 4 hours. For example cases of DUI may require court document preparation and testimony.)

626 unique actions * 4 hours = 2,504 hours

The police department has not been appropriated funds for additional officers for enforcement of MJ related offenses although the time spent on these activities represents the equivalent of two full time officer positions. These activities are currently covered by applying overtime. Although overtime pay is more expensive, there are no additional benefits allocated to overtime pay as there would be with new employees. The entry level $45,342 (from salary.com, http://www1.salary.com/CO/Pueblo/police-officer-salary.html, 9/28/17). Typically benefits account for about 1/3 of total salary, or roughly salary times a factor of 1.5. If two officers were hired to cover these activities, the total cost would be:

2 ($45,342 * 1.5) = $136,026

The total cost of $136,026 represents a maximum cost of labor. It does not include vehicle, equipment and other overhead costs, which could increase the impact cost. However, this cost also represents potential activity related to medical cannabis, illegally grown and/or obtained cannabis. Since it is difficult to parse out only the impact of adult use retail cannabis, the amount of the salaries plus benefits of the officers may be an appropriate impact for PPD law enforcement to apply, without factoring in all overhead costs.

The Pueblo County Sheriff’s office did not respond to repeated requests for information. Our assumption for the cost of law enforcement for the Sheriff’s office is based on proportion of population served.

According to the US Census Bureau, the 2016 Pueblo City population is 110,291. The population of Pueblo County is 165,123. The City of Pueblo accounts for about 66.8% of the population. Therefore, the remaining
county population represents 33.2%. Proportional costs for law enforcement estimated for the Sheriff’s office amounts to $67,606.

Total annual law enforcement costs related to all cannabis related calls, including code enforcement and response to citizen calls is estimated to be $203,632. Since PPD does not differentiate between black market, medical, or adult use retail cannabis, it is difficult to determine the exact impact of only adult use retail cannabis.

All code enforcement responses could be considered related to legalization of adult use cannabis. The data suggests a marked increase in the number of other violations, doubling within two years, and the inflection point coincides with the date of legalization. Applying all 67 code enforcements, and half of the remaining 2015 violations, that would suggest 347 total offenses could be related to adult use cannabis legalization, or 55.4%. Therefore, 55.4% of the cost of $203,632 for total marijuana offenses yields an estimated cost of $112,812.

As an aside, total U.S. marijuana arrests appear to have lessened slightly from 2014–2015 (Drug War Facts 2017—see TABLE 20), while Pueblo’s marijuana arrests have increased. This does seem to indicate there could be an association between the number of calls regarding cannabis to the PPD and legalization.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Marijuana Arrests</th>
<th>Marijuana Trafficking/Sale Arrests</th>
<th>Marijuana Possession Arrests</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>643,121</td>
<td>68,480</td>
<td>574,641</td>
</tr>
<tr>
<td>2014</td>
<td>700,993</td>
<td>81,184</td>
<td>619,809</td>
</tr>
<tr>
<td>2013</td>
<td>693,482</td>
<td>84,058</td>
<td>609,423</td>
</tr>
<tr>
<td>2012</td>
<td>749,825</td>
<td>91,593</td>
<td>658,231</td>
</tr>
</tbody>
</table>

Office to Collect Taxes
Categorizing jobs in this office as a cost may be somewhat misleading. Although jobs in this category are administrative expenses, they are also jobs resulting from the presence of a robust cannabis industry, and can produce offsetting benefits to the economy as much as they are a cost. According to Joan Armstrong (2017), Pueblo County Planning Department, Pueblo County employee, about 17 FTE in various departments, devoted to licensing, recording, inspecting, budgeting, staffing, assessing and more. All of these positions are wholly paid for, including benefits, from licensing and fees levied on businesses in the cannabis distribution channel. These jobs are not costs to the system, but a significant portion of the benefit may already be captured through the impact based on gross sales of cannabis, because these fees must be viewed as part of fixed costs for growers, extractors and retailers. Until further study can be undertaken in this area, the net effect of these jobs is considered zero.

Welfare Assistance
The secondary effects of retail cannabis on welfare organizations is investigated. Costs identified are typically not considered direct costs, and may be inferred based on circumstantial evidence.

Pueblo Soup Kitchen
The Pueblo Soup Kitchen reported a sharp increase in people served at all levels. From 2013 to 2016, the Soup Kitchen observed the following increases (See TABLE 21): Men, 30.69%; Women, 57.93%; and children, 82.13%. This amounts to an overall 38.06% increase in total visits to the Pueblo Soup Kitchen. According to Eva Matola, Pueblo Soup Kitchen director since 2013, the number of visits are the only data collected. Matola offered additional observations, noting that the Soup Kitchen served an increase in out of state visitors since 2013. Matola also indicated she has observed increasing numbers of patrons smoke marijuana
outside the Soup Kitchen. The reality is that an exact extent to which these increases can be attributed to the legalization of cannabis is unknown, however, the increase in out of state and smoking marijuana around the property may point to choices and behavior resulting from cannabis legalization.

<table>
<thead>
<tr>
<th>TABLE 21: Pueblo Community Soup Kitchen (Meals Served)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013 (1st Quarter) 2015 (1st Quarter) 2016 (1st Quarter) 2016 (4th Quarter)</td>
</tr>
<tr>
<td>Men</td>
</tr>
<tr>
<td>Women</td>
</tr>
<tr>
<td>Children</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

**Posada of Pueblo**

Posada of Pueblo is an organization in Pueblo that proves services to homeless individuals. As shown in TABLE 22 Posada reported serving 2,444 unduplicated homeless individuals in 2013, just before adult use cannabis was legalized in Colorado. In a 2014 report, one year after legalization, Posada recorded 3,767 unduplicated homeless individuals. The number of homeless served rose in 2015 to 4,946, and 7,800 in 2016. In Posada's 2017 report they specifically addressed the legalized cannabis issue, saying, “In January 2014 when retail marijuana was available, Posada began to see an explosion in out of state individuals and families relocating specifically to Pueblo and coming to Posada requesting shelter and services...People did not come to Pueblo to be homeless but they often ended up homeless because of the lack of affordable housing.”

Some of them may have come because of the availability of cannabis, while others may have been attracted due to the expectation of finding employment in the cannabis industry. Anne Stattelman, director of Posada, said that it is impossible to record how many come from out of state because Posada only requests a previous address. Stattelman stated that many will move from out of state, live in Pueblo, and end up homeless and report the Pueblo address. Often, they realize they are from out of state because of an out of state license plate on their car.

The 2017 Posada report indicated that, “agencies that serve the homeless in Pueblo report that it is more difficult and dangerous to provide services than it was four years ago. Posada has had staff assaulted, window broken, trespassers sleeping in our building overnight and security cameras destroyed.” They also noted, “Posada does not have the resources alone to adequately address the physical and social needs of this large influx of Affordable Care Act and marijuana migrants.”

<table>
<thead>
<tr>
<th>TABLE 22: Number of Unduplicated Homeless Served by La Posada</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
</tr>
<tr>
<td>2013</td>
</tr>
<tr>
<td>2014</td>
</tr>
<tr>
<td>2015</td>
</tr>
<tr>
<td>2016</td>
</tr>
</tbody>
</table>

Colorado Coalition for the homeless conducted a statewide count on January 25, 2017. On that date, the official count for homeless in Pueblo was 1,828 individuals. This number represents 1.66% of the Pueblo population. This number is contrasted with the 0.19% homeless proportion of the State of Colorado (see TABLE 23). According to the point in time study, the percent of homeless compared to Pueblo’s population is more than 8 times greater than the percent of homeless relative to the state’s population.
TABLE 23: 2016–2017 Homeless as a Percent of Population

<table>
<thead>
<tr>
<th></th>
<th>Population</th>
<th>Homeless</th>
<th>Homeless % of Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado</td>
<td>5,658,546</td>
<td>10,555</td>
<td>0.19%</td>
</tr>
<tr>
<td>Pueblo</td>
<td>110,291</td>
<td>1,828</td>
<td>1.66%</td>
</tr>
</tbody>
</table>

Fernholz (2016) indicates homelessness across the U.S. has steadily declined a total of 15% since 2007. Although national and Colorado homeless trends (see TABLE 24) are generally declining over the last several years, based on data from La Posada and numerous reports in the local press, homelessness in Pueblo appears to be moving dramatically in the opposite direction. The increase in homelessness in Pueblo appears to be coincidental with the legalization of adult use cannabis. Pueblo may appear relatively attractive to homeless considering Colorado due to its lower cost of living, the number of grow operations in the area, and the generally milder climate than northern locales.

TABLE 24: Colorado Homeless Trends

<table>
<thead>
<tr>
<th>Year</th>
<th>Number in CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>15,482</td>
</tr>
<tr>
<td>2011</td>
<td>15,116</td>
</tr>
<tr>
<td>2012</td>
<td>16,768</td>
</tr>
<tr>
<td>2013</td>
<td>9,754</td>
</tr>
<tr>
<td>2014</td>
<td>10,028</td>
</tr>
<tr>
<td>2015</td>
<td>9,953</td>
</tr>
<tr>
<td>2016</td>
<td>10,550</td>
</tr>
</tbody>
</table>

Homelessness is costly to the community. The Colorado Coalition for the Homeless estimates that local taxpayers spend $43,240 per homeless individual in Colorado each year on everything from emergency health care to legal issues (Bradley, 2013; Keyes, 2013). This figure is based on studies in 7 large Colorado counties near the Denver region, and includes cost of shelter, food, law enforcement issues, and the largest contributing factor, medical and psychiatric care. It is assumed that this expense is also based on the cost of living in the Denver region. In 2017, a comparison for the cost of living for Denver and Pueblo yielded these results:

- Pueblo = 85.2
- Denver = 127.5

Average index = 100.00

Using this adjusted cost of living index, the estimated cost for a homeless person in Pueblo would be $28,894. Based on statements from Anne Stattelman, a relatively large portion of the homeless in Pueblo, as many as 800 individuals according to personal interviews she conducted, is assumed to be related in some way to the cannabis industry, either job seeking, substance using, or both. The transient nature of homeless individuals can account for the difference between the official count and the number of individuals La Posada served in 2016. The official count may be more representative of the chronically homeless. The actual number of homeless in Pueblo during the year may be somewhat higher due to difficulties in obtaining accurate counts, noted in the point in time report. Moreover, homeless numbers may be significantly higher in warm weather months than during the winter, when the point in time study was conducted.

The maximum expected cost in the 2016 calendar year will be applied to the official homeless count of 1,828 individuals reported in the Colorado Coalition Point in Time Study. Based on the Pueblo adjusted cost of
living rates the maximum expectation for cost to taxpayers would be $28,894 * 1,828 = $52,818,232. The cost to taxpayer calculations in TABLE 25 are made based on possible projections for a proportion of the population driven to come to Pueblo for the primary purpose of the cannabis industry, either as a customer, or possible worker.

<table>
<thead>
<tr>
<th>Proportion of Homeless</th>
<th>Number of Homeless</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>1,828</td>
<td>$52,818,232</td>
</tr>
<tr>
<td>75%</td>
<td>1,371</td>
<td>$39,613,674</td>
</tr>
<tr>
<td>50%</td>
<td>914</td>
<td>$26,409,116</td>
</tr>
<tr>
<td>43.76%</td>
<td>800</td>
<td>$23,115,200</td>
</tr>
<tr>
<td>25%</td>
<td>457</td>
<td>$13,204,558</td>
</tr>
</tbody>
</table>

The calculation of 43.76% as a proportion of total homeless was included because this represents the headcount of 800 individuals that Stattelman identified as willing to cite cannabis as the reason they were in Pueblo. This amount is the expected approximate cost to Pueblo taxpayers of homeless related to legal adult use cannabis.

**Medical Impact**

A majority of costs incurred by hospitals relative to cannabis are related to indigent care. These costs are accounted for in the estimate for homeless costs previously calculated. Some of the medical costs for residents where cannabis is involved are covered by insurance. Parkview Hospital (Blood, 2017) provided statistics regarding incidence of positive toxicology tests for cannabis for the years 2012—2017. Those statistics are presented in TABLE 26. While direct societal costs for positive toxicology tests are not available, nor is it possible at this time to determine an economic impact, these results demonstrate (1) the presence of cannabis is increasingly detected in Emergency Department cases, and (2) pregnant women and newborn infants are increasingly testing positive for cannabis.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emergency Room</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Patients</td>
<td>51,703</td>
<td>79,950</td>
<td>84,686</td>
<td>85,593</td>
<td>84,298</td>
<td>61,812</td>
</tr>
<tr>
<td>% Patients Positive Tox Screens</td>
<td>1.38%</td>
<td>1.88%</td>
<td>2.11%</td>
<td>2.36%</td>
<td>2.72%</td>
<td>3.08%</td>
</tr>
<tr>
<td>Total Tox Screens</td>
<td>3,071</td>
<td>5,800</td>
<td>5,861</td>
<td>6,489</td>
<td>6,857</td>
<td>5,528</td>
</tr>
<tr>
<td>% Positive Tox Screens</td>
<td>23.31%</td>
<td>25.97%</td>
<td>30.46%</td>
<td>31.10%</td>
<td>33.44%</td>
<td>34.44%</td>
</tr>
<tr>
<td><strong>Pregnancy/Delivery</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Patients</td>
<td>2,157</td>
<td>3,391</td>
<td>3,466</td>
<td>3,411</td>
<td>3,551</td>
<td>2,428</td>
</tr>
<tr>
<td>% Patients Positive Tox Screens</td>
<td>0.46%</td>
<td>1.12%</td>
<td>1.56%</td>
<td>2.17%</td>
<td>2.25%</td>
<td>3.62%</td>
</tr>
<tr>
<td>Total Tox Screens</td>
<td>85</td>
<td>198</td>
<td>204</td>
<td>256</td>
<td>325</td>
<td>282</td>
</tr>
<tr>
<td>% Positive Tox Screens</td>
<td>11.76%</td>
<td>19.19%</td>
<td>26.47%</td>
<td>28.91%</td>
<td>24.62%</td>
<td>31.21%</td>
</tr>
<tr>
<td><strong>Nursery</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Patients</td>
<td>1,092</td>
<td>1,561</td>
<td>1,569</td>
<td>1,575</td>
<td>1,561</td>
<td>1,145</td>
</tr>
<tr>
<td>% Patients Positive Tox Screens</td>
<td>0.64%</td>
<td>0.32%</td>
<td>1.15%</td>
<td>3.68%</td>
<td>5.45%</td>
<td>5.68%</td>
</tr>
</tbody>
</table>
Total Tox Screens | 72 | 110 | 130 | 155 | 192 | 161
\% Positive Tox Screens | 9.72\% | 4.55\% | 13.85\% | 37.42\% | 44.27\% | 40.37\%

*2012 is not a complete year due to new electronic health record; **Data collected through 9/30/2017. NOTES: Patients may refuse toxicology screens. Emergency Department administers test when there is suspicion of drug use. Pregnancy and Nursery Departments screen when hospital policy criteria are met. If patient self discloses drug use, toxicology screen may not be completed.

**School Impact**
Both District 60 and District 70 were contacted. District 60 did not respond, and District 70 was unable to provide any data related to cannabis violations, truancy, behavioral issues, or other enforcement costs. It is expected that cannabis related incidents will mirror police department interactions with juveniles, but it is not possible to determine a cost at this time.

**Insurance Costs**
Bob Cabrera is one of the insurance agents contacted who investigated within his company and did not believe that current legalized cannabis affected insurance rates for commercial, residential or auto rates. Using cannabis products may affect life insurance rates, similar to tobacco usage.

**PEDCO**
Jeff Shaw, CEO of Pueblo Economic Development Corporation, was asked if attracting businesses to Pueblo has been made more difficult because of the legalization of adult use cannabis, or if any businesses have removed themselves from relocation consideration due to the passage of those laws. He stated “no, the legalization of adult use cannabis has not made attracting businesses for relocation more difficult… and no, there were no businesses that pulled out of the relocation pipeline because of legalization.”

**Business Sentiment Survey—Drug Testing Impact**
A common perception in Pueblo is that cannabis has made it more difficult to find employees who can pass drug tests for cannabis and other substances. In a 2017 business sentiment survey conducted by the Healy Center, about 27\% of respondents indicate that they turn down applicants for drug test reasons either often or very often. Another 22\% occasionally decline applicants for that reason. Only rarely or rarely do 18\% turn down applications, and about 33\% do not use drug testing.

**Total Costs Accounted For**
Based on available information, the primary costs identified related to cannabis in Pueblo County are law enforcement and homelessness. In a number of cases with welfare and family services, education, insurance and more, adult use cannabis may be a tangential factor in costs, but deriving contributing costs, if any, are problematic, either because of lack of data, or because correlation and causality are difficult to identify.

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Law Enforcement</td>
<td>$112,812</td>
</tr>
<tr>
<td>Homeless (Includes shelter, food, medical care)</td>
<td>$23,115,200</td>
</tr>
<tr>
<td>Total estimated annual costs for 2016</td>
<td>$23,228,012</td>
</tr>
</tbody>
</table>

**Total Annual Impact of Pueblo Cannabis Industry 2016**
The total annual impact of the cannabis industry in Pueblo for 2016 is total positive contributions (including multiplier effects) minus total costs. The estimated impact is:

\[(\text{Sales} \times \text{Multiplier}) + (\text{Related Construction} \times \text{Multiplier}) - (\text{Costs}) = \$57,354,156 + \$1,504,260 - \$23,228,012 = \$35,630,404\]
Projections

Forecast for the next 5 years

The past five years growth in the Pueblo cannabis industry has been robust. Between the years 2014 - 2016, tax revenues have grown at an average of 58% per year. Costs related to infrastructure support have also increased, namely, the homeless, medical care and law enforcement.

From this point forward, there are three distinct scenarios for the next five years. If the next five years look similar to the last five years, the average growth rate would be about 36.32%. This represents the best case scenario for projections (TABLE 27). The projection for 2017 was calculated based on taxes collected so far for this year. If the 36.32% growth rate is maintained for the following four years, the impact on the benefit side could be as much as $279 million. Costs would also likely rise, and a factored increase of 25% has been incorporated, resulting in costs of about $71 million. Under such a scenario total potential impact in the year 2021 could be as high as $208 million. However, such revenue growth is unlikely longer term.

<table>
<thead>
<tr>
<th>TABLE 27: Best Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefit*</td>
</tr>
<tr>
<td>Total Tax Revenue</td>
</tr>
<tr>
<td>Gross Sales</td>
</tr>
<tr>
<td>Sales Multiplier</td>
</tr>
<tr>
<td>Construction**</td>
</tr>
<tr>
<td>Cost***</td>
</tr>
<tr>
<td>Total Impact</td>
</tr>
</tbody>
</table>

*Based on average annual increase of 36.32%. **Construction has slowed significantly in 2017. Forecast will be based on 10% increase of 2017 values with multiplier of 3.05. *** Assume costs increase at same rate of 25%/year
The second projection, a more likely scenario (TABLE 28), is based on early indicators that suggest increasing competition, and a leveling of demand. This can result in lower prices, subsequently lower tax revenues if sales in terms of product volume remain the same, and a lower overall economic impact. A slowing of annual growth could be expected. For this scenario, we will begin with the 2017 projections. Revenue projections for 2018 would be 20% higher than the previous year, 2019 and 2020, 10% increase for each year, and level demand in year 2021. Simultaneously, the infrastructure costs are expected to remain relatively constant.

### TABLE 28: Most Likely

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Tax Revenue</td>
<td>$726,319</td>
<td>$1,024,179</td>
<td>$1,280,224</td>
<td>$1,408,246</td>
<td>$1,549,071</td>
<td>$1,549,071</td>
</tr>
<tr>
<td>Sales Multiplier</td>
<td>$57,354,156</td>
<td>$80,874,859</td>
<td>$101,093,574</td>
<td>$111,202,931</td>
<td>$122,323,224</td>
<td>$122,323,224</td>
</tr>
<tr>
<td>Construction</td>
<td>$1,504,260</td>
<td>$22,418</td>
<td>$22,418</td>
<td>$22,418</td>
<td>$22,418</td>
<td>$22,418</td>
</tr>
<tr>
<td>Cost (remain flat)</td>
<td>$23,228,012</td>
<td>$23,228,012</td>
<td>$23,228,012</td>
<td>$23,228,012</td>
<td>$23,228,012</td>
<td>$23,228,012</td>
</tr>
<tr>
<td>Total Impact</td>
<td>$35,630,404</td>
<td>$57,669,265</td>
<td>$77,887,979</td>
<td>$87,997,337</td>
<td>$99,117,630</td>
<td>$99,117,630</td>
</tr>
</tbody>
</table>

The third scenario (TABLE 29) is considered worst case for the cannabis industry and involves uncontrollable variables in the macro environment. The first impactful variable would be other states enacting their own cannabis legislation. This action is likely to impact cannabis tourism, and could be significant relative to demand in Pueblo County, depending upon which states pass legislation, and where they are situated relative to Colorado. The likelihood of other at least a few states passing legislation within five years is relatively high. The negative impact could be exacerbated if legislation favoring cannabis use is passed at the Federal level.
This last variable is probably not likely in the next five years, but could be very likely within the next ten years. Assuming a few other states pass legislation, especially if they are nearby, cannabis tourism could drop by 25–75% reducing demand in our region 15–45%. Our projections for the worst case scenario use the following assumptions: 2016 is selected as a base year for all calculations: 10% decrease from 2016 for 2018, 20% decrease from 2016 for 2019, and 30% decrease from 2016 for both years 2020 and 2021. In this scenario, new construction ceases in 2018; costs decrease from 2016 levels 5% in 2018, 15% in 2019 and 30% in 2020 and 2021, primarily because lower tourism, lower demand and lower production reduces the attractiveness of the Pueblo cannabis industry to the homeless.

**TABLE 29: Worst Case**

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Tax Revenue</td>
<td>$726,319</td>
<td>$1,024,179</td>
<td>$653,687</td>
<td>$581,055</td>
<td>$508,423</td>
<td>$508,423</td>
</tr>
<tr>
<td>Gross Sales</td>
<td>$25,045,483</td>
<td>$35,316,532</td>
<td>$22,540,935</td>
<td>$20,036,386</td>
<td>$17,531,838</td>
<td>$17,531,838</td>
</tr>
<tr>
<td>Sales Multiplier</td>
<td>$57,354,156</td>
<td>$80,874,859</td>
<td>$51,618,740</td>
<td>$45,883,325</td>
<td>$40,147,909</td>
<td>$40,147,909</td>
</tr>
<tr>
<td>Construction Cost</td>
<td>$1,504,260</td>
<td>$22,418</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Cost</td>
<td>$23,228,012</td>
<td>$23,228,012</td>
<td>$22,066,611</td>
<td>$19,743,810</td>
<td>$17,421,009</td>
<td>$17,421,009</td>
</tr>
<tr>
<td>Total Impact</td>
<td>$35,630,404</td>
<td>$57,669,265</td>
<td>$29,552,129</td>
<td>$26,139,515</td>
<td>$22,726,900</td>
<td>$22,726,900</td>
</tr>
</tbody>
</table>

**GRAPH 22: Worst Case**

**Discussion**

The Pueblo cannabis industry, along with much of the rest of the State of Colorado cannabis industry, has enjoyed robust growth. Investment has been made, new construction has occurred, jobs have been created, tourism has pumped millions of dollars into our economy, and governments have collected large amounts of tax. Compared to counties in Colorado and cannabis-legal Washington State, Pueblo appears to be holding its own, economically.

When compared to other similar communities in states where cannabis is not legal in any form, Pueblo appears to be doing better on a number of measures. The nine counties compared included three from
Colorado and Washington State each and three counties were selected from states where cannabis is not legalized either for medical or recreational purposes. We examined several different measures to compare these counties including county income (GDP per capita), real estate values, construction spending, changes in labor force and employment, and compensation (wages and salaries) for different industries. Here is a summary of our findings:

Pueblo County seems to have done quite well in terms of an increase in county income measured by GDP per capita as compared to other counties from states outside of Colorado. The trend for this change also seems to be positive suggesting that we will continue to see an increase in income per person for Pueblo County going into the future. Pueblo County also shows a high positive change in real estate values and the trend is positive suggesting that real estate values will likely continue to rise in the near future. The level of overall wages and salaries also appears to have increased significantly for Pueblo County with a positive trend for the future. In terms of construction spending and construction compensation, the change has been positive as well. Construction spending shows a very positive trend suggesting an increase in construction spending as we go into the future.

A noticeable decline has occurred in the Pueblo County labor force. This is concerning because other counties from Colorado have seen a significant increase in labor force over the past few years. Labor force refers to the portion of population that are either employed or unemployed. Unemployment has declined in Pueblo County and employment has increased, however a lower labor force suggests that fewer people either qualify to be a part of the labor force or are no longer interested in applying for jobs. A significant decline in employment in the finance and insurance industry is observed, but it is not a serious concern for Pueblo County, as the trend seems to be consistent with all other counties as well as the overall trend in the country. Farm compensation in Pueblo County has also declined over the past few years, which may be a major concern, considering other similar counties are observing a significant increase in farm compensation. This disparity could discourage workers to seek farm related jobs around Pueblo County and either switch to other industries or seek jobs outside the county. A Pueblo business sentiment survey reveals about 27% of employers frequently or often turn down applicants because they test positive for cannabis. It is unknown if this is a high or low value since it was conducted in 2017, and there are no earlier data, especially pre-legalization for which to compare. All of this leads to certain questions. Has cannabis made workers ineligible to participate in the workforce? Employment is high, labor force numbers have declined. What is the real impact of cannabis on unemployment?

There is a modest increase in wage and salary employment especially in healthcare and social assistance employment in Pueblo County. The trend also seems to be relatively flat in terms of growth of healthcare and social assistance compensation. Pueblo County has significantly more people employed by the healthcare industry as compared to other counties which can make it difficult to show a significant growth in industry-specific compensation and employment over time.

As a new industry, growth has been explosive for those involved in cannabis in Pueblo County. Between the first and second year, sales increased a modest 12.78%, but between the second and third years, sales jumped 55.17%. Project sales for 2017 suggest a slowing to an increase of approximately 41%. This can be a result of market saturation, but it may also be an artifact of increased competition. In an interview with Richard Kwessel, owner of a vertically integrated cannabis operation, he indicated that competition is becoming fierce and it is impacting pricing. As an example, he offered that in his first year of operation, he was able to command a wholesale price of $4,000/pound with no quantity discounts. In early 2017, that price had fallen to just over $1,000/pound, and quantity discounts may reduce that price further. This demonstrates that greater quantities of cannabis must be sold to earn the same revenue as in previous years. The greatest impact is a significantly lower profit margin for producers.

Overall, the positive changes that are noticed in Pueblo County, such as increasing real estate values, higher income per capita, and more construction spending may be attributed to legalization of cannabis in the
State of Colorado. However, it is also very likely that these positive changes may be the result of an overall economic expansion the United States as the economy continues to recover from the great recession as observed in TABLE 3.

Drawbacks may exist with the presences of a cannabis industry. As an adult product, it may be considered a vice industry, similar to tobacco, alcohol and gambling. Each of these industries carries a certain stigma, and are associated in some measure throughout society with a number of social ills, some of which are hard to quantify and find direct correlation. Some of the costs associated with adult use cannabis are very direct and quantifiable, such as code enforcement. Others, such as police calls for marijuana related violations, juvenile violations, the number of crimes involving cannabis, increased incidence in patients in emergency rooms, pregnancy delivery centers, and nurseries may be simply coincidental with legalization, but are striking in their presence. Adult use cannabis can be considered an attractive nuisance for juveniles, miscreants, recidivists, and a variety of other individuals who represent a cost burden for society. This is not to imply that all who use cannabis are unsavory, indeed, many respected members of the modern establishment, including presidents, have admitted to using it, but this substance has historically implied a certain attraction for people who live on the fringes of legal society.

It is apparent in observing the cost data that law enforcement demands have increased, not only for code issues, but for a number of calls and crimes that involve marijuana. There is a decided upward inflection in reporting from 2013 to 2014, and the trend continued upward in 2015, which is coincidental with the legalization of cannabis. This also seems counter to national trends for arrests involving cannabis. Interestingly, there does not seem to be a comparable significant difference in the number of marijuana DUIs for the same years. The difficulty in drawing further conclusions about any cause and effect regarding cannabis legalization are compounded by the several sources of cannabis, some of which are illegal, but not separated in the data reported by the Pueblo Police Department. Illegal cannabis has existed for years, and so have related socially undesirable or illegal behaviors. The increase in certain problem areas may reflect a more open social acceptance and conspicuous use of cannabis as a result of legalization, and not necessarily the actual availability of legal cannabis. Especially troubling, however, is the incidence of increasingly younger juveniles who are found in possession of cannabis and drug paraphernalia.

A dilemma facing the research team is how to handle certain jobs that may be viewed as an administrative expense, such as county positions in licensing, but are also byproducts of a healthy cannabis industry. These are essentially jobs created because of the cannabis industry, have positive impact on the economy, are funded by cannabis fees, but are also a cost to the system, and may be considered part of the gross cannabis retail sales multiplier. Until further research can be conducted on these types of positions, the net impact should be considered approximately zero.

The issue of homelessness is contentious in many ways, but it has been such a salient concern in our community that it cannot be ignored in discussions involving cannabis. Homelessness is an American artifact of our current economic system, and Pueblo has a proportional share of chronic homeless in Colorado during the January Point in Time study. However, there seems to be a larger transient population during warmer months that avail themselves to the various shelters and services for the homeless, evident in reports from the local soup kitchen and La Posada. This summer increase also coincides with a spike in cannabis sales. A possible explanation is that there is a certain supply and demand that will either attract or repel the homeless during this season. Factors that make Pueblo attractive to homeless individuals are the weather, a relatively low cost of living, a nurturing and supportive infrastructure, and perhaps the opportunity to work in the burgeoning cannabis industry.

An important, perhaps explanatory point about the relationship between a large number of transient homelessness and cannabis, is a third, moderating variable: mental illness. National Coalition for the Homeless (2009) identified a strong correlation between mental illness and homelessness. Moreover, half of the mentally ill homeless suffer from substance abuse and dependence, often self-medicating with street
drugs. The direction of causality between drug use, mental illness and homelessness may not always be clear, but the perceived availability of cannabis in a legal environment can be attractive to homeless people who are regular users.

Regardless of why people use cannabis, or why they are in Pueblo, it does appear that increased demand by homeless individuals on limited resources has occurred coincidental with legalization of cannabis. Chief among the demand on resources is medical costs. Indigent populations routinely visit the emergency room for any medical concern and cannot be turned away. This medical burden is borne by hospitals and municipalities. Ultimately, the rest of society pays for this through taxes and higher insurance costs. If homeless are in Pueblo even partially due to our cannabis industry, that is a cost that should be recognized.

It must be acknowledged that there is a certain disparity between costs incurred and taxes collected. In 2016, a total of $3,448,842 in taxes were collected in Pueblo County. Simultaneously, estimated costs of $23,318,832 were incurred that must be covered primarily by taxpayers. That is a shortfall of nearly $20 million. While the revenues coming in stimulate the economy overall, and eventually result in additional tax revenues from local sales or property taxes, there has been an effective $20 million shift in funds from taxpayers to for-profit businesses.

Regarding taxes and societal expenses we offer a few recommendations. The costs incurred relative to legalized adult use cannabis are carried by the taxpayer in the form of costs to the legal system, and costs associated with the increase in the homeless population interested in legal cannabis that have found Pueblo attractive. A portion of the tax revenues are channeled back into state and local budgets, but it is unclear how much has been devoted to specific unintended consequences of legalization. It will never be possible to charge enough tax to cover expenses without making illegal cannabis prohibitively attractive. Still, earmarking a more significant portion of the tax receipts to address homeless needs is both logical and humanitarian. Other municipalities have a line item in their budget devoted to homeless, and in Pueblo’s case, it may be entirely appropriate to review specific funding for the homeless as a distribution from cannabis tax receipts.

Second, the incidence of crime that coincides with legalization suggests that law enforcement is deserving of some of the tax revenue to deal with the undesirable outcomes attendant with a vice industry. Finally, the increase in juveniles as young as ten years old who have been detained for possession of cannabis and paraphernalia leads us to recommend that more of the tax receipts be devoted to education programs, not unlike the programs that have been created regarding use of tobacco products.

Projections for Next 5 Years
There are currently 183 licenses issued for cannabis businesses (Schaneman, 2018), with 24 retail stores located in Pueblo County, with 8 more stores awaiting approval to open within Pueblo city limits. In interviews with local retail cannabis growers, the wholesale selling price for a pound of cannabis has decreased from $4,000 in 2015 to about $1,000 in 2017, along with increasing price competition in retail outlets. Store owners attribute the drop in price to an increase in supply. Demand has been fairly consistent, (with modest growth). In the near term (next five years) the market should continue to become more saturated, and we can expect to see prices continue to drop, making the product more like a commodity. Some of the mid- to late-entrants in this market may be at greater risk of failure. We are already witnessing some early entrant businesses beginning to consolidate market and vertically integrate. There are a few local businesses that grow most of their own supply, and operate multiple retail outlets. Such businesses are poised to take advantage of experience curve effects and new market opportunities if other states in the region legalize. As an industry that requires cash to engage in most transactions, business that have accumulated significant cash reserves, backed with significant industry experience, can exploit opportunities to become larger businesses within the industry.

Falling prices will have some effect on tax revenue. On a given quantity of cannabis, sales tax will decline proportional with the decline in revenue. Excise tax is also determined by average market rate, and would also decline proportionately. If the county levied a tax not on dollar value, but on weight, or total THC
content, this portion of the tax could be maintained at a consistent level. Given extant tax policies of state and local governments, we predict that tax revenues will level and could eventually decline as the supplier market becomes saturated.

Longer term, four factors could dramatically change the retail cannabis industry: increasing numbers of states legalizing adult use, a change in the federal government’s legal position on cannabis, automation technology, and a change in distribution channels. These factors are interrelated and listed in the expected order of change.

Currently 29 states have authorized medical use for cannabis and 8 states have legalized retail cannabis for adult use. It also appears that more states are considering ballot initiatives that would further legalize the use of cannabis, either for medical or legal adult use. Cannabis tourism in Colorado and Pueblo County can be expected to decline as more states legalize adult use.

The pressure of a majority of states authorizing at least medical use for cannabis creates a dilemma for the federal government. Currently designated a Schedule I drug, banks are prohibited from engaging in any financial transactions of organizations involved in growing or distributing cannabis. This forces the industry to rely on cash transactions, creating a potentially dangerous situation for operators who must deal with large amounts of cash, and creating opportunities for certain corrupt practices. The federal government is currently turning a blind eye toward this situation, and electing not to prosecute individuals for most cannabis transactions in states that have legalized cannabis. However, business operators must still pay federal tax, creating a potential situation of cognizant dissonance for legislators. As momentum for cannabis legalization at the state level accelerates, there will likely be a decision at the federal level that will legally accommodate any state wishing to legalize some form of cannabis use, perhaps with imposition of a federal tax. Such an action will authorize banks to be involved in financial transactions, attracting the interest of much larger businesses, such as tobacco and alcohol producers. Entry into the market by such players would dramatically change the rules of competition and consolidate the industry, likely leading to oligopoly conditions.

If adult use cannabis is legalized at the federal level, and banks are allowed to engage in financial transactions with cannabis industry businesses, it will likely attract larger players, more than the largest of the current cannabis industry. Likely candidates include tobacco businesses. With more capital available, increased automation of operations is likely, reducing the number of jobs available within the industry. Moreover, large businesses will view free-standing stores dedicated exclusively to the distribution of cannabis as inefficient. It is conceivable that distribution could be changed to allow sales in other stores, for example, liquor stores. This would reduce costs by reducing overhead from investment in buildings, utilities, insurance, etc., and eliminate redundant labor costs, further eroding any positive benefit from jobs generated by the cannabis industry.

All preceding factors exert downward pressure on price and profit margins for producers/distributors, making new entry into the industry increasingly difficult. It may still be possible for local, small scale, niche businesses to enter and operate in the market, much like the craft beer brewing industry.

Advice from the research team to other states: Collect baseline data before legislation is enacted.

**Limitations**

Not all counties identified for the survey had full data set available.

A number of organizations did not collect data prior to cannabis legalization, limiting pre-legalization and post-legalization comparisons.

Many sources only included the term “marijuana” and did not differentiate between adult use cannabis, medical cannabis, or illegally obtained marijuana. This comingling of terms confounds the explicit impact of adult use cannabis on economic impact variables.
In some cases, such as criminal activity and hospital visits, individuals have co-presence of two or more substances. Discerning the exclusive impact of cannabis is problematic.

Only the most salient revenues and costs have been collected and evaluated. Tertiary and lower levels of benefits and costs may exist that could be identified through future research.

The cannabis industry is so new, and there is a healthy suspicion among operators in this industry of researchers probing for information, especially financial. Likewise, it is difficult to obtain information from the homeless for the same reason. For reasons of privacy, interviewing out-of-state customers at cannabis shops is not possible, so observational techniques and interviews with owners or employees are employed. All of these factors have imposed limits on the amount of information that can be collected, and casts some doubt on the overall accuracy. Certainly costs, but even revenues, in a cash only system, should be viewed with some skepticism. As a result, it should be noted that all projections, including the specific numbers for absolute impact, are estimates.

**Directions For Further Research**

As a new industry in the U.S., there are a number of enticing, fertile areas for research in the fields of economics and business. Economic researchers should consider relationships and interactions between legal, black, and gray markets. Before determining clear economic impact, clear causal connections must be identified. Moreover, there is a need for continued monitoring for change in cost structure, jobs, real estate value.

A potentially important factor to include in future impact studies is revenue from wholesale activities, such as cultivation operations, extractions, and manufacture of cannabis infused products. The trend appears to be increasing revenues for these categories of cannabis businesses. The difficulty will arise in teasing out the products eligible for a multiplier effect. Excluded products are those distributed through medicinal dispensaries, and/or products sold within the county. This will require significant cooperation with the county and producers to gain accurate data.

The level of competition and its subsequent impact on prices is of paramount interest. The industry would benefit from analyses of optimal number of licensed shops to ensure both low cost to consumer, and adequate profit for industry stability. Also of interest is the degree of consolidation and vertical integration within the industry and the impact both have on cost structures and prices.

Regarding employment, there are compelling questions about the impact cannabis has on the workforce. Has cannabis made workers ineligible to participate in the workforce? Although employment is high, labor force numbers have declined. What is the real impact of cannabis use, legal or illegal, on unemployment?

The evolution of this industry offers a once-in-a-lifetime opportunity for researchers to observe an industry move from illegal to legal status. Further comparison research should be adopted as more states legalize. We encourage researchers and government administrators in states that are considering legalization to establish baselines measures on as many existing variables as possible prior to enactment of legalization. From our experience in this study, there may be time series data that would be very useful that you identify after the laws are passed, but is not available because no one thought to collect it a priori the enactment of legalization. When in doubt, track all data possible. Also, it is advisable that increased aggregate tracking of cannabis sales be embedded in new legislation, not be individual, but by categories, such as 5 digit zip code, age, gender, ethnicity, etc. Such information would be valuable to health departments in dealing with health and social impacts.

Regarding costs, ripple effects in the economy are important to consider. Further examination is needed of tertiary costs, such as road maintenance where grow facilities are kept that must accommodate large trucks conveying water to more remote sites, effects on interest rates, effects on number of employees turned down for failure to pass drug tests, and societal costs related to positive cannabis toxicology results from hospital Emergency Departments, Pregnancy/Delivery Departments, and Nurseries.
Unintended consequences that bear costs for tax payers need to be addressed by future research. Some of the questions include what is the optimal form of tax structure. How much tax can be charged without encouraging black market activity? Could there be fees levied for home grow plants?

Another tertiary unintended consequence and cost that should be explored is the impact of cannabis industry on other vice industries, specifically tobacco and alcohol. Has the legalization of adult use cannabis changed demand for either or both of these products?

Finally, there is ripe opportunity to engage in multi-disciplinary research to explore the mental illness/drug use/homeless relationship and subsequent economic impact.

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Cannabis buffer zones

Introduction and Background

The problem with Cannabis Pollen: Hybridization between Low THC Cannabis and High THC/CBD Cannabis

Hybridization of high THC Cannabis with low THC Cannabis can result in crop loss for both growing operations. If genes that promote high levels of tetrahydrocannabinol (THC) are transferred by pollen from high THC Cannabis to low THC Cannabis, the resulting seed could result in subsequent generations of plants that test over the permitted THC limit, requiring the crop to be destroyed and result in large investment losses (Small and Antle 2003). This is probably a less frequent occurrence because high THC Cannabis growers and low THC Cannabis growers who are producing crops for cannabidiol (CBD) production normally eliminate male plants, or grow female clones, and the extent to which pollen from high THC or high CBD Cannabis cultivation represents a large pollen source is unknown and probably minimal. On the other hand, pollen from low THC or low CBD Cannabis fertilizing high THC or high CBD Cannabis plants will produce seed that could significantly reduce the value of the high THC or CBD crop. Both low THC hemp growers (industrial hemp) and high THC or high CBD growers are faced with a perennial problem of ensuring that their plants are adequately protected from contaminating pollen.

Cannabis Pollen

A single flower can generate about 350,000 pollen grains (Faegri et al. 1989), and there are hundreds of flowers on larger plants (Small and Antle 2003). Given this production, a hectare of Cannabis could release $10^{10}$ to $10^{11}$ pollen grains, similar to maize (Aylor et al. 2003, Fonesca et al. 2003, Fonesca et al. 2004).

Pollen grains of dioecious strains (having reproductive organs on separate individuals, i.e. sexually distinct or unisexual) tended to have a diameter averaging about 33 microns (µm) (Migalj 1969), while the grains of monoeccious strains (bisexual or hermaphroditic) were smaller, with a diameter averaging about 27 µm. Pollen grains are viable up to 72 hours (Bassani et al. 1994, Demkin and Astachova 1952, and Zhatov 1983). Zhatov (1983) reported higher figures and that after 3 days of storage pollen viability was 50%, dropping to about 16% after 7 days.

Long-Distance Cannabis Pollen Transfer

Although considered rare, long distance transport of pollen grains have been extensively reported (Campbell et al. 1999, Mohanty et al. 2017), including jack pine and white spruce pollen travelling 3000 km and juniper pollen has been shown to travel 1500 miles (Mohanty et al. 2017). Cannabis pollen can be carried long distances by the wind. Cabezudo et al. (1997) and Aboulaich et al. (2012) both noted Cannabis pollen, apparently from marijuana cultivated in North Africa, being transported by wind currents to southwestern
Europe. In the United States, Stokes et al. (2000) recorded hemp pollen as 36% of the total pollen in the atmosphere in mid-August.

**Regional and Local Cannabis Pollen Transfer**

Small and Antle (2003) studied distribution of Cannabis pollen from an isolated field over a 3-week period. They found that the amount of pollen distributed downwind was about six times the amount distributed upwind. Pollen distribution appeared to follow a leptokurtic curve (see Figure 2), dropping as they sampled further from the source, but much more slowly with increasing distance.

![Figure 2. Data from Small and Antle (2002) showing mean Cannabis pollen grains/m²/day over a 3 week collection period.](image)

Small and Antle (2003) concluded that it is impossible to guarantee complete absence of potentially contaminating pollen in the field and, for practical purposes, a very low amount of undesired gene flow needs to be tolerated.

Pollen transport has been extensively studied in other crop plants, like maize (corn). Hoffman et al. 2014 produce a robust model for pollen deposition at differing distances from a source for maize based on 216 sites in Germany (see Figure 3). This dispersion model produces a linear relationship between log distance and pollen (Figure 3), and seems to be suitable for Cannabis pollen (see Figure 4).
Figure 3. Data and Figure reproduced from Hoffman et al. 2014. Maize pollen deposition versus distance to the next maize field. Data points from field measurements 2001 to 2010 (gray/dark, data from 2001 to 2006; light blue/light, data from 2007 to 2010; N=216) and results of regression analysis (linearized power regression equation \( \log_{10} Y = -0.585 \cdot \log_{10} X + 6.104 \), \( R^2 = 0.709 \), \( p<0.001 \); power regression equation, \( Y = 1.271 \cdot 10^6 \cdot X^{-0.585} \); \( Y \), deposition in n/m²; \( X \), distance to nearest maize field in meters m). Central bold blue line, expected deposition; dashed lines, confidence interval for expected deposition; red solid lines (outer lines), 95% confidence intervals for single predictions. Deposition values in n/cm² were obtained by multiplying displayed deposition values by 0.0001.

Figure 4. Data from Hoffman et al. (2014) and Small and Antle (2003). Line (linearized power regressions) from Figure 3. Light blue line is expected deposition, dotted lines are the 95% confidence intervals, dark blue and yellow lines are 95% confidence intervals for single predictions. Green diamonds are Cannabis pollen data from Small and Antle 2003.
Results

Regional and Local Cannabis Pollen Transfer

Using the data from Small and Antle (2003), who studied distribution of Cannabis pollen from an isolated field over a 3-week period, a log transformed linear relationship was created similar to the Hoffman et al. (2014) maize pollen study. Figure 5 displays this relationship and linear equation is shown in Equation 1. Table 1 provides estimated pollen at given distances from a source field using Equation 1. Surprisingly, given the original finding that the pollen distribution appeared to follow a leptokurtic curve (see Figure 2), dropping as they sampled further from the source, but much more slowly with increasing distance, pollen grains are predicted to still be found at distances over a million meters.

![Figure 5. Cannabis pollen data from Small and Antle (2003). Line (linearized log transformed data) denotes a best linear fit with equation and R2 value on chart. X axis (bottom) is in meters, Y axis (left) is number of pollen grains.](image)

**Equation 1.** \( \log_{10}(\text{pollen grains/m}^2) = -\log_{10}(\text{meters}) + 6.7796 \)

<table>
<thead>
<tr>
<th>Pollen grains (m²/day)</th>
<th>Predicted distance (meters)</th>
<th>Predicted distance (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,000,000</td>
<td>0–in field</td>
<td>0–in field</td>
</tr>
<tr>
<td>100,000</td>
<td>80.1 m</td>
<td>0.049 miles (86 yards)</td>
</tr>
<tr>
<td>10,000</td>
<td>944.1 m</td>
<td>0.586 miles (1,031 yards)</td>
</tr>
<tr>
<td>1,000</td>
<td>11,127.3 m</td>
<td>6.91 miles</td>
</tr>
<tr>
<td>10</td>
<td>1,555,916 m</td>
<td>966 miles</td>
</tr>
<tr>
<td>0</td>
<td>18,337,424 m</td>
<td>11,394 miles</td>
</tr>
</tbody>
</table>

Meteorological Conditions for Pueblo County—Summer 2016

Shedding of pollen and pollen viability is promoted by increased temperature and low humidity. Further, wind direction and wind speed have been shown to control pollen deposition within natural Cannabis grows in Canada (Small and Antle 2003). Figure 6 outlines temperature and dew point, wind speed, and wind direction for Pueblo, CO as captured at the Pueblo airport for the summer of 2016. Temperature is high, humidity is low, and wind speed and direction are extremely variable during the summer months.
Selected Current Buffer Zones for Cannabis

In Canada, regulations for isolation distances for the production of low THC Cannabis seed depend on the type of seeds being produced (certified vs registered) and the type of sexual system displayed by the plant (dioecious vs monoecious) (Table 2). Isolation distances for Cannabis in Canada vary between 1 meter up to 5 km (3.1 miles), a distance which exceeds the requirements for all other Canadian crops (Small and Antel 2003). These distances were based on a survey of European regulations for Cannabis (Small and Antel 2003), which differ somewhat among countries in Europe but are generally comparable. In Russia, for example, an isolation distance of 3–4 km was used for some seed varieties stored at the Vavilov Institute (Lemeshev et al., 1995, Small and Antel 2003). Small and Antel (2003) state that the 5 km distance was never validated experimentally and appears to be the result of collective empirical observations. It is also important to point out that many organic farmers often double or triple official requirements (Moyes and Dale, 1999).

<table>
<thead>
<tr>
<th>Location</th>
<th>Sexual System</th>
<th>Type of Growth</th>
<th>Isolated From</th>
<th>Distance</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>Dioecious</td>
<td>Registered Seed</td>
<td>Different variety</td>
<td>4800 m</td>
<td>Canadian Seed Growers Association</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Same variety but lower pedigree</td>
<td>2000 m</td>
<td>Association</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Same variety</td>
<td>1 m</td>
<td>Association</td>
</tr>
<tr>
<td>Canada</td>
<td>Dioecious</td>
<td>Certified Seed</td>
<td>Different variety</td>
<td>1000 m</td>
<td>Canadian Seed Growers Association</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Same variety but lower pedigree</td>
<td>200 m</td>
<td>Association</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Same variety</td>
<td>1 m</td>
<td>Association</td>
</tr>
</tbody>
</table>
In order to put different isolation distances in context, a map of Pueblo County was produced showing the zoning. Currently, outdoor *Cannabis* production is limited to land zoned as agriculture, shown in light green on the map in Figure 7.

<table>
<thead>
<tr>
<th>Country</th>
<th>Type of Seed</th>
<th>Isolation Distance</th>
<th>Distance in Miles/E.</th>
<th>Responsible Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>Registered Seed</td>
<td>4800 m</td>
<td>5 miles</td>
<td>Canadian Seed Growers Association</td>
</tr>
<tr>
<td>Canada</td>
<td>Registered Seed</td>
<td>2000 m</td>
<td>2.5 miles</td>
<td>Canadian Seed Growers Association</td>
</tr>
<tr>
<td>Canada</td>
<td>Registered Seed</td>
<td>200 m</td>
<td>1 mile</td>
<td>Canadian Seed Growers Association</td>
</tr>
<tr>
<td>Washington</td>
<td>Certified Seed</td>
<td>1000 m</td>
<td>6.25 miles</td>
<td>Washington State Department of Agriculture</td>
</tr>
<tr>
<td>Pueblo County, CO, USA</td>
<td>Certified Seed</td>
<td>200 m</td>
<td>1 mile</td>
<td>Pueblo County Zoning</td>
</tr>
<tr>
<td>Pueblo County, CO, USA</td>
<td>Certified Seed</td>
<td>1 m</td>
<td>0.625 miles</td>
<td>Pueblo County Zoning</td>
</tr>
</tbody>
</table>

**Figure 7.** A map of Pueblo County with agriculture zoning indicated in light green. Different isolation zone sizes are shown on the map.
Discussion and Recommendations

**Long-Distance Cannabis Pollen Transfer has been demonstrated**

As reported above, long distance transport of Cannabis pollen has been demonstrated in multiple studies on multiple continents (Cabezudo et al. 1997, Aboulaich et al. 2012, Stokes 2000, Small and Antle 2003). Given that we know the pollen is in the atmosphere, only one regional-scale distance study has been completed, finding that the pollen distribution appeared to follow a leptokurtic curve (see Figure 2), dropping as they sampled further from the source, but much more slowly with increasing distance. This result follows what has been demonstrated in corn. Small and Antle (2003) also concluded that, given this pollen distribution, it may be impossible to guarantee complete absence of potentially contaminating pollen in the field and, for practical purposes, a very low amount of undesired gene flow would need to be tolerated.

**Shape of the buffer zones**

In wind pollinated plants, like Cannabis, it has been demonstrated that pollen is carried primarily downwind (Jo et al. 1984, Saeglitz et al. 2000). Therefore, wind direction, especially in the summer months, could help inform if buffer zones in Cannabis could be different shapes, depending on prevailing wind directions. Further, it is known that low humidity promotes both pollen shedding from male flowers and extends pollen viability to multiple days. Weather conditions in Pueblo County promote pollen shedding and pollen viability (see Figure 6). Further, there is no expected or common wind direction during the summer warranting the use of circular buffer zones instead on other shapes.

**Buffer zone size**

A 5 km (3.1 mile) buffer zone is widely used in Canada, and was based on exclusion zones used in Europe. Although this size is used widely, it is important to point out again that the equation based on the Small and Antle (2003) Cannabis pollen distribution study predicts that a significant number of pollen grains/m² would still be found at this distance (between 1,000–10,000 pollen grains/day/m²).

**Future Studies**

Future studies should focus on 1) measuring pollen distances in Colorado, and 2) measuring seed set in Cannabis at different distances from a pollen source to predict buffer distances where a tolerable amount of pollination occurs, instead of just measuring pollen. Another avenue for future studies is the viability of Cannabis pollen at different times/distances after shedding.

**Literature Cited**


Water and energy use in cannabis cultivation

Abstract
Because practices and opinions vary about the growth of cannabis, the industry is far from having established best practices to minimize the use of inputs such as water and electricity. A preliminary finding, based on interviews with six people involved in cannabis production, is that cannabis can be grown indoors with ½ gallon per plant per day; outdoor grows use more water. Energy use varies widely and interviews are continuing to determine the range of practices and usage. A Systems Dynamics model with seven sectors (demographics, housing, attractiveness, land use, business attractiveness, energy, and water) has been developed to analyze the region’s energy and water demand variation when a new supply chain system is introduced.

Introduction, including literature review
We report on preliminary findings of a study of the impact of the legalization of cannabis on water and energy use in Pueblo County. First, we studied how much energy and water are needed to grow cannabis. Second, we created a systems dynamics model to project the effects under different scenarios.

Searching for credible information on water and energy use in refereed journal articles and from other sources resulted in a significant and frustrating waste of time. Sources state specific numbers and cite other sources in an echo chamber in which it was difficult to locate the original source, which then sometimes turned out not to contain the statement for which it is cited.

For example, many sources in newspapers and other periodicals on the Internet cite Xcel Energy in Denver as making specific statements about the growth in energy use in the area from marijuana cultivation. After eventually tracking down the source and asking for information, we were told that “As is often the case with news media, what we share with them is not necessarily what is reported, especially if it doesn’t fit the narrative of their story.” In fact, the spokesman said that the company does not gather the data that would be necessary to make statements about electricity consumption by any specific industry.

A figure of water usage of six gallons per plant per day is widely stated in popular magazines and on web pages often without citing a source. For example, Ashworth and Vizuete (2017) cite three sources for a conceptual diagram on the environmental impacts of indoor marijuana cultivation that shows water use of 22.7 liters (6 gallons) per day per plant. Their third source (Bauer et al.) contains the 6 gallons number, citing as its source “the 2010 Humboldt County Outdoor Medical Cannabis Ordinance draft.” That report has an attachment from the Humboldt Growers Association dated December 13, 2010, which estimated the water needs of a mature cannabis plant with 5 foot by 5 foot canopy, watered for about 30 minutes every other day with 24 emitters flowing at 1 gallon per hour; this calculation leads to an estimate of 6 gallons per plant per day. The Humboldt Growers Association paper is the only source we could find for this widely quoted number of 6 gallons per plant per day.

Other sources report environmental impacts at a very high level. A 2012 paper, “The Carbon Footprint of Indoor Cannabis production” appeared in Energy Policy and is widely cited and also quoted, we believe without citation, for statements like this one: “Resulting power densities are on the order of 2000 W/m2, which is on a par with that of modern datacenters.” In terms of CO2 emissions, they state:

From the perspective of individual consumers, a single Cannabis cigarette represents 1.5 kg (3 pounds) of CO2 emissions, an amount equal to driving a 44 mpg hybrid car 22 miles or running a 100-watt light bulb for 25 h, assuming average U.S. electricity emissions.

Another high-level report, the 2016 report by the Marijuana Policy Group, created an input-output model to estimate the overall effect of the marijuana industry on Colorado’s economy.

The literature on growing hemp as fiber for many uses may be relevant, and papers such as Fernando et al. (2014) provide estimates of energy use during the entire production process, including growth,
harvest, processing, and use. Finnan and Styles (2013) examine the effects of replacing other bioenergy crops with hemp. Turunen and van der Werf (2006) examine the major impacts of production of hemp yarn as compared to flax and cotton yarns. The 2005 report from the Stockholm Environment Institute compares the environmental impacts of textile production from cotton, hemp, and polyester. However, these reports focus on the average for crops grown in various environments, especially environments that vary considerably in natural rainfall, and thus their conclusions may not be relevant to Pueblo County.

Water use in growing cannabis can also be compared to water required for other crops. A 2017 news report (http://www.kfyrtv.com/content/news/Industrial-hemp-continues-to-grow-even-during-drought-conditions-430963633.html) quoted a North Dakota farmer as stating that industrial hemp was flourishing in drought conditions and that “it only takes about a third of the water as other cash crops.” Mekonnen and Hoekstra state “The water footprint of cotton fibres is substantially larger than the water footprints of sisal and flax fibres, which are again larger than the water footprints of jute and hemp fibres.”

In order to describe the impact of the newly created supply chain system involving the production and distribution of high and low THC cannabis on Pueblo County, we developed a System Dynamics (SD) model in order to support the decision-making process regarding water and energy consumption. SD methodology was developed by electrical engineer Jay W. Forrester in the 1950’s and it is frequently used for analyzing complex natural and human systems in which there are multiple states with feedback mechanisms between variables of the system whose relationships are defined with nonlinearity (Sterman, 2000). According to Borschev and Filippov (2004), in SD models, the system behavior can be explained by the following:

- There are balancing or reinforcing feedback loops between the variables.
- The system is analyzed at an aggregate level and the items in stocks or flows are not distinguishable.
- The model includes global structural interrelationships and interdependencies between variables of the system.
- There are several delays and the effect of a root cause is seldom proportionate to each other due to differential, nonlinear relationships.

According to Forrester, SD is mostly used to facilitate the decision making process at different levels, where problems are dealt with by including one single decision. However, decision makers might have more than one possible decision and one decision made at one point of time affects the future behavior of the system (Vogstad, 2004). Therefore, SD is defined as the study of complex information-feedback systems with stocks, flows, time delays and parameters depending on the scope of decision making problem. (Borschev & Filippov, 2004).

**How cannabis plants are grown**

Understanding the statements of growers about water and energy use requires some understanding of how cannabis plants are grown; we present a brief description.

Growers use approximately a 90-day cycle. Clones are clipped from a mother plant, rooted in small pots, and then transferred to larger pots or into the ground. In indoor grows, plants may be planted in soil in the ground, in soil in pots, or in a growing medium in pots. In outdoor grows, plants are planted directly into the soil. If plants are planted directly in soil, whether indoor or outdoor, they can be watered with flood irrigation, drip irrigation, or sprinkler irrigation. Plants in pots can also be watered by such methods. In a hydroponics approach, plants are placed in a growing medium in pots, and water is circulated over the plant’s roots several times a day, using pumps.

Indoor grows require fans to circulate air and keep plants cool, heat to keep plants warm, and lights for growth. Pests may be controlled by preventing entry of pests to indoor grows, by encouraging beneficial insects, by using pesticides, or by using animals (such as chickens) to eat the pests. Water can be used as is from the source (tap water, well water, delivered water) or treated to remove contaminants that may accumulate and affect the plant. Nutrients can be added to the water. During growth and flowering states,
plants have different light, humidity, heat, water, and nutrient requirements. Requirements also differ based on strain and on the desired composition of the product. When the plants are mature, they are harvested, dried (which requires air circulation), trimmed, and cured (in containers). Some growers sell the resulting product wholesale or retail, while others process the product into other cannabis products. Such processing require water and energy.

Growers differ in their opinions about the best method for every step described above and the choices made by growers affect the amount of water and energy used.

**Research Methods**

Since our goal was to provide data and a model useful to policy makers in Pueblo County, we chose to focus on gathering information from growers in the County and on creating a model for Pueblo County.

We merged the state lists of MED and REC growers in Colorado (downloaded on July 9, 2017, from the Colorado Department of Revenue Enforcement Division website at https:/ / www.colorado.gov/pacific/enforcement/med-licensed-facilities), eliminated duplicate addresses, and mailed printed letters to 155 growers. Over one-third (54 or 34.8%) of the letters were returned by the post office for various reasons (no such number, no mail receptacle, not known, not deliverable as addressed, attempted). We also used word-of-mouth to locate others who know the industry. We learned that some growers were suspicious of talking with us, believing that information provided to us would be used against the industry. Others were very forthcoming, expressing the belief that policy makers can make better policy if they are well informed.

We have so far spoken with seven people knowledgeable about growing methods, particularly water and energy use. They range from people conversant with methods for very small grows (“smaller than Mom-and-Pop”) to people conversant with very large grows and include indoor and outdoor grows. While the people we talked with were very informative and while their information matched closely across interviews, because the number of people we have talked to is so small, we stress that our findings are preliminary. We are continuing to locate and talk to more people in the industry.

Our modeling approach uses Systems Dynamics (SD). In SD, stocks, flows, and negative or positive reinforcing feedback loops are used in order to study the given complex system. A stock represents the things that can accumulate over time in the system. The stock level changes depending on its in-flows or out-flow. While in-flows are additions to the stock, outflows are losses out of stock. The equilibrium of the system occurs when all in-flows in the system are equal to out-flows. In Figure 1, apart from stock-flow representation, it can be seen that one variable can affect another with the help of an arrow. This can have positive or negative effect on the variables.

![Figure 1. Stock, Flow and Variable Notations in SD Models](attachment:figure1.png)

To better understand the SD approach, a simple model representing a mice population is shown as an example in Figure 2 below. In the model, the “Birth Fraction” variable affects the population increase through the “Mice Population” stock. The rate of inflow “Mice Born Per Year” increases the “Mice Population”. On the other hand, the flow “Death Fraction” and “Mice Population” stock define the dying mice per year, which eventually decreases the population over time since it is an outflow.
Apart from stocks, flows and variables, causal loops between variables are an important concept in SD in order to get an overview of the causality between variables. Causal loop diagrams demonstrate cause and effect. They also help keep track of the behavior of the system through the feedback mechanism between key variables of the system. Those key variables are connected to each other through arrows with a minus or plus sign in a causal loop diagram. A plus arrow represents the positive relationship between connected variables. This means that the variable at the beginning of the arrow affects the variable at the end in such a way that when the former increases, the latter increases as well. A minus sign shows the negative relationship between two variables. In a negative causality, when the variable at the beginning of the arrow decreases, the one at the end of the arrow increases. The causal loop diagram of the mice population model represented in Figure 3 is shown as an example of causal loop diagram. In this causal loop, when births are increasing, population is also increasing, which in turn affects the births in a positive way. This is called a positive reinforcing feedback loop, represented with an uppercase letter R. On the other hand, when population increases, death also increases, which in turn affects the population in a negative way. This is called a negative reinforcing loop, represented with an uppercase letter B.

With the help of these structures and concepts, SD is used to analyze the multistate and multi-loop complex systems which are difficult for decision makers to understand directly. SD gives the opportunity to better grasp the dynamic nature of man-made systems for decision making under certain conditions. When the model of a particular system is coded in a computer program, it gives stakeholders the power of running different simulations under different conditions. This saves a lot of money and time if the built-in model represents the actual system correctly (Najjar, 2013).

**Results**

**Water use**
We state a preliminary finding that cannabis can be grown indoors with an average of ½ gallon of water per plant per day; some growers in some conditions use even less, while others use more. These statements come with significant caveats. This number is not based on measurements, but rather on use as reported by the people we interviewed. Also, we do not know how many plants in Pueblo County are being grown with such practices. Finally, we do not know if specific practices will be sustainable if the retail price for cannabis products falls as supply increases.

Specific practices can minimize the water applied to the plant. For example, cooling by evaporation (using...
cooling walls) adds water to the atmosphere in an indoor grow, reducing evaporation from the plant, and thus the need to add water. However, the cooling wall uses water. In hydroponic growing, the choice of growing medium makes a difference in water retention and thus in water use. Other practices increase the water use. Our preliminary finding is that outdoor grows using flood irrigation use close to the 6 gallons per plant per day estimated by the Humboldt Growers Association.

Some growers treat water before use including reverse osmosis to purify the water. Depending on the design of the RO system, a considerable amount of water can be consumed in generating a required amount of purified water. The indoor hydroponic growers we talked with dispose of waste water via a septic service, that is, the water is placed in a holding tank and picked up for disposal by a septic company. Irrigation in the ground results in some water being consumed by the plant and some being returned to the soil.

Our estimate of the amount of water consumption shows that some indoor growers use considerably less than the widely cited number of 6 gallons per plant per day; our finding is supported by a 2016 presentation by Michael Thomas, Conservation Specialist with Denver Water, who worked with three Denver growers in 2014. Because he did not have data on the number of plants being grown, he did not cite a specific number for water use per plant per day, but he concluded that plants grown in the Denver area did not require 6 gallons and that “water use in this industry is better than many.” He presented data showing that a marijuana grow with medium use of water is similar to a coffee shop or restaurant in the amount of water used. He also made recommendations to reduce water use, including avoiding reverse osmosis, looking for recycling opportunities, and avoiding leaks.

**Energy use**

We do not yet have specific numbers for energy use which seems to vary greatly among growers.

In indoor grows, energy is used to power lights, fans, water pumps, and heating. Growers differ in the lights they use: high pressure sodium lights or LED lights were used by the growers we talked with. Cannabis requires fresh air, so fans are used to make frequent air exchanges. Water pumps are used to water plants and to move water for cooling walls. Heat may be powered by electricity or propane. Other needs for power include operating camera systems, automatic control systems, and opening and closing of windows.

From their viewpoint, the growers we talked with found the electrical infrastructure and reliability to be the challenge. Depending on the lights used, an indoor grow can have high power demands requiring a robust infrastructure. A variation in light delivered to the plants can disrupt the plants’ growth at various stages, so growers need back-up generators in case the power fails. Such generators are also used to maintain power to cameras. Renewable energy (wind or sun) would only be useful with a significant investment in energy storage.

**General Structure**

In order to describe the long-term impacts of the newly created supply chain system involving the production and distribution of high and low THC cannabis on Pueblo County, the time horizon is taken as four years for the simulation starting from 2018 to 2022. Figure 4 describes the main structure of the simulation model, the key variables, and the causal loop diagram. A total of seven sectors were analyzed in the general model with each sector contributing to defining the overall energy and water demand in Pueblo County as a result of the new THC market. The following is a description of these sectors (Najjar, 2013). Most of the following discussion is based on the master thesis developed by Wareef Najjar (Najjar, 2013) which was based mainly on the work done by Vaudreuil et al (2011). Also, part of the modeling is based on the master thesis developed by Gulsevi Basar (Basar, 2013).
**Demographic Sector**

This sector features a four-stock aging chain that represents the total population broken down by age groups "0–19", "20–44", "45–64", and the "65+" group as shown in Figure 5. The stock and flow structure of the aging chain begins with the inflow of Births to the stock of "0–19". All the births of the region (Pueblo region) over the span of one year accumulate in the 0–19 stock. Then there is an outflow from the "0–19" stock called "maturing". This "maturing" is the inflow to the "20–44" age group, which is the next stock in the sequence. The aging chain continues with the outflow "aging" becoming the inflow to the "45–64" age group, followed by the outflow "retiring" flowing into the last age group stock "65+", then has the outflow "elder deaths" which increases with decreasing elder remaining life (exogenous variable). Moreover, Figure 5 shows that the age group "45–64" stock has another outflow which is the "adult deaths" that is a function of the adult death rate (exogenous variable). Net immigration is also an inflow into all age group stocks.

While the birth rate and the death rate will affect the total population, the most important factor that drives total population up or down is the "Perceived Attractiveness" of the region. That is, if people perceive, or believe that a region is particularly attractive, they would then migrate to that region. In the model, labor force is a function of the age groups "20–44" and "45–64" and the labor force participation rate (LFPR) (exogenous variable) (as the stocks "20–44", "45–64" and the LFPR increase the labor force increases). Total population is the summation of all age groups in the region (Figure 5). 'Normal in migration' and 'Normal out Migration' are exogenous variables affecting net immigration for all age groups.
**Housing Sector**

The housing sector describes how the level "Housing" impacts the behavior of the model. The inflow "House Construction" adds to the stock "Housing", while the outflow "Housing Demolition" drains the "Housing" stock as shown in Figure 6. "House Construction" is determined by several factors that combine to show that people move into a region if there is abundant housing, and people move away when housing is scarce. House Construction increases when the "Household to House Ratio" is high, which means there are more people demanding housing than available housing in the region. The "Total Population" from the Demographic part feeds into the "Household to House Ratio", linking the two modules together.
It can be seen that the "Total Population" influences the "Household to House Ratio", which influences the "Housing", which influences the "Perceived Attractiveness", which then feedbacks to influence the "Total Population". The plus at the arrow heads indicates that, if "Total Population" increases, then the "Household to House Ratio" increases. Additionally, if "Total Population" decreases, then this ratio will also decrease, or moves in the same direction.

As shown in Figure 8, there are also minor feedback loops in the Demographic and Housing sector that are seen throughout the model as a growth rate multiplied by a stock. In the Demographic part there is a minor loop containing Births and Population, and in the Housing part of the sector there is the minor feedback loop containing the flow "House Construction" and the "Housing" stock. These minor loops drive the model for positive growth, but they are balanced by negative loops, thus limiting the positive growth that these minor loops bring. Figure 7 shows positive and negative minor loops. Positive loops drive the growth in the model, while negative loops limit the growth.

**Attractiveness Sector**

This sector keeps track of how various factors affect the overall attractiveness of the region to current and potential residents. Things like good town services, open space and a rural feel, besides jobs make the region attractive, while their absence makes the region unattractive. These factors were chosen because of the results of a meeting and interview with the GIS (Geographic Information System) manager of Pueblo County. He provided us with a ranking for these factors with rank 1 being the most important. Table 1 shows these rankings with the factors' strengths:
<table>
<thead>
<tr>
<th>Factor</th>
<th>Rank</th>
<th>Factor Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative regional services</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Relative job market</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>Housing availability</td>
<td>3</td>
<td>1.3</td>
</tr>
<tr>
<td>Land occupied</td>
<td>4</td>
<td>1.2</td>
</tr>
</tbody>
</table>

In order to include these factors into the model, each one of them is placed on a scale from 0 to 2 with zero being extremely attractive and two being extremely unattractive. Each effect is also assigned a factor strength. A power law model including the ratio between the desired and the current value for each factor, using a multiplicative formulation was used to calculate the region attractiveness (Sterman, 2000).

The important piece of this sector is the perception structure. It does not matter to people how attractive the region is. What affects whether or not they move in or out of the region is how attractive they perceive it is. People do not change their minds about a region instantly; it takes some time for this change to take place. To represent this, there is a stock for perceived attractiveness, with a flow to represent the change in perception as shown in Figure 9. The model assumes it takes people about a year to see the changes in attractiveness (Vaudreuil et al, 2011).

**Figure 9. Attractiveness Sector**

**Land Use Sector**

The Land Use sector calculates the total land fraction occupied by housing, commercial, agricultural, and industrial structures in the region. To accomplish this, it was required to determine the total amount of land zoned for residential, commercial, agricultural, and industrial. If we look at the commercial part of the sector in Figure 10 we can see that the variable “land used commercial” divided by the variable “land zoned commercial” gives us the commercial land fraction occupied “commercial LFO”. The variable “land used commercial” is calculated by multiplying “land per commercial” by “commercial business”, and this product is combined with the products from other parts of the sector and finally divided by the “total land area” to give us the “total land fraction occupied”.

**Figure 10. Land Use Sector**
The variable “total land fraction occupied” affects the attractiveness of the region. If this variable value is low, the Pueblo region will be perceived to be more attractive to people and businesses. As more land is used for housing, commercial, agricultural, and industrial new construction, land becomes scarcer, and the “total land fraction occupied” increases causing the region to be less attractive.

There are two attractiveness sectors in this model: One for residential construction represented by the variable Housing (region attractiveness sector) and the other sector for businesses (region business attractiveness sector). Accordingly, there are two feedback loops in this sector as shown in Figure 11: one feedback loop for housing and the other for businesses. These two loops are independent from one another and both are balancing (negative loops) as evidenced by attractiveness decreasing when Total Land Fraction Occupied increases.

**Business Sector**

The developed model looks at the future energy and water demand of the entire region, with special emphasis in the additional consumption generated by the newly created supply chain system involving the production and distribution of high and low THC cannabis, thus the main goal of the business sector of the Pueblo...
County model is to track the growth or declination of commercial, agricultural, and industrial businesses in the region. Businesses will grow in the region if the region is perceived to be attractive to business. Likewise, businesses will decline in the region if the perception of the region is neutral or unattractive. Figure 12 shows that the commercial/agricultural/industrial land fraction occupied, normal commercial/agricultural/industrial in-migration, effect of attractiveness on commercial/agricultural/industrial in-migration, and number of commercial/agricultural/industrial businesses are all factors that affect the growth or decline in the number of businesses. As land fraction occupied increases the number of new businesses will decrease (region is less attractive). As normal commercial/agricultural/industrial in-migration, effect of attractiveness on commercial/agricultural/industrial in-migration, and number of businesses in the area increase, number of new businesses will also increase. In this sector, we are dealing with net change in the number of businesses.

**Business attractiveness sector**
This sector is the same as the attractiveness sector except for the factors. There are four factors affecting business attractiveness as shown in Table 2, availability of skilled labor, cost of doing business, telecommunication services, and regional regulatory environment. These factors were chosen based on the expert's opinion (the GIS manager of Pueblo County) by asking about what factored into decisions of where to locate businesses. We also received a ranking for these factors as shown in Table 2.
TABLE 2: Business attractiveness factors and their rankings

<table>
<thead>
<tr>
<th>Factor</th>
<th>Rank</th>
<th>Factor strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of doing business</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Availability of skilled labor</td>
<td>2</td>
<td>1.4</td>
</tr>
<tr>
<td>Regional regulatory environment</td>
<td>3</td>
<td>1.3</td>
</tr>
<tr>
<td>Telecommunication services</td>
<td>4</td>
<td>1.2</td>
</tr>
</tbody>
</table>

In order to include these factors into the model, each one of them are placed on a scale from 0 to 2 with zero being extremely attractive and two being extremely unattractive. Each effect is also assigned a factor strength. A power law model including the ratio between the desired and the current value for each factor, using a multiplicative formulation was used to calculate the region attractiveness (Sterman, 2000).

Similarly to the general attractiveness sector, the important piece is the perception structure. It does not matter to business how attractive the region is. What affects whether or not business move in or out of the region is how attractive they perceive it is. Business, similar to people, do not change their minds about a region instantly; it takes some time for this change to take place. To represent this, there is a stock for “perceived business attractiveness” with a flow to represent the change in perception as shown in Figure 13. The model assumes it takes business about a year to see the changes in attractiveness (Vaudreuil et al, 2011).

**Figure 13. Region business attractiveness sector**

**Energy Sector**

The energy sector captures four different sources of energy demand as shown in Figure 14, "Total Gasoline and Diesel", "Total Natural Gas Demand", "Total Electricity Demand", and "Total Propane Demand". These four are then added together to give us the "Total Regional Energy Demand", which then flows into the stock, called 'Cumulative Energy Demand Per Capita'. The number of energy consumers in the region was determined; they are represented by "Households", "Commercial Businesses", "Industrial Businesses", "Agricultural Business", and "Municipal Vehicles". For the "Total Natural Gas Demand", "Total Electricity Demand", and "Total Propane Demand" the energy consumers are "Households", "Commercial Businesses", "Industrial Businesses" and "Agricultural Business". The "Total Gasoline and Diesel" has the same consumers
as the rest of the sources of energy demand, in addition to the "Municipal Vehicles". Two particular sources of energy demand in agricultural and industrial businesses are included in the model, agricultural businesses growing high and low THC cannabis and industrial business processing the same products. These particular groups of consumers are analyzed in more detail in order to estimate the increase in energy demand due to the newly created supply chain system involving the production and distribution of high and low THC cannabis.

Figure 14. Energy Sector

**Water Sector**
The water sector captures four different sources of water demand, "Total Residential Water", "Total Commercial Businesses Water", "Total Industrial Businesses Water", and "Total Agricultural Businesses Water". These four are then added together to give us the "Total Regional Water Demand", which then flows into the stock, called "Cumulative Water Demand Per Capita". Two particular sources of water demand in agricultural and industrial businesses are included in the model, agricultural businesses growing high and low THC cannabis and industrial business processing the same products. These particular groups of consumers are analyzed in more detail in order to estimate the increase in water demand due to the newly created supply chain system involving the production and distribution of high and low THC cannabis.

**Discussion and Conclusion**
Growers differ greatly in their practices for growing cannabis, and these practices affect the water and energy use. Differences of opinion appear in specific choices (for example, "LED lights are superior because they can deliver full control over the spectrum" versus "LED lights still vary greatly in quality, especially of the spectrum," versus "LED lights cost too much") and in overall growing philosophy ("light cycles must be rigorously maintained" versus "cannabis plants need stress" versus "some stress is good and some stress is bad"). With increasing study of the science of growing cannabis, best practices may emerge, but the industry is very far from that state.

Because water and energy cost money, growers want to reduce their use of these inputs to reduce their costs. Thus, as growers learn what works, the use of water and energy is likely to fall. However, mitigating against
that trend, is the widely accepted prediction that wholesale and retail revenues from sales of cannabis are likely to fall as supply increases. If emerging best practices require a large investment, will growers be able to afford such investment, or will they cut corners? Many predict that these pressures will lead to a consolidation of the industry with only the largest growers able to operate at a profit.

A Systems Dynamics model has been developed to analyze the region’s energy and water demand variation when a new supply chain system is introduced. Several scenarios can now be analyzed such as environmental policies related to water and land use, CO2 emissions, impact on related and non-related business attractiveness in the region, and high and low THC taxation and its impacts on Pueblo County.

A base case model was run for the main variables of the system. In this model the base case implies that the birth and death rates are kept constant; electricity, natural gas, water and propane usage per house and per business are kept constant as well. Additionally, telecommunication services are constant; average family size is constant; and cost of doing business and regional services are constant as well. Table 3 shows the results of this base case run. The data for the initial values of the population and housing were obtained from the US census (https://www.census.gov/quickfacts/fact/table/pueblocounty/colorado/PST045217#viewtop visited on 12/20/2017). The initial values of the number of businesses were obtained from several business summary reports for Pueblo County; in addition, the city’s sales tax department lists “new businesses” every month on their website (http://www.pueblo.us/Archive.aspx?AMID=41 in 12/20/2018). With these two data sets, the initial values for industrial (primary) and commercial (secondary) business were defined. Both categories, namely of commercial and industrial businesses, include businesses related to the cannabis industry. At this point in our analysis, the model assumes that the consumption of both electricity and water for either a commercial or industrial cannabis-related business is the same as for a non-cannabis-related business—clearly, more data about the size and the type of operation are required to get a better estimate of the impact on electricity and water consumption due to cannabis-related businesses in Pueblo County. Once such data are available (e.g. average number of indoor plants and average number of outdoor plants for industrial cannabis businesses, and related averages for commercial cannabis businesses, along with type of water irrigation system), the model can readily be run with these updated data, to see the impact that these businesses have on water and energy use as predicted by the model.

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Number of Industrial businesses</th>
<th>Number of Commercial businesses</th>
<th>Total Regional Energy Demand (BTUs/Year)</th>
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References


