Adult-use Cannabis and State Research Agencies an Exploratory Study and Development of a Harm-reduction Course

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ADULT-USE CANNABIS AND STATE RESEARCH AGENCIES

AN EXPLORATORY STUDY AND DEVELOPMENT

OF A HARM-REDUCTION COURSE

By

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B.S. Southern Connecticut State University, 2016

A THESIS

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The increasing demand of adult-use cannabis is outpacing the regulatory stride of the states that legalize recreational marijuana. This work is the product of two studies that focus on those states’ agencies that closely work with their constituents. They include those who are invested or reliant on cannabis businesses and those who consume cannabis for medical or recreational purposes. State agencies and resources are funded by those same constituents’ taxes, for which they have the responsibility to protect the public’s best interests as the industry grows.

Chapter 2 describes an inquiry on what information and support is shared with adult-use cannabis industry stakeholders. Land Grant Universities, Cooperative Extensions, and states’ Departments of Agriculture in American states with legalized recreational marijuana by January 2020 were investigated, including recruiting participants for an interview. The policies and norms of interaction with adult-use cannabis business-owners were compiled, and it was found that those agencies that participated in regulation were most likely to provide cannabis stakeholders with information. Regulating authorities and their approaches varied among states. Many agencies’ policies
were unclear or unfinished. Reliance on federal funding is a barrier to support and research, which are both crucial to maintaining a safe and sustainable industry for the entire community.

The University of Maine (a Land Grant University) prohibits all cannabis from its campus, even that which is legally purchased by a medical marijuana patient 18 years of age or older. This is due to the university’s reliance on federal funding for scholarship and other services. Chapter 3 focuses on the development of a cannabis harm reduction course for the University of Maine to utilize when disciplining students who violate its cannabis ban. A pilot course was delivered to student volunteers who also opted into an anonymous survey. The survey was designed to promote self-reflection on cannabis use habits and beliefs as well as to capture their valuable information as University of Maine students. Sharing reliable researched-based information on cannabis aligned with the principles of harm reduction with college students reduces the negative effects of consuming marijuana and acknowledges adult-use cannabis as a legitimate recreational drug as it is in an increasing number of states.

The disparity between federal prohibition of marijuana and state adult-use cannabis causes tension and hinders adequate research and regulation. State-run research institutions struggle to advise and support their citizens without risking their standing with the federal government and its funding. To sufficiently fulfill their responsibilities, state agencies must have freedom to research and clarity on how to regulate adult-use cannabis. While states continue to legalize cannabis and the required infrastructures are built, a multifaceted approach is recommended. Ensuring the safety of products and efficient industry standards attends to the wellbeing of each member of the community.
DEDICATION

This thesis is dedicated to David and SJ.
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TABLE OF CONTENTS

DEDICATION.......................................................................................................................... i

ACKNOWLEDGEMENTS.......................................................................................................... ii

LIST OF TABLES....................................................................................................................... iv

LIST OF FIGURES................................................................................................................... iv

Chapter

1. LITERATURE REVIEW ......................................................................................................... 1
   1.1. Introduction .................................................................................................................. 1
   1.2. Classifications of Cannabis and Cannabinoids ............................................................... 1
       1.2.1. Tetrahydrocannabinol (THC) ................................................................................. 1
       1.2.2. Cannabidiol (CBD) and other cannabinoids .......................................................... 2
   1.3. Marijuana in the United States ...................................................................................... 2
       1.3.1. Medical marijuana legalization ............................................................................. 3
       1.3.2. Recreational marijuana legalization ..................................................................... 3
       1.3.3. Social justice reform measures ............................................................................. 4
   1.4. The Adult-Use Cannabis Industry ............................................................................... 5
       1.4.1. Cannabis business risks ....................................................................................... 6
       1.4.2. Safety of cannabis products .................................................................................. 6
           1.4.2.1. Cannabis-infused foods ................................................................................. 6
           1.4.2.2. Cannabis contaminants ................................................................................. 9
   1.5. State Agencies and Adult-Use Cannabis .................................................................... 9
       1.5.1. Land Grant universities ....................................................................................... 10
       1.5.2. Harm Reduction .................................................................................................. 11
2. REGULATORY FRAMEWORKS AND THE ROLE OF LAND GRANT INSTITUTIONS IN THE
ADULT-USE CANNABIS EDIBLES MARKET: AN EXPLORATORY STUDY........................................... 13

  2.1. Introduction ............................................................................................................................... 13

  2.2. Methods ...................................................................................................................................... 17

  2.3. Results ........................................................................................................................................ 18

    2.3.1. Regulatory framework ........................................................................................................... 21

    2.3.2. Land Grant institutions ....................................................................................................... 23

  2.4. Discussion ................................................................................................................................. 26

  2.5. Conclusions ............................................................................................................................... 32

3. DEVELOPMENT OF A CANNABIS HARM REDUCTION COURSE FOR LIBERAL ARTS UNIVERSITY
STUDENTS ....................................................................................................................................... 34

  3.1. Introduction ............................................................................................................................... 34

    3.1.1. The University of Maine and adult-use cannabis in Maine.................................................... 35

       3.1.1.1. Cannabis policy violations ............................................................................................... 35

    3.1.2. Course development, format, and content .......................................................................... 37

       3.1.2.1. Confidentiality and informed consent ................................................................................. 37

       3.1.2.2. Course content ................................................................................................................. 37

  3.2. Methods ....................................................................................................................................... 39

  3.3. Results ......................................................................................................................................... 40

    3.3.1. Course content and delivery .................................................................................................. 40

    3.3.2. Post-course survey results ................................................................................................. 40

  3.4. Discussion .................................................................................................................................... 50

    3.4.1. Course content and delivery .................................................................................................. 50

    3.4.2. Post-course survey results ................................................................................................. 50
3.4.3. Limitations ........................................................................................................... 54

3.4.4. Implementations and recommendations ......................................................... 54

3.4.4.1. Course implementation by the University of Maine Student Wellness

Resource Office ........................................................................................................... 54

3.4.4.2. Policy recommendations ............................................................................... 54

3.4.4.3. Future research ............................................................................................. 55

3.4.4.4. Alternative uses for the course ..................................................................... 55

3.5. Conclusions ........................................................................................................... 56

SUMMARY .................................................................................................................. 57

BIBLIOGRAPHY ......................................................................................................... 59

APPENDIX A............................................................................................................... 66

APPENDIX B............................................................................................................... 68

APPENDIX C............................................................................................................... 70

APPENDIX D............................................................................................................... 76

APPENDIX E............................................................................................................... 84

BIOGRAPHY OF THE AUTHOR ........................................................................... 87
LIST OF TABLES

Table 2.1. Relative Level of Guidance Provided by State Institutions ........................................ 19
Table 2.2. Departments Regulating Adult-Use Cannabis by State.................................................. 22
Table 2.3. Consultation Policies as Described by Interview Participants ...................................... 24
Table 2.4. Written Policies Provided Without Interview ................................................................. 26
LIST OF FIGURES

Figure 2.1. Relative levels of industry support provided by state institutions to adult-use Cannabis stakeholders .................................................................................................................................................. 21

Figure 3.1. Participants' cannabis use habits .................................................................................................................................................................................. 41

Figure 3.2. Participants' confidence in making decisions about cannabis ................................................................................................................................. 42

Figure 3.3. Participants' confidence in making decisions about cannabis based on usage .... 43

Figure 3.4. Participants' opinions on stigmatization ...................................................................................................................................................... 44

Figure 3.5. Causes of increase in cannabis use .............................................................................................................................................................. 45

Figure 3.6. Participants' purposes for consuming cannabis ........................................................................................................................................ 46

Figure 3.7. Participants' use of THC vehicles .............................................................................................................................................................. 47

Figure 3.8. Participants' perceived benefits of consuming cannabis ................................................................................................................................. 49

Figure 3.9. Participants' perceived adverse effects of consuming cannabis .................................................................................................................. 49

Figure D.1. Slide 1, Cannabis Harm Reduction Course ........................................................................................................................................ 76

Figure D.2. Slide 2, Cannabis Harm Reduction Course ........................................................................................................................................ 76

Figure D.3. Slide 3, Cannabis Harm Reduction Course ........................................................................................................................................ 77

Figure D.4. Slide 4, Cannabis Harm Reduction Course ........................................................................................................................................ 77

Figure D.5. Slide 5, Cannabis Harm Reduction Course ........................................................................................................................................ 78

Figure D.6. Slide 6, Cannabis Harm Reduction Course ........................................................................................................................................ 78

Figure D.7. Slide 7, Cannabis Harm Reduction Course ........................................................................................................................................ 79

Figure D.8. Slide 8, Cannabis Harm Reduction Course ........................................................................................................................................ 79

Figure D.9. Slide 9, Cannabis Harm Reduction Course ........................................................................................................................................ 80

Figure D.10. Slide 10, Cannabis Harm Reduction Course ......................................................................................................................................... 80

Figure D.11. Slide 11, Cannabis Harm Reduction Course ......................................................................................................................................... 81

Figure D.12. Slide 12, Cannabis Harm Reduction Course ......................................................................................................................................... 81
Figure D.13. Slide 13, Cannabis Harm Reduction Course ................................................................. 82
Figure D.14. Slide 14, Cannabis Harm Reduction Course ................................................................. 82
Figure D.15. Slide 15, Cannabis Harm Reduction Course ................................................................. 83
CHAPTER 1

LITERATURE REVIEW

1.1. Introduction

This review will introduce cannabis by giving an overview of the genus and pertinent details about the most important species. This includes chemical properties, human health effects, a brief history of use, historical and current regulatory status in the United States, and a concise summary of some of the most relevant ongoing controversies.

1.2. Classifications of Cannabis and Cannabinoids

The term “cannabis” refers to the genus of the same name and specifically the sativa Linnaeus species and its subspecies sativa and indica (Pollio, 2016). Cannabis is widely known and utilized in the United States for both medical and recreational purposes due to its richness in cannabinoids, which are unique bioactive compounds. Though cannabis, hemp, and marijuana are often used casually and interchangeably, there is a legal distinction between them. The American federal government officially recognizes marijuana as containing greater than 0.3% tetrahydrocannabinol (THC) by weight and retains its illegal status (U.S. Department of Justice, 2019). Otherwise, it is known as hemp, a fully legal crop and product.

1.2.1. Tetrahydrocannabinol (THC)

THC is the primary cannabinoid of interest due to its psychotropic properties. Several derivatives of THC exist within a typical cannabis plant’s biochemical profile, and most of them need heat activation to obtain the desired psychoactive effects (Brown, et al., 2019).

While there is a dearth of conclusive research about the health and physiological effects of THC such as the differences between the affect it has on those assigned male versus female at birth, some of the inherent characteristics of cannabis consumption are associated with health risks. THC is a
hallucinogen and can alter a user’s perceptions and state of mind, causing impairment. Lung health is impacted by smoking or vaping cannabis: there was a recent uptick in cases of adverse effects due to vaping in the United States (Boudi, et al., 2019). Contamination is a risk of any consumable product or drug, but the social nature of sharing cannabis using a pipe or other device that one puts their mouth directly on heightens the concern about spreading of pathogenic illness and viruses like SARS-CoV-2, the cause of the COVID-19 pandemic.

1.2.2. Cannabidiol (CBD) and other cannabinoids

In 2018 the United States legalized hemp and CBD products, if they contain <0.3% THC (U.S. Department of Justice, 2019). Various health benefits have been reported, yet there is little-to-no consensus among the scientific community about the validity of health claims. Currently the United States Food and Drug Administration (FDA) prohibits any health benefit claims to be attributed to any CBD in various products including foods and has warned several companies of noncompliance (Food and Drug Administration, 2019). Within cannabis there are dozens of other known cannabinoids, flavor and odor compounds like terpenes, and more biochemicals but there is an inadequacy of research and information on them (Janatová, et al. 2018).

1.3. Marijuana in the United States

Since the early 20th century cannabis has been both consumed and controlled in the United States. In 1970 cannabis was officially classified as a Schedule I narcotic by the federal Drug Enforcement Administration (DEA), making it one of the most strictly controlled substances in the country (National Institute on Alcohol Abuse and Alcoholism, n.d.). Under the Controlled Substance Act, marijuana is recognized as a drug with no medicinal benefit and high risk for abuse (U.S. Drug Enforcement Administration, n.d.). Regardless, Americans are increasingly accepting of recreational marijuana use: polling indicates 60% of citizens support full legalization of cannabis (Van Green, 2021). States continue
to legalize medical marijuana and adult-use cannabis without the support of the federal government or loosening of restrictions causing a conflict of interest between federal and state autonomy. Ambivalence over federal legalization is largely focused on the unknown public health and economic effects of adult-use cannabis. Entire frameworks of effective policy around safe use and restriction of the drug are needed for development of the actual needs of cannabis legality and oversight. Federal prohibition restrictions would lower the barriers to research and lessen the difficulty of a state developing its legality (Sandler, et al. 2019).

1.3.1. Medical marijuana legalization.

California became the first state to legalize medical marijuana in 1996 followed by Washington, Oregon, Alaska, Maine, and Washington D.C. before 2000, and just over 20 years later persons 18 years of age and older can be prescribed marijuana in 37 states (Berke, et al., 2021). Conditions that are recognized as treatable by cannabis include Alzheimer’s disease, human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), amyotrophic lateral sclerosis, cancer, inflammatory bowel disease, glaucoma, multiple sclerosis, Parkinson’s disease, post-traumatic stress disorder, cachexia/anorexia/wasting syndrome, severe or chronic pain, severe or chronic nausea, seizure disorders, skeletal muscle spasticity (Bridgeman & Abazia, 2017). Cannabis has gained wider acceptance as a therapeutic due to its promise as a versatile drug for the debilitating conditions listed above. It also may help to replace drugs like opioids which are associated with a high risk of dependency and accidental overdose resulting in death (McKenna, 2014). It is expected that within the next 5 years 2.4% of the American adult population will be registered medical marijuana patients (Dorbian, 2021).

1.3.2. Recreational marijuana legalization

Recreational marijuana is known in the United States as “adult-use cannabis” to differentiate it from medical marijuana, and this generally refers to marijuana that can be legally sold to purchasers who are age 21 or older. As of 2021, 18 states and the District of Columbia have legalized adult-use cannabis
Decriminalization and medical marijuana legalization typically precede adult-use cannabis legislation (Pacula & Smart, 2017), where a gradual approach to regulation and acceptance is favorable to the constituency. The District Attorney of New York City relaxed enforcement of some marijuana-related crimes in 2018 (Fertig, 2018), ahead of New York State’s outright legalization in 2021. This pattern may be mirrored in other states, although documentation on the lack of enforcement is not readily available and probably does not exist. In a state where adult-use cannabis is gaining acceptance, police officers might be less inclined—personally or culturally—to charge someone with a low-level possession in favor of an unwritten warning.

As each state legalizes and develops policy at the pace their constituents and governments set individually, the adult-use cannabis infrastructures are built separately. A heterogenous regulatory system obstructs the cooperation state agencies practice when it comes to other agricultural industries. Further, there is a risk of complication when it is necessary to adjust to broader cannabis standards and as they are developed.

1.3.3. Social justice reform measures

Marijuana’s criminalization is extremely costly to those who are charged or convicted of related crimes. It costs thousands of dollars to navigate the court systems before paying any fines or fees to the court, and criminal records with or without incarceration deeply damage a convicted person’s employment potential (Hickey & McLaughlin, 2019). Laws have been disproportionately enforced on Black Americans and other communities of color, and policies such as barring individuals with records of drug possession from participating in adult-use cannabis entrepreneurship deepen social inequities (Resing, 2019). Today, a Black person is more than three times as likely to be arrested for marijuana possession than a white person (American Civil Liberties Union, 2020). States such as New York and Connecticut included conviction expungement measures for some offenses in their 2021 legalization bills, to begin correcting these disparities (Hansen, et al., 2021).
Similar attempts are beginning to be moved through federal legislation. In December 2020 the Marijuana Opportunity Reinvestment and Expungement Act was proposed to decriminalize marijuana and expunge the records of those convicted of nonviolent marijuana offenses (Edmonson, 2020). It passed in the United States House of Representatives, though it failed to advance in the Senate (Walsh, 2020). In May 2021 it was reintroduced with enhanced social justice measures aimed at removing economic barriers to marginalized communities negatively affected by the mass incarceration of drug users (Lozano, 2021).

1.4. The Adult-Use Cannabis Industry

The cannabis market is growing in value and customer base rapidly as legalization occurs state by state. In 2020 $17.5 billion of cannabis was legally sold (Yakowicz, 2021). A 2021 Gallup poll reported the largest proportion of Americans ever (49%) has consumed cannabis at least once (Jones, 2021). Over 300,000 Americans are employed in cannabis (Agustin, 2021). The growth and earning potential make the adult-use cannabis industry irresistible for many entrepreneurs.

As customers demand more choice and better quality, the market lacks the support it needs to stabilize. The expectation of market standards in the United States requires adequate oversight on producers and their inputs and operations. Each state struggles with gaps when it comes to advising, overseeing, and regulating adult-use cannabis (Lamonica et al., 2016), and each one needs to fund the administration and enforcement of these objectives. Secondary sources of information like private organic or other certifying bodies often step in to fill the void left by the state. In the meantime, industry stakeholders, state researchers, cannabis consumers and the greater public rely on faith that the industry and products are safe and sustainable.
1.4.1. Cannabis business risks

Entering the adult-use cannabis market currently is inherently risky, especially for those with less experience in producing and selling such products. The rapid growth in the market is not to be depended on long term because it is new and unstable (Wallace, 2019). Disorganization and a lack of systematic information compounds the risks and limits the options available to cannabis business owners that might need help optimizing their investments.

Cannabis growers, like any other farmers, risk losing yield due to crop disease or improper harvesting methods, growing systems, and inputs (Lenton, et al. 2018; Punja & Rodriguez, 2018; Vogel et al., 2004; Forrest & Young, 2006). Safety concerns surround the use of pesticides or microbial exposure for both farmers and food producers (Green, et al., 2018). It is in the best interest of growers to understand the genetics of the plants they are growing (Mitchell, 2019), but by tradition cannabis strains are highly cross-bred and poorly documented. These topics need research to protect the investments and safety of cannabis business owners, employees and particularly, end users. There is no centralized point of reference to verify the qualities of the strain being grown or even a seed bank system, which in turn hamstrings authorities and research professionals who work to protect the public’s best interests and wellbeing.

1.4.2. Safety of cannabis products

1.4.2.1. Cannabis-infused foods

Commonly known as ‘edibles,’ the most popular forms of edible cannabis are snack and novelty foods like candies, pastries, and other confections. Both THC and CBD are used to infuse food, but THC-infused edibles face a unique set of challenges due to their federal ban and suffer from research and regulatory deficiencies.
Normal challenges of food analysis are further complicated by adding cannabis. Complex food matrices surely interact with cannabinoids, but this area is severely under researched. Thus, methods for standard analyses of edibles do not yet exist (Leghissa, et al. 2019). The potential for any combined or synergistic effect of the bioactive compounds is poorly characterized, especially in the form of an edible. Additionally, cannabinoid concentration determination is not standardized across the scientific community. There is no central body of knowledge on cannabinoids in food and how they are co-metabolized. This dearth of literature is a public safety risk as best protective policies should be scientifically informed (Nie, et al. 2019). The edibles that cannabis consumers are already obtaining are not being researched to the extent that other products might due to the federal restrictions on marijuana.

The key components used in edibles are usually limited to extractions of the flower. Most of the products that are at the highest risks of falling through regulation gaps are infused with potent THC flower extracts (King, 2019). Essential oils are also often extracted by steam distillation and then added back into products for flavor and aroma enhancement (Iseppi, et al. 2019). Each extraction offers opportunity for contamination or concentration miscalculation. To comply with health and quality standards, solvents should be limited to those that are generally recognized as safe (GRAS) including carbon dioxide, ethanol, water, propane, butane, and triglycerides (King, 2019). However, where oversight is lacking there is risk of substandard practices. The safe buying and selling of edible products in the United States requires a high level of compliance with guidance and regulation which is not yet standardized across adult-use states.

The packaging and marketing of these products are not without their own challenges. The goal is to entice the intended adult cannabis users to consume a product, but not children who are also drawn to packaged snack foods and candies. While in states with more robust regulation (i.e., California)
there is usually a set of regulations around things such as the allowed shapes of cannabis candies and approved child-proof containers (Department of Cannabis Control, n.d.), there is no guaranteed avoidance of accidental ingestion. In that case or that of an adverse reaction in an adult consumer, knowing the dosage of THC consumed is valuable information. However, there is no scientific consensus as to what a standard dose of THC is, and further it can affect individual users in surprisingly different and contradictory ways. Adding to the confusion and risk, the actual THC or other cannabinoid content is not always displayed or even accurate on adult-use cannabis products (McPartland, et al. 2017).

Dosages are usually displayed prominently on legitimate cannabis products, but without standardization across cannabinoid testing and research about the longevity of these compounds in food products, uncertainty remains. The scientific community has yet to establish industry standards for testing legal marijuana products of all kinds, despite the increase in demand and distribution of such products nationwide.

According to the state of Colorado’s report on its adult-use cannabis market, the THC potency of both concentrate and flower products has been increasing since 2014 (Orens et al., 2018). Demand for all cannabis products is also increasing. While the demand for flowers intended for smoking dominates the market at 61.8%, edibles contribute only 4.9% (Orens et al., 2018). This implies that in Colorado edible products are not the focus of the industry, and small businesses may be the primary purveyors of such products. Those who may be entering the edibles market with a background in cannabis may lack valuable experience with and special knowledge of food safety. Access to a cannabis dispensary has been associated with an increase in edible use in established cannabis users (Borodovsky, 2016), which is expected to increase further as legalization spreads throughout the country.
1.4.2.2. Cannabis contaminants

_Salmonella_ and _Escherichia coli_ are two pathogenic bacteria that have been found in cannabis, which is known to have a robust microbiome colonizing the tight flower buds (Seltenrich, 2019). These may cause gastrointestinal infections when ingested, but this risk requires more research. Mycotoxins are also a risk in the case of _Aspergillus_ or _Penicillium_ colonization in any agricultural commodity (McPartland, et al. 2017). Without proper testing and oversight, there is an unknown risk that dangerous microflora might cause an outbreak of illness through an edible or other cannabis concentrate product.

Pesticides or plant growth regulators may be dangerous to human health when used irresponsibly. For a crop such as cannabis with little-to-no guidance on such protocols, there is a considerable chance of dangerous levels of pesticide residues contaminating cannabis products. These risks are not mitigated by adequate testing programs in most states, though contamination is found by anecdotal studies (Lenton, et al., 2018). Pesticides have been shown to have carcinogenicity and teratogenicity in humans, (Dryburgh, et al. 2018).

Additionally, heavy metals bioaccumulate in plants such hemp (McPartland, et al. 2017), and could potentially be coextracted and concentrated in products infused with THC. The chances of these adverse health incidences increase as the market and production of such products grows. Consumers are left with little choice but to trust the integrity of the cannabis producers, as there is no external authority verifying the safety of what they are purchasing with intent to consume.

1.5. State Agencies and Adult-Use Cannabis

In the United States food product development is traditionally shepherded by agriculture consultant agencies. These institutions are intended to produce and disseminate research that is
objective, reliable, accessible, and to utilize the resources they are already equipped with to apply science to the industry and interests of the constituents who will benefit from it. Additionally, these agencies often inform or participate in regulation and oversight including licensing and inspections.

State institutions are upheld as public centers of reliable, science-based information, and they are often closely associated with or funded by the federal government. For example, Land Grant institutions are provided monies for both agricultural research and student academic costs. In fact, the University of Maine has a proud legacy of supporting Maine’s rich agricultural history. However, accepting this financing causes a conflict of interest when it comes to cannabis and its contradictory legal status. Producers of all types of cannabis products need reliable information, guidance, and oversight left by regulation and research gaps, and researchers and authorities cite a lack of clarity on what is appropriate and acceptable participation in the industry (Carnevale, et al. 2017; Ghosh, et al. 2016; Lamonica, et al. 2016; Sandler, et al. 2019). Each state approaches this conundrum individually, leading to a lack of consistency across the country. Ultimately these factors contribute to concerns about public health and safety, including delayed policy and guideline development.

1.5.1. Land Grant Universities

Land Grant universities are state-run and federally funded specifically for agricultural research and public benefit (Croft, 2019). The three enactments of this funding are the Hatch Act (1887), the Evans-Allen Act (1977) and the Agricultural Research, Extension, and Education Reform Act (1998). Cannabis is an agricultural product that is burgeoning in America, and it is a research opportunity for students, faculty, and professional staff at these establishments.

Land Grant institutions also include universities established with social equity in mission, including historically black colleges and universities and tribal colleges and universities. Considering the current disparities between law enforcement of white and Black Americans (American Civil Liberties
Union, 2020), and the colonization and dispossession of Native American land and people (Nash, 2019), cannabis research could directly benefit marginalized individuals associated with Land Grant universities.

### 1.5.2. Harm Reduction

Harm reduction is an approach many social programs adopt to protect public health from the negative outcomes of drug use. The University of Maine is an undergraduate university where students are expected to use THC products at an increasing rate as access increases under adult-use cannabis legalization. However, as is the case on most colleges and universities across the country, cannabis is completely banned on university property and at university events due to their reliance on federal funding (Chang, 2021).

Harm reduction theory revolves around the understanding and acceptance that drug use exists and is a part of the spectrum of human behavior in societies. It confronts the reality of drug use without moral judgement of those who choose to use drugs and strives to provide them with what they need to make the healthiest choices possible regardless of drug use. Quality research-based information empowers community members with knowledge, giving them greater autonomy and leading to fewer negative outcomes from drug use, especially in the case of illicit drugs (Ritter and Cameron, 2006). Harm reduction values the voices and perspectives of the affected community (in this case, marijuana consumers at the University of Maine), which is exceptionally important to young adults who are often experimental with drugs and their lifestyles (Palmer et al., 2012). It also prioritizes the reduction of stigma and acknowledges that stigmatizations do not affect all individuals equally. Gender, race, sexuality, socio-economic status, and other intersecting identities may leave some students more vulnerable to stigma than others. Any program disseminated in the name of harm reduction should be based on reliable information so that the target audience has autonomy over their choices. Harm reduction in practice is based on the following principles (National Harm Reduction Coalition, n.d.):
1. Acceptance of drug use in the community and an approach which aims to actively minimize harmful outcomes without judgement.

2. Focus on improving the quality of life of community members rather than abstention only to determine success.

3. Inclusion of the perspectives of the intended community.

4. Consideration of intersectionality, systemic oppression, personal history of trauma and other potential circumstances when designing programs.

5. Acknowledgment of drug use as a complex and non-binary choice, where the goal of increasing the safety of everyone who uses drugs and surrounds them is top priority.

6. Provision a service free of judgment or ulterior motives to the community where it lives.

7. Empowerment of those who use drugs with informational and strategic support to have full agency over their use.

8. Does not minimize or avoid the harm that drug use can cause.
CHAPTER 2

REGULATORY FRAMEWORKS AND THE ROLE OF LAND GRANT INSTITUTIONS IN THE ADULT-USE CANNABIS EDIBLES MARKET: AN EXPLORATORY STUDY

2.1. Introduction

The legal cannabis (*Cannabis sativa* L.) industry is growing rapidly in the United States. The medical and recreational marijuana market grew almost fifty percent between 2019 and 2020 to a value of $17.5 billion (Yakowicz, 2021). Under state and federal law, marijuana has been among the most strictly controlled and controversial substances since the 1930s. In 1973, however, tension began to build as restrictions were loosened by state-level legislation. That year the Drug Enforcement Administration (DEA) began enforcing federal prohibition (Adrian, 2015), while state-level decriminalization had already begun, making possession of small amounts of marijuana a minor offense (Pacula & Smart, 2017).

Today the cannabis plant is recognized by the United States government as having two primary forms, depending on its cannabinoid (bioactive compound) content (U.S. Food and Drug Administration, 2021). “Marijuana” refers to cannabis containing >0.3% of the cannabinoid tetrahydrocannabinol (THC—the psychoactive compound associated with intoxication) by dry weight, and “hemp” contains ≤0.3% THC (Abernethy, 2019). Another cannabinoid found in all types of cannabis is cannabidiol (CBD), which has become a popular natural health ingredient in recent years. Both THC and CBD can be extracted and used to infuse food and other products, and THC-infused foods are commonly called “edibles.” In 2019 the United States federal government legalized hemp and CBD products, if they contain ≤0.3% THC (U.S. Department of Justice, 2019). Hemp is an increasingly popular crop for use in textile and food applications. Any CBD extracted from a hemp plant can be bought and sold legally in the United States and across state lines for any use. THC, however, remains illegal at the federal level, despite being legal in an increasing number of states.
Medical marijuana was legalized for the first time in California in 1996 and is now legal in 37 states (Berke et al., 2021). The first states to legalize recreational marijuana—widely known as “adult-use cannabis” (Wilhelm, 2017)—were Colorado and Washington in 2012, then Alaska, Oregon, and Washington D.C. in 2014, and California, Nevada, Maine, and Massachusetts in 2016 (Hansen, et al., 2021). New York, Virginia, New Mexico, and Connecticut were the four most recent states that passed legalization measures through their state legislatures in 2021.

The process of establishing legitimate adult-use cannabis sales is often halting, indirect, and legally ambiguous. Historically, regulation of recreational THC-containing products in these states is fraught due to the disparity between state and federal legalization statuses. The Controlled Substances Act (CSA) states that any production, distribution, possession, or use of marijuana is illegal, and this designation supersedes state legalization, according to the Supreme Court (Carnevale et al., 2017). Under this rule, the federal government can choose to charge any adult-use cannabis business in the country, which fuels tension and confusion in the industry.

With a market projected to be worth $41 billion in 2026 (Yakowicz, 2021), the allure of an adult-use cannabis business opportunity is hard to resist. Entrepreneurs often arrive with little prior experience in agriculture or food production, raising concerns for public safety. Additionally, the instability of the market equates to high risks for stakeholders (Wallace, 2019). This poses a dangerous dichotomy in the industry. When farmers and processors have questions about crop loss or food safety, they need access to reliable information. If they cannot find reliable guidance, they are vulnerable to economic loss and endangerment of public health.

As adult-use cannabis grows in popularity, different vehicles of THC ingestion move through the market. Many of them are sold by cannabis producers to differentiate their products and expand their brand. Edibles are an increasingly popular THC vehicle that pose a unique set of challenges for the adult-use cannabis industry. Since the processing of ready-to-eat foods has an entirely different regulatory
structure and set of safety concerns, there is a steep learning curve for newcomers to the trade. A food safety failure could cause illness or death in a consumer, and inaccurate THC dosing could cause an overdose. These concerns are magnified in children and underage users, who might be more easily enticed by edibles which often come in familiar candy and pastry forms rather than a smokeable product (MacCoun & Mello, 2015). It is further complicated for the producer when the state agency regulating adult-use cannabis sales is not the same one that regulates the preparation and sale of food. In newly legalized states, selling marijuana and THC is legitimate commerce for the first time. Without access to information or other resources to maintain legal requirements and stay up to date on the latest guidance for product safety, an adult-use cannabis business owner might find themselves at risk of distributing an unsafe edible or other THC product.

Edibles can be formulated from almost any kind of food, but the most popular are pre-packaged desserts, snacks, and candies (Denver Public Health, n.d.; Larkin, 2018). They can be made with unprocessed plant matter, but they are more often made with oils or extracts. The most common solvents used for edible production are hydrocarbons, carbon dioxide, and ethanol (King, 2019). It is unclear to what extent edible processors are preparing marijuana extractives onsite rather than purchasing a standardized commercial product. Since there is no commonly accepted method to extract THC or other cannabinoids, determine their concentrations, and calculate a standard dose, products advertised and actual THC concentrations risk inconsistency. In an ongoing study of a nonrepresentative group of CBD-containing products, the FDA found unlabeled THC in 66% of products tested in 2020 (Hahn, 2020). This study does not include any products labeled as containing THC, but it implies comparable discrepancies between a legal edible’s label and its content. Although states with adult-use cannabis typically prohibit edible packaging from being enticing to children (Gourdet et al., 2017), the concern remains that children and adolescents are more likely to ingest psychoactive THC through edibles than other vehicles, due to the ease of use and familiar yet inconspicuous delivery system.
(Larkin, 2018; Friese et al., 2017). Edibles can be very concentrated, and the effects have a longer onset time, so there is a risk that a consumer—especially children—would ingest much more THC than intended (MacCoun & Mello, 2015).

For many participants in the cottage food industry, the first point of contact for information is a state agency such as Land Grant universities and/or Cooperative Extension services. These institutions receive much of their funding from federal dollars, which can be a barrier to providing support to members of the adult-use industry. Another option for stakeholders to turn to is their state government, such as the department of agriculture. Land Grant universities often work together with state departments on issues important to the community such as food safety, but it is unclear to what extent that is permissible regarding marijuana-specific guidance. These state-run institutions are traditional storehouses of scientific, objective, and unbiased information that is used to serve the constituents of their states, both business owners and consumers. However, the legislature and regulating bodies have been slow to adapt and gaps in the regulation and support networks are well-documented (Carnevale, et al. 2017; Lamonica, et al. 2016; Sandler, et al. 2019).

The lack of clarity on what state institutions are allowed to do with marijuana in terms of adult-use cannabis is a stumbling block to productivity and advancements in significant research and effective policy. The cannabis market is growing, and people are already consuming THC and edibles legally in 18 states and Washington DC. While each state individually develops its regulatory framework for adult-use cannabis, the lack of unification poses problems for the future. There are no central bodies of resources or information, and no baseline for states to start from, making the established market widely variable in a country that has generally open trade across state lines. The characteristics of this new market will pose challenges to the federal government if it legalizes marijuana nationwide, to the favor of most Americans (Daniller, 2019). This industry cannot be safe to both business owners and product consumers without Land Grant institutions providing scientific knowledge and critical discussion.
generated by experts in all fields. The purpose of this study was to 1) gather information from state institutions in those with legalized adult-use cannabis using personal communications and internet searching, and 2) catalog the outreach, transparency, and willingness to interact with the adult-use cannabis industry therein.

2.2. Methods

A standard set of interview questions was developed and approved by the University of Maine (UMaine) Institutional Review Board for the Protection of Human Subjects. Representatives from twelve states (and Washington D.C.) that had fully legalized recreational cannabis by 2020 were contacted for recruitment using a standard script (Appendix 1). Three types of agencies were targeted for this study: Land Grant universities, Cooperative Extension organizations, and state departments of agriculture. These criteria were chosen to focus on food product development and agriculture consultant agencies that may be contacted by adult-use cannabis industry stakeholders in a legal market as the focus of this study was the implications of guidance availability on THC-containing edible production and sales. A total of 27 representatives were contacted. Consenting representatives were asked a standardized set of interview questions (see Appendix 2). Interviews were carried out over phone calls via Zoom online video conferencing software and lasted approximately 20 minutes. The interviews were recorded, transcribed, and summarized in writing. Some recruits declined to be interviewed but provided written policies. These were read and the relevant information was summarized. Information regarding positions and services of organizations not responding to outreach was acquired through official organization websites, when available.

States with legalized adult-use cannabis were characterized by what apparent relative level of support state institutions provided to that industry, which was primarily based on how freely they
shared information (Table 1). Those who provided extensive support included specific items such as informative and technical support, licensing and regulatory information, and food safety guidance. Limited support included providing contacts and referrals, links to other sources, and vague or non-specific information. Institutions classified as providing little-to-no support provided support only to hemp business owners, provided a written statement declining involvement, or provided nothing at all.

2.3. Results

State institutions’ response to recruitment is displayed in Table 1. Four institutions provided an interview with a representative and three provided written policies via email. Five responded to decline participation, while 15 institutions did not reply. Representatives from the Colorado Department of Food and Agriculture, University of Maine and UMaine Cooperative Extension, and the University of Illinois and Illinois Cooperative Extension were interviewed. A representative from the Alaska Alcohol and Marijuana Control Office—who was referred from the Alaska Division of Agriculture, also provided an interview. Three agencies declined to participate but provided references to written policies: Washington State Department of Agriculture, Colorado State University (CSU), and Oregon State University (OSU) and Extension Service. Overall, three state institutions provided extensive guidance, seven provided limited, and 17 provided little-to-no guidance.
Table 2.1.

Relative Level of Guidance Provided by State Institutions

<table>
<thead>
<tr>
<th>Relative Level of Support</th>
<th>Type of Resources Provided</th>
<th>Institutions</th>
</tr>
</thead>
</table>
| Extensive                 | • Comprehensive information, guidance, and technical support available from state experts  
• Licensing and regulatory information  
• Specific food safety guidelines | • Colorado Department of Food & Agriculture  
• Oregon Department of Agriculture  
• Washington State Department of Agriculture |
| Limited                   | • External contacts and referrals  
• Links to external sources  
• Vague or non-specific information | • California Department of Food & Agriculture  
• Colorado State University  
• University of Maine & Extension  
• Maine Department of Agriculture, Conservation & Forestry  
• Massachusetts Department of Agricultural Resources  
• Nevada Department of Agriculture  
• Oregon State University & Extension Service |
| Little-To-None            | • Support exclusive to hemp business owners  
• Provision of written statement declining participation in the study  
• No support was provided or found | • University of Alaska Fairbanks & Cooperative Extension  
• Alaska Division of Agriculture (referred to Alcohol & Marijuana Control Office)  
• University of California Berkeley  
• University of California Davis Cooperative Extension  
• Colorado State Cooperative Extension  
• University of the District of Columbia  
• University of the District of Columbia Cooperative Extension Service  
• University of Illinois & Extension  
• Illinois Department of Agriculture  
• University of Massachusetts Amherst & Extension  
• Michigan State University & Extension  
• Michigan Department of Agriculture & Rural Development  
• University of Nevada Reno  
• University of Nevada Cooperative Extension |
Table 2.1. Cont.

*Relative Level of Guidance Provided by State Institutions*

<table>
<thead>
<tr>
<th>Relative Level of Support</th>
<th>Type of Resources Provided</th>
<th>Institutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little-to-No</td>
<td>• Support exclusive to hemp business owners</td>
<td>• University of Vermont &amp; Extension System</td>
</tr>
<tr>
<td></td>
<td>• Provision of written statement declining participation in the study</td>
<td>• Vermont Agency of Agriculture, Food &amp; Market</td>
</tr>
<tr>
<td></td>
<td>• No support was provided or found</td>
<td>• Washington State University &amp; Extension</td>
</tr>
</tbody>
</table>

*Note:* This study included each Land Grant University, Cooperative Extension, and state Department of Agriculture in each state that legalized adult-use cannabis as of January 2020, n=27. The agencies contacted to request for an interview declined participation or did not respond, except for the following:

- A representative from this agency provided an interview.
- A representative from this agency provided written policies.

States were classified based on the greatest amount of technical assistance and information available through their Land Grant universities, Cooperative Extensions, and Departments of Agriculture. Colorado, Oregon, and Washington provided extensive industry support, while Alaska, California, Maine, Massachusetts, and Nevada were more limited. Washington DC, Michigan, Illinois, and Vermont provided little to no support (Figure 1).
Figure 2.1. Relative levels of industry support provided by state institutions to adult-use cannabis stakeholders

Note: This study included each state that legalized adult-use cannabis as of January 2020, n=12.

2.3.1 Regulatory framework

Five states regulated their adult-use cannabis through their revenue or commerce departments. Three utilized a control department. Two states used multiple departments, and two, one of which was Washington D.C., did not have a regulatory board established at the time of contact (Table 2).
Table 2.2.

Departments Regulating Adult-Use Cannabis by State

<table>
<thead>
<tr>
<th>Adult-Use Cannabis Regulatory Board Type</th>
<th>State &amp; Agency/Agencies</th>
</tr>
</thead>
</table>
| Revenue/Commerce                        | • Alaska: Department of Commerce, Community, & Economic Development – Alcohol & Marijuana Control Office  
• Colorado: Department of Revenue – Marijuana Enforcement Division  
• Illinois: Department of Financial & Professional Regulation – Adult-Use Cannabis Program  
• Maine: Department of Administrative & Financial Services – Office of Marijuana Policy  
• Nevada: Department of Taxation – Marijuana in Nevada |
| Control/Enforcement                     | • Massachusetts: Cannabis Control Commission  
• Michigan: Department of Licensing & Regulatory Affairs – Marijuana Regulatory Agency  
• Oregon: Liquor Control Commission – Recreational Marijuana Program |
| Shared                                 | • California: Bureau of Cannabis Control; Department of Food & Agriculture – CalCannabis Cultivation Licensing; Department of Public Health – Manufactured Cannabis Safety Branch  
• Washington: Department of Agriculture – Marijuana Department and Liquor & Cannabis Board |
| None                                    | • District of Columbia  
• Vermont |

Note: This study included each state with adult-use cannabis as of January 2020, n=12.

Two enforcement agencies provided interviews for this study. They were referred to us by the state departments of agriculture in Alaska and Colorado. Both agencies shared objective information and facts freely but refrained from providing legal advice or opinions of any kind (Table 3). The Colorado Marijuana Enforcement Division described a robust and extensive structure around their adult-use
cannabis market, promoting a “seed-to-sale” approach of covering the entire production chain with effective policies (Gray, S., personal communication, February 13, 2020).

2.3.2 Land Grant institutions

Two interview participants represented Land Grant universities or associated Cooperative Extension agencies—UMaine and the University of Illinois. Of the two, UMaine employees reportedly had broader permissions to consult with adult-use cannabis stakeholders—including disseminating objective information and visiting legitimate marijuana farms upon request—but no cannabis was currently allowed on university property for any purpose (i.e. testing or research). This hinders adult-use cannabis growers who need information including testing services and producers and sellers who need to verify THC content and other relevant safety and quality parameters such as microbial quality/safety, pH, water activity, etc.. The UMaine Extension, food, and agriculture laboratories and applicable services cannot be utilized for marijuana testing of any kind (Carter, H., personal communication, December 4, 2019). The University of Illinois was, at the time of the interview, exclusively consulting with hemp stakeholders (Alberti, P., personal communication, January 17, 2020). Both representatives reported receiving a high volume of inquiries on cannabis, but neither had organization-level written policies available at the time of the interview.
Table 2.3.

Consultation Policies as Described by Interview Participants

<table>
<thead>
<tr>
<th>Institution</th>
<th>Information Provided</th>
</tr>
</thead>
</table>
| Alaska Alcohol & Marijuana Control Office (Hoelscher, J., personal communication, February 5, 2020.) | • When the Department of Agriculture was contacted for recruitment in this study, they referred us to this office.  
• Various requests on adult-use cannabis, including edibles, are being fielded.  
• The current policy approves of providing factual information on policies written by the Control Board.  
• No opinions or legal advice are permitted to be disseminated. |
| Colorado Marijuana Enforcement Division (Gray, S., personal communication, February 13, 2020) | • When the Department of Agriculture was contacted for recruitment in this study, they referred us to this office.  
• This enforcement agency falls under the Department of Revenue, and it cooperates with the Department of Public Health.  
• The oversight is summarized as “seed-to-sale,” and regulators actively improve their practices.  
• There is a fully functioning set of policies and statutes. Almost all support is approved, except legal advice. |
| The University of Illinois and Extension (Alberti, P., personal communication, January 17, 2020) | • A wide variety of requests regarding hemp are received, and informative support is broadly permitted.  
• Marijuana may not be consulted on whatsoever. No known inquiries about edibles had been made at the time of the interview.  
• Written policies are in progress. |
| The University of Maine and Extension (Carter, H., personal communication, December 4, 2019.) | • Many requests are reaching the Extension office, the vast majority of which are for agricultural support.  
• The standing policy is that providing informative support is approved of, including answering questions, providing diagnostics, and farm visits.  
• No cannabis plant material (marijuana or hemp) is allowed on the university’s property, including labs.  
• These policies are disseminated verbally. |

Note: This table contains results from all offices that agreed to provide a representative for interviewing, n=4.

Representatives from the respective Extension offices at CSU and OSU declined participation but provided written policies via email in response. The emailed responses provided links to similar disclaimers indicating limited support was provided to the adult-use cannabis industry (Table 4). CSU
declared no financial gifts or funding was accepted from adult-use cannabis businesses and provided an external link to the FDA’s statement on the legalization of hemp (Colorado State University Research Integrity & Compliance Review Office, n.d.). It is unclear whether product samples for testing and payment for the service would be accepted at CSU. OSU stated that they provided no advice on anything related to adult-use cannabis, only broad or vague questions applicable to other crops. Specific queries should be forwarded to other agencies (Oregon State University, 2019).

The Washington State Department of Agriculture—one of two licensing bodies in the state—also declined to be interviewed but offered links to their website. There, one seeking information on marijuana could find links to all the adult-use cannabis regulations in Washington and contact for technical support. A broad range of support on crop and product production is readily accessible including a guide to achieving licensure ("Marijuana-infused edibles processors," n.d.).
Table 2.4.

Written Policies Provided Without Interview

<table>
<thead>
<tr>
<th>Institution</th>
<th>Information Provided</th>
</tr>
</thead>
</table>
| Colorado State University (Colorado State University Research Integrity & Compliance Review Office, n.d.) | • CSU does not accept gifts (financial or otherwise) from the adult-use cannabis industry (URL: www.research.colostate.edu/ricro/cannabis-research/marijuana-faqs/)
• A link to the FDA’s statement regarding CBD is provided (URL: www.research.colostate.edu/ricro/cannabis-research) |
| Oregon State University and Extension Service (Oregon State University, 2019) | • “OSU Extension Services will not provide instruction regarding how to grow, manufacture, distribute or dispense marijuana.” (URL: research.oregonstate.edu/cannabis-research)
• Queries from the industry should be referred to other state agencies. However, broad questions that apply to other crops may be answered, such as best practices for pesticide use. Extensive background on marijuana and its current legal context and status are provided. (URL: policy.oregonstate.edu/UPSM/07-045_university_policy_marijuana) |
| Washington State Department of Agriculture (“Marijuana-infused edibles processors,” n.d.; RCW §§ 69.07.200, 2016; WAC §§ 16-131-010–16-131-110, 2018; WAC §§ 314-55-077, 2018) | • This agency regulates and licenses (via special endorsement) edible marijuana businesses. To this end, it cooperates with the Washington State Liquor and Cannabis Board. It costs $895 per year to maintain the special endorsement. The Food Safety Program will provide technical support to edible processors, along with regulations and inspections. Edible production facilities must be kept segregated from non-marijuana-containing production. (URL: agr.wa.gov/departments/food-safety/food-safety/marijuana-infused-edibles)
• Links to the regulations on marijuana products are provided. (URL: apps.leg.wa.gov/wac/default.aspx?cite=16-131) |

Note: This table contains results from all offices that provided written policies via email, n=3.

2.4. Discussion

The differences in relative industry support provided by institutions in different states with adult-use cannabis may be partly explained by how recent the legalization is. Colorado and Washington passed legislation in 2012 (H.B. 13-1317, 2013; Initiative Measure No. 502, 2011), and Oregon followed suit in 2014 (Measure 91, 2014). Each provides extensive information and support to adult-use cannabis.
industry business participants and stakeholders. Conversely, Vermont legalized marijuana in 2018 with Michigan and Illinois following in 2019 and 2020 (No. 86, 2018; Initiated Law 1, 2018; Public Act 101-0027; 2020), and none of these more recently legalized states provides substantial support to adult-use cannabis businesses through their state institutions. It can take several years for legal sales to commence after legalization, but producers need information before that time to seek appropriate licenses and develop safe product formulations.

More newly legalized states may look to more veteran infrastructures for guidance on regulations and licensing. Colorado was one of the first states to legalize adult-use cannabis, and its Marijuana Enforcement Division demonstrated the most comprehensive oversight plan documented in this study. Their regulations cover each aspect of the adult-use cannabis market and are frequently reviewed and updated in collaboration with the Department of Health (Gray, S., personal communication, February 13, 2020). Washington also had a multifaceted approach to integrating legal marijuana into its economy. There, adult-use cannabis may be licensed by either the State Department of Agriculture or the Liquor and Cannabis Board (Washington Department of Revenue Marijuana Enforcement Division, n.d.), and a broad range of cannabis products is covered by specific policies (Gray, S., personal communication, February 13, 2020). These actions make Colorado and Washington two states that others can look towards for guidance when legalizing adult-use cannabis. California demonstrates that states are benefiting financially from embracing adult-use cannabis: the state has raised $2.8 billion in related tax revenue since early 2018 (Campbell, 2021).

Existing heterogeneity in regulatory structure within legalized states may create uncertainty for both newly legalized states and business owners, as well as barriers to interstate commerce or establishment of multiple storefronts as regulations continue to ease. States typically use either commerce and revenue or control and enforcement boards to regulate adult-use cannabis, indicating substantially different approaches. Overseeing adult-use cannabis from a revenue-focused standpoint
lends itself well to structuring the market and taxing it appropriately, while an enforcement approach is prepared to ensure appropriate distribution and consumption is practiced. It is recommended that both areas of concern—economic impact and supply chain—are formally involved regardless of which branch is used to regulate adult-use cannabis to ensure a sustainable, healthy industry for all stakeholders. Siloing regulation without coordination between the governing bodies can lead to a lack of official guidance for industry members. For example, additional regulations should apply to sales of edible products, which more closely resemble foods, as opposed to smokable products. Appropriate expertise may therefore comprise a variety of state employees from commerce, agriculture, and enforcement branches.

Two states are placing the licensing and oversight authority on multiple departments. California’s regulatory boards are the Bureau of Cannabis Control, CalCannabis Cultivation Licensing under the Department of Food and Agriculture, and the Manufactured Cannabis Safety Branch under the Department of Public Health. Washington has established a Marijuana Department under the Department of Agriculture and included adult-use cannabis in their liquor regulatory structure under the Liquor and Cannabis Board (Washington State Department of Agriculture, n.d.). These shared licensing structures may provide more balanced oversight in the industry by sharing the responsibility and expertise across several departments. On the other hand, there is an increased chance of delays or confusion caused by competing priorities when it comes to regulating products for constituent cannabis consumers. It would be particularly pertinent to assess attitudes among adult-use cannabis business owners in these states to determine whether a more comprehensive regulatory structure is viewed as a source of value or a hindrance to the operation of their firms.

Vermont and Washington D.C. do not yet have a regulatory board established for adult-use cannabis. Vermont passed legislation in 2018 (No. 86, 2018), demonstrating the time it takes to begin licensing and selling a new controlled substance. Washington D.C. legalized adult-use cannabis in 2014,
and although it still has no legal sale infrastructure for adult-use cannabis, medical THC products, and CBD products are purchasable (“Weed delivery services & smoke shops in DC,” n.d.). This is probably because it has no state government, which is the level at which most states regulate adult-use cannabis, causing a lack of clarity on how to proceed. This conflict would also contribute to the lack of informative support available at the relevant institutions. Regardless, cannabis products are still being sold to the extent the law will allow it, even in places with stricter controls, regulation gaps, and a lack of guidance.

The institutions’ responses to requests for participation were partially used to gauge their willingness to disseminate information. Most agencies were at least somewhat reluctant to comment or share knowledge, which speaks to the ongoing trepidation of institutions in the face of conflicting state and national legal status of marijuana. Regulatory bodies—such as Alaska Alcohol & Marijuana Control Office, Colorado Marijuana Enforcement Division, and Washington State Department of Agriculture (Tables 3 and 4)—were typically more willing to discuss adult-use cannabis, logically, as they are officially tasked with operating within this market. Reluctance especially in the cases of Land Grant universities—like UMaine, the University of Illinois, CSU, and OSU (Tables 3 and 4), which receive essential federal funds for their research and basic operation—likely stems from the confusion between state legality and federal prohibition. Any external involvement with adult-use cannabis stakeholders that may be deemed inappropriate would risk the financial health of their institutions and potentially damage the careers of the individuals involved in disseminating information or support.

Land Grant institutions are intended to be at the forefront of discovery in the United States, but they are largely uninvolved in adult-use cannabis research, even in states where it is fully legal. Research on marijuana or any other controlled substance must be approved and licensed by the DEA, which is a restrictive process. However, there is an ever-growing list of questions about adult-use cannabis that researchers are presented with, especially as legalization and legal use spread throughout the country. Rigorous investigations are needed in sciences including cannabis plant genetics, extraction and
puration methods, accurate testing protocols, and health and safety effects. If universities are not addressing these concerns through reproducible studies, the safety and legitimacy of adult-use cannabis production are compromised. Progress is limited in the field, including potential advancements in the use of cannabis for pain and disease treatment. Academic researchers are also hampered by being excluded from an extensive area that is worthy and necessary to study. Those who are interested in and poised to advance research in the field through their work at a university waste time and effort trying to navigate ever-shifting policies and verbal implications. Students at these universities are thereby prohibited from participating in formal research and academic work in the field, so cannot be well-prepared for a career in this booming market.

Even if there were no restrictions on marijuana research, analysis of adult-use cannabis edibles poses several challenges to the industry. There is an increasing concern about contaminants, including heavy metals, pesticide residues, and pathogenic microbes. Cannabis absorbs heavy metals from soil and there is little guidance on pesticide use or microbial safety (Brown, et al., 2019; Dryburgh, et al. 2018; McPartland, et al. 2017). Additionally, there is a large chemical composition variability between ‘strains’ or cultivars of marijuana (Janatová, et al. 2018). All these concerns become greater when the desired cannabinoids are extracted from the flowers, concentrated, and added into foods. Chemical profiling of these characteristics is possible, but it requires chromatographs and mass spectrometers, as well as chemistry and food science expertise (Leghissa, et al. 2019).

Edible producers need to know where to go to test their products, for both safety and accurate labeling purposes. For traditional food products, these functions would be filled by universities and Cooperative Extension, but because of the discrepancy between state and federal regulations, publicly funded institutions are unable to fill these needs. The risk of participating in testing and advising adult-use cannabis producers is a loss of funding or employment. This causes a break in the chain of responsibility, as neither the regulators nor the producers nor the consumers have the legitimate power

30
to make informed decisions. Accurate testing is vital for a healthy legal market, which relies on trust between the consumer and the processor, but this area too is under-regulated (Ghosh, et al. 2016; Seltenrich, 2019). For employees of public universities, it is currently unclear to what extent support of cannabis-related businesses is acceptable within their positions, leading to uncertainty and frustration on the part of experts and the business owners who contact the universities for direction.

Reticence to engage directly with the members of this growing industry presents several significant ongoing issues concerning the protection of public health. The Land Grant and Cooperative Extension institutions in each state commonly advise state agencies and industry members on issues, especially those that protect the health and interests of the community. The variety of adult-use cannabis products available to the public are new to the legal market, so unbiased research-based information on them is desired by the public and needed to fulfill the responsibilities of regulatory and entrepreneurial bodies alike. In the case of less controversial products (e.g., hemp and CBD), the Land Grant university and Cooperative Extension system consults on topics covering the entire production chain: from business best practices and sustainability to the preservation of public and ecological health. Further, the Extension system is funded by grants under the Hatch Act of 1887 to further agricultural research broadly (U.S. Department of Agriculture, n.d.). Cannabis cultivation is an agricultural business and since marijuana cannot be legally bought or sold across state lines the businesses remain dependent on their local communities and infrastructures. Important services such as cannabinoid content determination and product safety testing are not being done by these institutions in most legalized states. While some of these tests may be executed by private laboratories, unbiased research on the methods used is not being done by the university scientists either due to the restrictions of marijuana’s Schedule I designation by the DEA. Regardless of these hindrances, adult-use cannabis products are being produced, sold, and consumed. The reluctance of state-run agencies to discuss these topics and the existing adult-use cannabis businesses in their states is alarming and speaks to the crux of the
problem: while the regulatory and scientific systems of government are slow to confront the reality of adult-use cannabis commerce, the industry continues to grow like a weed.

2.5. Conclusions

The adult-use cannabis industry needs guidance and resources, especially when it comes to edibles (Leghissa, et al. 2019; Seltenrich, 2019). The current disorganization and lack of systematic information cause problems for producers beyond needing to search for secondary unreliable information sources. For example, to best participate in the industry, farmers need to understand the genetics of their marijuana plants and how they reproduce (Mitchell, 2019). Consumers should understand the difference between hemp and marijuana as well as the differences in the strains of marijuana available to them, and they should trust this information. There should be a reliable seed bank to protect the genetic diversity of these strains. There are also challenges for researchers and authorities, who are not in agreement with how to best address the changing adult-use cannabis market. There is a broad public food safety concern, due to the lack of information, guidance, and oversight provided to the edible adult-use cannabis industry (Nie, et al. 2019).

When discussing adult-use cannabis policy at specific state agencies, regulatory bodies are more forthcoming, while others are more hesitant. Large variability in regulation structure was observed from state to state—in both policies and types of agencies carrying it out. Such discrepancies may lead to further confusion as more states legalize adult-use cannabis. Research and informative support are needed throughout the adult-use cannabis industry to serve the public’s best interest, protecting both adult-use cannabis business owners and the consumers of their products. Most of the regulatory and research attention is focused on smokable marijuana flowers. However, other vehicles—especially edibles—may compound health concerns. The lack of clarity and structural differences in oversight leaves consumers and state constituents under-protected in this novel market. A systematic,
coordinated approach to regulation, oversight, taxation, and enforcement is recommended to protect adult-use cannabis consumers, producers, and other stakeholders including employees of the state.
3.1. Introduction

Maine legalized adult-use cannabis for users 21 years of age or older in 2016 and legitimate sales began in 2020. Despite this legislation, cannabis is banned on the University of Maine campus due to it remaining a federally illicit drug. Currently, students who are found in violation of the UMaine alcohol and drug policies are required to take a harm-reduction course that primarily focuses on alcohol. These contradictions cause confusion for consumers and university employees alike. Cannabis is a vastly different drug from alcohol, and it best serves each community to provide specific relevant information as it becomes available with increasing research.

In legalized states there is often increased access to marijuana for all consumers, regardless of their age. The use and acceptance of marijuana is growing so fast that public institutions struggle to adequately support their citizens who consume cannabis. Regulation and oversight tend to be sparse and lacking rigorous scientific support (Lamonica et al., 2016). This is due to the difficulty of studying or even acknowledging legal marijuana which is still prohibited at the federal level. State agencies and infrastructure must adapt policies and programs to accommodate marijuana or develop new ones which is a costly and typically mystifying endeavor in the rapidly shifting political and legal climate. Proactive, systematic policies and programs are recommended to address the regulation and research gaps and protect marijuana consumers. One of these programs is the culmination of this chapter’s work: the development of a harm reduction course on cannabis for use by the University of Maine Division of Student Life using evidence-based practices.
3.1.1. The University of Maine and adult-use cannabis in Maine

Although it is in a state where both adult-use cannabis and medical marijuana, cannabis of any kind is banned on University of Maine property (Division of Student Life, 2017). This is true even if it was legally prescribed or purchased. Thus, it is anticipated that there will be an increase in university cannabis policy violations because of the increased access to marijuana in Maine and the confusion between state and federal legality.

3.1.1.1. Cannabis policy violations

The University of Maine Student Conduct Code applies to all students on campus, off-campus at a university function, and those who “adversely affect the university and/or the pursuit of its objectives” (Division of Student Life, 2015). When a student violates this code, they are referred to the Office of Community Standards, Rights, and Responsibilities via an incident report (Division of Student Life, 2017). The student in question will then have a hearing, where the office will decide whether a student is in violation of the code. If so, the student will be sanctioned, or given sanctions that may affect their status and/or privileges as a student, require payment of a fine, and/or allocation of time including being required to attend “substance abuse” courses. In the 2019–2020 academic year, 4,179 cases of various policy violations were handled by the office and 2,745 individuals went through the conduct process, although it is undisclosed how many of these violations were related to drugs and/or alcohol (Division of Student Life, n.d.). A sanctioned student may appeal the finding of their case, but if found in violation in permanency, their record will be held for at least seven years which could affect the student’s ability to get a job in certain fields post-graduation. Among the negative consequences of being found in violation of the conduct code, the stigma of being deemed a marijuana user may be a detriment to the students’ quality of life. This negative judgement is expanded to the students’ place within the community if the code is being applied under the evaluation that a student is “adversely affect[ing] the university and/or
the pursuit of its objectives,” which would imply that the use of marijuana in general—even that which is medically prescribed—is regarded negatively by the university administration.

Currently, when students are found in violation of the university’s alcohol and drug policy, they may be required to take a harm reduction course through the Student Wellness Resource Center. The course is called Brief Alcohol Screening and Intervention for College Students (BASICS), and its goal is to provide students with information and insight to help them make better decisions if consuming alcohol (Dimeff et al, 1999). Implementation of BASICS has demonstrated effectiveness in reducing alcohol-related problems and risky decisions (Tomaka et al., 2012). At the University of Maine, the course typically only contains a brief overview of cannabis use, uses outdated information, and primarily focuses on its interaction with alcohol. However, it is in the best interests of University of Maine students and the greater community to provide the sanctioned students with information specific to their violation. Alcohol and cannabis are vastly different drugs and providing a separate and specific course for cannabis ensures the right information be delivered to the target audience. The goal of the course is to empower students to make informed choices regarding cannabis use, and ultimately reduce negative outcomes associated with marijuana consumption.

Alternatively, a student may attend a one-on-one meeting with a Student Wellness Resource Center employee which consists mainly of motivational interviewing techniques. Since these meetings are less structured and driven by what the student shares, they may be more relevant and focused on marijuana. However, there is less emphasis on sharing research-based information, which is crucial for empowering the student to make the best choices for them. This option may help some students feel more comfortable sharing their opinions of and experiences with marijuana. Each student should have the opportunity to engage with the material in the format that suits their learning and development styles as naturally as possible, especially when addressing public health and drug use. A course and
information repository specific to cannabis is an asset to the University of Maine which refines its harm reduction services and offerings for the student body.

3.1.2. Materials and Methods

The goal of implementing a harm reduction course is always to reduce the frequency of negative outcomes from cannabis use, rather than to promote abstinence only or use shame to convince drug users to quit. It was modeled after the BASICS course, which is the method utilized by University of Maine Student Life to reduce the harm caused by alcohol use by students sanctioned for drug and alcohol violations.

3.1.2.1. Confidentiality and informed consent

Each course delivered may not be given privately, but typically with other sanctioned students. Thus, confidentiality is emphasized and explained to each participant. The students are expected to gain confidence by the instructor setting the standards for the behavior of the participants directly, and explaining what confidentiality means in the context of university services.

Before the course began the students were given a thorough explanation as to the purpose of the course, the concept and approach of harm reduction, and how confidentiality works. The use of research-based information was emphasized, and knowledge was linked to empowered autonomy. They were then encouraged often to participate only to their level of comfort by sharing their opinions and perspectives and/or asking questions. This context was presented before the material to give the students more confidence in participating in the class and making future choices about using cannabis (Dimeff et al, 1999).

3.1.2.2. Course content

The course was designed to provide balanced perspectives to each topic covered, providing both positive and negative associations, effects, and outcomes of marijuana that have been rigorously studied. Topics were chosen based on their anticipated relevance to the community: the University of
Maine student body. These included THC vehicles and metabolism, occasional versus regular cannabis use, tolerance acquisition, and intoxication factors, and how gender may or may not affect those. Care was taken to refer to the sex someone was assigned at birth, so that the biological information was communicated without alienating those who may identify as a gender other than the one they were assigned (Rainbow Resource Center, n.d.). The evidence for how cannabis interacts with alcohol and other drugs was also cited, which is an important consideration for those who interact with any collegiate community as they are associated with the use of various drugs including marijuana.

Legal concerns were also covered in the course. Although marijuana is legal in Maine, there are still restrictions on use (i.e., age, usable amounts, etc.) and potential conflicts with local or federal laws. For instance, one might still be charged with a criminal offense of operating a vehicle under the influence of marijuana in Maine (Department of Public Safety, n.d.). However, there are currently no accurate tests for THC metabolites that pinpoint the time of marijuana use or even a standard metric for THC intoxication. Transporting marijuana across state lines, even to states with legal recreational marijuana, constitutes trafficking a Schedule I narcotic across state lines, a federal crime (Malyshev & Ganley, 2021). Criminal charges carry an enormous amount of stigma with them, and often label the accused a drug user or dealer regardless of the actual circumstances of the charge, or the person’s guilt or innocence (Wogen & Restrepo, 2020).

While much of the available research on marijuana is about the effects it has on its users and behavioral studies about marijuana users, techniques for drug use reduction or abstension were adapted for the audience of this course (Dimeff et al, 1999). Information on and strategies for discontinuing use of cannabis were provided, as well as resources on- and off-campus for students to access free of charge. The importance of bystander intervention is always emphasized in Student Wellness Resource Center programming. It is understood and accepted that those who are involved socially in their communities will be the first to be aware of an adverse situation, and it is important to
empower those members with the knowledge and preparedness to act calmly and appropriately in a matter of community safety.

3.2. Methods

The participant population was undergraduate students enrolled in the state of Maine’s public university system. Participants were screened and only those 18 years old or older took part in this study. Students were recruited by an in-class pitch (over Zoom), social media post, and flyer (Appendix C). Six participants were recruited in Spring 2021. The survey was approved by the University of Maine Internal Review Board as an exempt study with minimal risk to participants, who could leave the study at any time. Great care was taken to ensure that the participants knew that they did not have to interact with any portion of the course or survey that made them feel uncomfortable. The students were compensated by entry into a raffle.

The students attended the pilot cannabis course presented over Zoom (Appendix D). The course was delivered in a manner which requested active participation in the discussion if the subject felt comfortable to do so. Then, immediately following the presentation (lasting approximately one hour) the participants were asked to complete a voluntary survey online. The survey was generated on Qualtrics and consisted of a standard set of predetermined questions (Appendix E) and took approximately 15 minutes to complete. The questions were designed to get an accurate representation of students’ attitudes and opinions about their cannabis use, which informed the further development and improvement of the course. Additionally, the survey gathered information about first-year student cannabis use, which is a population of interest to Student Wellness due to the importance of early intervention in harm reduction (Dimeff et al, 1999).
3.3. Results

3.3.1. Course content and delivery

Participants were generally engaged with the course content and interacted with the delivery, as desired. They were forthcoming with their opinions and cannabis consumption habits within the context of the course discussion. While the delivery was consistent across all four pilot sessions, the content tended to shift slightly based on the participants’ interaction with the material.

The sample size for this study (six) is very low, which hindered rigorous statistical analysis. This is largely attributed to the difficulty of recruitment via remote and impersonal means due to the restrictions imposed by COVID-19 pandemic health and safety guidance.

3.3.2. Post-course survey results

The responses of the post-assessment survey were used to gain more information about how UMaine students use and perceive cannabis. One third of the student participants reported daily cannabis consumption, but none of them indicated possession of a medical marijuana prescription card. All participants were over the age of 18, and the legal age of adult use of cannabis in Maine is 21. The two participants who stated that they usually used cannabis seven days per week also estimated that they spent $30 per week on cannabis (Figure 3.1). One of those described obtaining their marijuana from a black-market source, but the other did not volunteer their method. Two of the participants who did not consume cannabis daily and are not purchasing cannabis regularly indicated occasional use (Figure 3.1).
Figure 3.1. Participants’ cannabis use habits

Note: Participants reported their cannabis use frequency, average number of days consuming cannabis per week, and how much money they typically spend on cannabis per week, n=6.

The cannabis harm-reduction course improved the confidence of students regarding making an informed decision about using cannabis. Half (three) of the participants indicated that before the course they were somewhat confident in making the choice to use cannabis or not, while the other three felt strongly confident. When considering making an informed decision about using cannabis after taking the course, all participants reported strong confidence (Figure 3.2).
Figure 3.2. Participants’ confidence in making decisions about cannabis

Note: Participants were asked to reflect on their confidence level before and after the harm reduction course, n=6.

The course increased confidence for all usage types: daily, occasional, and never. Before taking the course, one student from each of those categories felt somewhat confident and very confident in making informed decisions about cannabis, respectively. After taking the course, all participants felt very confident on the subject (Figure 3.3).
Figure 3.3. Participants’ confidence in making decisions about cannabis based on usage

Note: Confidence level of participants—who use cannabis daily, occasionally, or never—before and after taking the course, n=6.

Stigmatization of cannabis use is a relevant concern for those who consume it, especially daily. That group experienced more stigmatization than occasional consumers and were slightly less comfortable with others knowing about their use. Occasional consumers and those who never use were less stigmatized and agreed that legalization reduces stigmatization in general more compared to daily users (Figure 3.4).
Figure 3.4. Participants’ opinions on stigmatization

Note: Participants’ answers were categorized by cannabis usage. Their answers were assigned a numerical value and added together. Likert scale quantification: strongly agree = 5, somewhat agree = 4, neutral = 3, somewhat disagree = 2, strongly disagree = 1, does not apply = 0, n=6.

Students’ who use cannabis might increase their consumption when entering college or due to other lifestyle and stress circumstances. Three participants reported consuming more cannabis while they were enrolled in college. Additionally, three indicated that their cannabis use increased during the COVID-19 pandemic (Figure 3.5).
Figure 3.5. Causes of increase in cannabis use

Note: Participants were asked whether their cannabis use increased after starting college and/or during the COVID-19 pandemic, and their answers were grouped by their usage. Their answers were assigned a numerical value and added together. Likert scale quantification: strongly agree = 5, somewhat agree = 4, neutral = 3, somewhat disagree = 2, strongly disagree = 1, does not apply = 0, n=6.

Students consume cannabis for a variety of purposes. Participants who consumed cannabis daily primarily consumed cannabis alone or with others for enjoyment and social benefit, while those who reported occasional cannabis use tend to do so in social circumstances only. Both groups used cannabis to a lesser extent for treating symptoms of illness or disease.
Figure 3.6. Participants’ purposes for consuming cannabis

*Note:* Answers were grouped by the participants’ reported cannabis use. Their answers were assigned a numerical value and added together. Likert scale quantification: strongly agree = 5, somewhat agree = 4, neutral = 3, somewhat disagree = 2, strongly disagree = 1, does not apply = 0, n=6.

Smoking cannabis flowers is the most popular THC vehicle used among the student participants. All the students who consume cannabis (four) reported using that method of consumption. The other two reported no cannabis use, except one volunteered the use of a CBD-containing moisturizer. Edibles were the second-most used THC vehicle. The two participants who consumed cannabis daily reported using a wider variety of THC vehicles including the use of concentrates and vaping. The two participants who are occasional users only reported use of smoking flowers or eating edibles (Figure 3.7).
Participants reported several perceived benefits and adverse effects from using cannabis in open-ended responses that varied in length and detail. The specific benefits of using cannabis mentioned by participants were as follows: decrease anxiety, depression, and stress, treat pain, improve sleep, enhancement of social interactions or experiences, cognitive and spiritual benefits, and that it has a low risk of abuse or harm. The specific negative effects mentioned were lung damage, vision impairment, potential poisoning from untrustworthy sources, increasing anxiety, decreasing confidence, vomiting, decreasing productivity, memory or awareness impairment, driving impairment, and it had a high risk for dependence/abuse. (Note: those who mentioned the latter distinguished it from “addiction” but did not elaborate.) Variable positive or negative outcomes among users were cited.

A student falling into each usage type category thought that the potential benefits of consuming cannabis varied case-by-case. Daily cannabis consumers displayed a belief in a wider range of potential benefits than other user groups, including mental health, sleep, and enjoyment. Enjoyment was the
most common benefit cited by daily users (Figure 3.8). Bias and self-validation cannot be ruled out, due to the nature of personal evaluation and reflection. Participants cited a wider range of potential adverse effects than benefits from using cannabis. Daily cannabis consumers cited the most concerns about impairments (Figure 3.9). Mental health benefits and adverse effects were both most popularly mentioned by occasional cannabis consumers (Figures 3.8 and 3.9). Additionally, they mentioned as many adverse effects related to impairment as they did mental health. Occasional cannabis consumers also cited lung-health impact and potential for dependency as adverse effects, citing the widest range (Figure 3.9). Both students who never use cannabis were the only participants to cite a benefit of marijuana being that it is a drug that can be used responsibly (i.e., it has a low potential for abuse, Figure 3.8), but one participant from all three usage types mentioned that marijuana does have a considerable potential for dependency or addiction. One participant who never uses cannabis cited potential adverse effects associated with a lack of knowledge and trust in sourcing marijuana (Figure 3.9).
Figure 3.8. Participants’ perceived benefits of consuming cannabis

*Note:* The participants were asked to share whatever benefits they believe consuming cannabis might have and each mention of a specific opinion was counted in the above groups, n=6.

Figure 3.9. Participants’ perceived adverse effects of consuming cannabis

*Note:* The participants were asked to share whatever adverse effects they believe consuming cannabis might have and each mention of a specific opinion was counted in the above groups, n=6.
3.4. Discussion

3.4.1. Course content and delivery

The success of the course is determined by students’ willingness to interact within the session and their confidence in making choices about cannabis upon completing the pilot course. The former resulted in students being generally forthcoming with their ideas and opinions during the class and demonstrating comfort with discussing cannabis course material, regardless of whether they consumed cannabis and at what usage rate. Although the students who used cannabis reported experiencing stigma, that did not prevent them from using cannabis or participating in the course. This may indicate a reduction in stigma overall as legalization and acceptance of marijuana expands. Else, these students may be less prone to behavior modification due to stigma or social pressure.

The goals of harm reduction were achieved successfully within the limitations of the study. The participants interaction with the material, volunteered information, survey answers, and feedback were used to recommend improvements. The presented material and discussion were anchored on the premise of non-judgmental acceptance of the use of cannabis and sharing information and strategies to minimize the negative effects of cannabis use. Students’ goals for living their safest, healthiest lives and protecting their autonomy were prioritized above all else, in addition to the health and safety of the community at large. Both information and strategies for making choices were shared, without minimization or avoidance of the discussion on harms of marijuana consumption. Consideration of intersectional issues and marginalization was taken when developing and delivering the course.

3.4.2. Post-course survey results

Marijuana is used by University of Maine students: two-thirds of the survey respondents reported consuming cannabis daily or occasionally. One-third of the participants used cannabis daily and spent approximately $30 per week on the drug, representing a substantial amount of time spent consuming and under the influence of THC and a considerable cost for an undergraduate student’s budget. The
consumption of cannabis may be a bigger part of a students’ routine than alcohol if they use it daily, reinforcing the need for programming specific to cannabis to maximize the harm-reduction potential.

The confusion between statewide legalization in Maine, federal prohibition, and the campus’ ban on marijuana can lead to students inadvertently violating the Student Conduct Code triggering a sanctions process. Although none of the participants in this study had a medical marijuana prescription card, Maine allows for adults 18 years of age or older to obtain one. There is a great potential for conflicting messages to impact students’ choices if they are following the laws but breaking the Student Conduct Code. This indicates the necessity and appropriateness of a harm-reduction course focused on the needs of the University of Maine student body. The course developed for this thesis is an asset to the community by investing in reducing harm and negative consequences like conduct sanctions.

It is recommended that departments like UMaine Student Life consider stigmatization when designing policies and programs for marijuana consumers. Although the two participants who used cannabis daily felt comfortable enough to share their use habits in the survey, both also indicated experiencing considerable stigmatization for their use (Figure 3.4). Legitimization of the student and their choices is crucial to harm-reduction and setting a tone of mutual respect and honesty within the context of a mandated harm-reduction course.

The results indicate that some students still obtain marijuana through illegal means, which is a potential source of harm. Marijuana users who buy it off the black market will be purchasing an unprotected or regulated product, along with making themselves susceptible to civil or criminal penalties, depending on the situation. Awareness and acknowledgment that there is the potential for someone who has very little or no experience with marijuana, as the circumstances of someone undergoing the sanctions process can be complex. UMaine’s harm-reduction programming should be targeted to a wide range of students regardless of their cannabis use habits. The target population of this course could include both occasional and regular cannabis consumers, and those who use medical
and/or recreational marijuana. In the future, the audience could contain students that obtain and use marijuana completely legally under Maine law (i.e., being 21 years old or older and purchasing it from a licensed dispensary) or in violation of some laws (i.e., being underage and/or purchasing it on the black market). The results of this survey indicate a diversity in cannabis use status, frequency, purpose, and legality. Regardless of those factors, sharing unbiased, scientific information to as many students as possible reduces harm.

Overall, the responses show that University of Maine students likely have high confidence in making choices about using marijuana. Each participant felt very confident in making an informed decision about consuming cannabis after taking the course. This is an indicator of successful harm-reduction and an effective delivery. The primary goal of the course was empowering the cannabis-using student population with knowledge and resources to be autonomous when making decisions regarding cannabis. Each use-frequency group (i.e., daily, occasionally, or never) had one participant who was somewhat confident before taking the course, and each of those participants felt more confident afterward. The course effectively empowered students regardless of their marijuana consumption habits, demonstrating that it is wide-reaching in its scope and information. It was beneficial for all members of the community, regardless of whether they use cannabis or not.

People who consume cannabis still experience stigmatization, especially if they use it daily, which may explain why the participants who identified as daily users were more reticent to be open about their cannabis use. Those who were less stigmatized (consuming occasionally or never), were more willing to share their cannabis use openly and had a greater sense of stigma reduction accompanying legalization. This indicates that daily use of cannabis may be more likely to be stigmatized or viewed as problematic than occasional use of the drug. Those who do not consume cannabis or do so sparingly may have experienced a greater change in their own perception of recreational marijuana use
as state-legalization increases, causing the perceived reduction of stigmatization through legitimization. Stigmatization negatively impacts mental health and reduces access to harm reduction resources.

It is generally expected that students use their newfound freedom in college to experiment with various lifestyles and experiences, often including the use of recreational drugs (Palmer et al., 2012). Three students each reported an increase in cannabis consumption after entering college and during the COVID-19 pandemic. However, those who reported consuming cannabis daily demonstrated a stronger increase in their consumption due to COVID-19 compared to occasional users, who saw a greater increase in use during college. It is highly likely that during quarantine daily smokers were spending more time at home where they can consume cannabis privately and perhaps alone. Those who are occasional or social users were probably less likely to seek out and obtain cannabis for themselves or attend social engagements where cannabis might be offered to them due to the practice of social distancing.

In 2018, Maine passed a bill by the state legislature allowing physicians to prescribe medical marijuana for any health issue at their discretion, including mental illnesses (State of Maine Legislature, n.d.; LD 1539). The results of this study suggest that marijuana is seen by both its consumers and the greater public as being an effective remedy for mental ailments, but that it also can potentially damage mental health. Stigma and shame associated with marijuana use as well as behavioral effects (e.g., decrease in productivity) can also negatively impact a cannabis users’ mental health. This speaks to the general belief and evidence that marijuana and THC can affect users very differently. Additionally, this illuminates a conundrum in the incorporation of marijuana into mainstream medicine and culture. There is a need for flexibility, standardization, and study of marijuana to fully understand the effects it can have when used medically or recreationally. However, these endeavors are hindered or prevented by the federal prohibition on marijuana.
3.4.3. Limitations

This study is limited by the low number of participants that volunteered for the course. Recruitment suffered due to both the time constraints of a Master’s program and the communication options available during the COVID-19 pandemic.

The course was delivered over Zoom, which hindered communication. Ideally this course would be delivered in-person in order to encourage open participation and discussion.

3.4.4. Implementation and Recommendations

3.4.4.1. Course implementation by the University of Maine Student Wellness Resource Office

The course will be implemented for Student Wellness to use in the fall of 2021. When University of Maine students are found in violation of the Student Conduct Code policy on cannabis, one of their possible sanctions will be to attend this cannabis course. The course will be presented by a member of the Student Wellness staff, and the sanctioned student will have an opportunity to discuss, question, and reflect on cannabis use in a safe space with trained employees. The survey may also be used as an instrument of self-reflection for the office to share with students who may find it beneficial. It is highly recommended that the information and accessibility options are updated regularly by University professional staff.

3.4.4.2. Policy recommendations

It is recommended that programming aimed at bettering the student community quality of life also address stigma reduction. This is done by normalizing and legitimizing the use of marijuana, respecting those who use marijuana, and working to minimize and eliminate the barriers to health resources.

An important recommendation is to revise the language of the student handbook regarding cannabis and other drug use. The rules are outlined in a section covering all illicit drugs and alcohol. The decision to use cannabis is described as “poor,” and students are encouraged to make “better choices in the future,” (Division of Student Life, 2017). It characterizes consumption of alcohol as something that is
not congruent with “intellectual, ethical, and physical development,” “integrity,” full realization of their potential (Division of Student Life, 2017). This tone communicates judgement of students’ choice to consume cannabis or not, and in the case of medical marijuana use connotes a disdain for a students’ chosen treatment of their conditions. Another warning is delivered to the students through the code of conduct: a disciplinary record of a cannabis policy violation may result in losing job opportunity in certain sectors such as childcare, education, law enforcement, or government (Division of Student Life, 2017). This mirrors the historical stigmatization and loss of opportunity cost to those convicted of cannabis possession in the formal court systems of our states and country, and ignores the negative impact that shame has on mental health. To stay ahead of drug policy as it evolves towards harm reduction, the University of Maine should adopt a more accepting and collaborative approach while navigating the new legitimization of cannabis as a medical and recreational drug.

3.4.4.3. Future research

Potential opportunities to continue and expand this work would include long-term studies on University of Maine students who participate in the conduct process and their cannabis use habits and beliefs. The Division of Student Life may use the outcome of this work as a template to develop additional specific drug courses to provide students with as much accurate and precise information as possible.

3.4.4.4. Alternative uses for the course

This course could be delivered to the greater community surrounding the University of Maine in outreach initiatives, such as high school staff or adult education audiences. It may be delivered to other university professionals who would find themselves intervening in a situation where a student is in violation of the cannabis ban. This course may also be delivered in other diversion programs where cannabis is not permitted, and disciplinary measures might be taken. Mental and other health professionals may benefit from participating in the course to keep well informed of adult-use cannabis.
3.5 Conclusions

Cannabis users should not be treated unilaterally. It is a drug that is used with or without a doctors’ guidance to treat symptoms and conditions, but it is also used recreationally to varying degrees and usage rates. Smokeable cannabis remains the most popular form, but others are gaining popularity. Harm reduction courses such as the one described in this chapter may help compensate for the regulation and information gaps left by the contradictory legality of cannabis and resulting confusion. This program is aligned with the goals of the social values of state-run agencies. Building a cooperative system of information sharing as early as possible is advantageous to promoting safe, sustainable, and equitable policy. Confronting adult-use cannabis and acknowledging its use among college-age students involves preventative mental health and other university services, and offices should work together to ensure successful community health programming. Differentiating marijuana from alcohol and other drugs is an important step in legitimization, reducing stigma and harm. It is an honest reflection of the biochemical characteristics of cannabis as well as the reality of how it is regarded in America, as a simultaneously medical and recreational drug. Both socioeconomic and political intersections should be considered when applying this and other such courses with the intent of reducing harm. The circulation of credible information rather than misconceptions is beneficial to community health for all members.
SUMMARY

As adult-use cannabis is legalized state-by-state, marijuana is losing its culturally taboo status. It is being used by almost half of the adult populations in fully legalized states, despite the lack of clarity on implications of widespread or long-term cannabis use for medical or recreational purposes (Russo, 2016). As it stands there is not enough reliable and scientifically proven information about cannabis agriculture, processing, and human health effects to define the safety of marijuana products, as exemplified by edibles (Lamonica, et al. 2016; Leghissa, et al. 2019). Adequate standardization, regulation, and research momentum to maintain the industry cannot keep up with the production, sales, and consumption of cannabis that already exists. The growth in value and demand of cannabis shows no signs of slowing. The market is so large and diverse, that states with several years of established adult-use cannabis still have large regulation gaps, (Carnevale, et al. 2017; Ghosh, et al., 2016). Without federal legalization, impartial research is challenging to accomplish, and regulation is complex to develop and enforce. Regardless, central standards and best practices need to be developed as soon as possible while the industry is growing quickly and unstable. Bylegalizing cannabis, state governments and agencies are responsible for managing the risk to those who invest time, money, and resources in marijuana production businesses like any other product or commodity. Leaving it instead to industry stakeholders and cannabis consumers by leaving them to use unreliable sources of information and best guesses does not serve the constituency as intended. The risk of devastating loss or accidental public health threat can disproportionately affect those with limited experience in similar industries. They will often have fewer resources for information and quality testing, as well as less money to pay for consultations and private testing labs.

While institutions such as Land Grant universities might be limited in the type of support they can offer industry stakeholders without risking their federal funds, they should, at a minimum,
participate in the effective dissemination of information about cannabis that does exist. Harm reduction courses are designed to share reliable information without judgement and with the purpose of minimizing the negative effects of using drugs. The course developed for this thesis achieved that goal and will be utilized at the University of Maine in the future. Proactive, systematic policies and programs are recommended for effective harm-reduction and to confront the reality of marijuana consumption in the United States.
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APPENDIX A: CHAPTER 2 RECRUITMENT MATERIALS

1. Email Script

Subject: “Cannabis Industry Consultation Policy”

Body: “Dear ___,

My name is Abigail Wiegand, and I am a graduate student researcher at the University of Maine. I obtained your contact information from ___. I am contacting you because I am researching the policies of state institutions regarding edible cannabis production support. Would you or another representative be willing to answer a set of questions about the policies at your institution? Participation would include a Zoom online phone interview lasting about 30 minutes. The interview will be recorded. The answers provided will not be confidential, except for several opinion-based questions. In these cases, the state and/or institution may be identified. If you would be interested in participating, please reply to this email. I would be happy to answer any questions that you have.

Thank you for your time and consideration.

Sincerely,

Abigail Wiegand”

2. Phone Script

“Hello, ___. My name is Abigail Wiegand, and I am a graduate student researcher at the University of Maine. I obtained your contact information from ___. I am contacting you because I am researching the policies of state institutions regarding edible cannabis production support. Would you or another representative be willing to answer a set of questions about the policies at your institution? Participation would include a Zoom online phone interview lasting about 30 minutes. The interview will be recorded. The answers provided will not be confidential, except for several opinion-based questions. In these cases, the state and/or institution may be identified.”
If you are interested in participating in this study, we can schedule a time now, or you can let me know when a better time would be.

Thank you for your time and consideration. I would be happy to answer any remaining questions that you have, and I look forward to speaking again soon. You can best reach me by email at abigail.wiegand@maine.edu or phone at 203 414 9299.”
APPENDIX B: CHAPTER 2 INTERVIEW QUESTIONS

1. Introduction

“This call is hosted on Zoom, with which I will record the interview. You may do the same, by clicking the fourth icon from the right of the toolbar at the bottom of the window. If you wish to ensure that video is not recorded as well, make sure the video camera icon second from the left of the toolbar has a red slash through it.

My name is Abigail Wiegand, and I am a graduate student in Food Science at the University of Maine.

The purpose of this interview is to gather information on state institution policies for consulting the cannabis industry, specifically edible production.

This data will be compiled and reported in a white paper intended for publication. Additionally, the results will be presented in a seminar at the University of Maine.

I will ask a series of questions on the following three topics: (1) interactions with producers, (2) administrative guidance, (3) the state of the industry. Then, there will be an opportunity for open comments and questions.

The interview is expected to take approximately 20 minutes.

I will send you my summary of our conversation approximately 1-2 weeks after the interview.

If you have any further questions, comments, or concerns, you can best reach me by email at abigail.wiegand@maine.edu.

2. Questions

A. The following question is regarding your experience during employment at your state institution:

Please state your name, your official title, and which institute or agency you work for.

B. This set of questions is regarding your interactions with edible cannabis product producers.
1. Have you been contacted by anyone in the edible marijuana industry?

2. What type of inquiries is coming to your agency?

3. What type of support is requested?

4. Are there cannabis research/outreach programs already established at your agency?

C. These questions are in regard to your experiences with the administration of your agency or institution.

1. To the best of your knowledge, what information are you allowed to provide to edible cannabis producers?

2. To the best of your knowledge, what information are you not allowed to provide to edible cannabis producers?

3. Have you received any guidance or direction via...
   a. Written policy?
   b. Guidelines?
   c. Verbal permissions?

D. The next questions are regarding the state of the industry in general, to the best of your knowledge.

1. Is there an adequate amount of support and information available to meet the needs of the edible cannabis product industry?

2. What (other) information and support are available?

3. Do you perceive this as a problem in the current state of the edible cannabis industry?

E. Before we close the interview, ...

1. Is there anything that you’d like to add?

2. Do you have any remaining questions at this time?

3. May we contact you for follow-up questions if there is a need?
1. Zoom Recruitment Pitch

“My name is Abigail Wiegand, and I am a Food Science graduate student researcher and a graduate assistant at the Student Wellness Resource Center, here, at the University of Maine. I contacted your course instructors for permission to request your participation in a study I am conducting with my colleagues, Dr. Jennifer Perry and Dr. Robson Machado. I have developed a harm-reduction course on cannabis use for students who are found in violation of the UMaine cannabis policy. I am delivering the course to first year student volunteers, and I greatly appreciate your participation, regardless of whether or not you use cannabis or have been sanctioned before. You must be at least 18 years old to participate. We hope that you will participate in the course and provide your valuable feedback as UMaine students. Participation would include an interactive presentation on Zoom lasting about 1 hour, and completion of an anonymous post-course self-assessment about 30 minutes. The survey contains questions about your cannabis use opinions and habits. The answers provided in the survey will be anonymous, and no personal identifying information will be requested or recorded. Your participation is voluntary, and you may end the survey at any time or skip any question. As compensation, you will be given the opportunity to enter into a raffle for a Bluetooth speaker (worth $40) at the end of the survey.

If you would like to participate in this study, please let me know at this time by following the link provided or email me at abigail.wiegand@maine.edu before 5 p.m., Friday March 26, 2021. Then, you will receive an email from me with further information.
<Google Forms link/URL/QR code displayed>

Thank you for your time and consideration. Your help is vital to this study and producing the best programs for our community. I would be happy to answer any remaining questions that you have here or by email, and I look forward to speaking with you again soon.”

Social Media Post and Flyer Recruitment Text

“You are invited to participate in a research study:

Want to help your community? Want to learn more about cannabis? Have opinions to share?

Participate in our course on cannabis harm reduction and take our anonymous survey to be entered in a raffle for a Bluetooth speaker (worth $40).

This research is being conducted by Abigail Wiegand, Dr. Jennifer Perry, and Dr. Robson Machado from the School of Food and Agriculture of UMaine. You must be at least 18 years old to participate. Participation includes attending a 1-hour confidential course on cannabis harm reduction over Zoom, and then answering a 30-minute anonymous online survey on your own opinions and cannabis use
habits. No personal information will be requested or recorded. Your participation is voluntary, and you may end the survey at any time or skip any question.

If you would like to participate in this study, please let me know at this time by following the link below or email me at abigail.wiegand@maine.edu before 5 p.m., Friday March 26, 2021. Then, you will receive an email from me with further information.

https://tinyurl.com/jmk6a4x9

Thank you for your time and consideration. Your help is vital to this study and producing the best programs for our community. I would be happy to answer any remaining questions, comments, or concerns that you have here or by email (abigail.wiegand@maine.edu).”

Official Email Invitation

Subject: “UMaine Cannabis Course and Survey”

Body: “Hello,
You are receiving this email as a result of filling out the Google Form for recruitment in my cannabis harm-reduction course and post-assessment survey. Thank you very much for your interest. Your valuable participation is greatly appreciated and will contribute to progress in cannabis research and public health.

Your course time & date: <TIME, DATE>

Your Zoom meeting link: <Zoom link/URL>

To cancel or change your course date, click here, or copy and paste the URL into your browser: <Google Forms link/URL>

Remember, the course is confidential, and the survey is anonymous. No personal identifying information will be requested or recorded. Your participation is voluntary, and you may leave the course or end the survey at any time or skip any question. If you have any questions, comments, or concerns, please contact me (abigail.wiegand@maine.edu).

Many thanks again,

Abigail Wiegand”
Email Reminder

Subject: “Reminder - UMaine Cannabis Course and Survey”

Body: “Hello,

This email is to remind you of your scheduled participation in my cannabis harm-reduction course and post-assessment survey. Your participation is greatly appreciated and will contribute to progress in cannabis research and public health.

Your course time & date: <TIME, DATE>

Your Zoom meeting link: <Zoom link/URL>

To cancel or change your course date, click here, or copy and paste the URL into your browser: <Google Forms link/URL>
Remember, the course is confidential, and the survey is anonymous. No personal identifying information will be requested or recorded. Your participation is voluntary, and you may leave the course or end the survey at any time or skip any question. If you have any questions, comments, or concerns, please contact me (abigail.wiegand@maine.edu).

Many thanks again, and I look forward to speaking with you soon.

Best,

Abigail Wiegand”
Figure D.1. Slide 1, Cannabis Harm Reduction Course

Figure D.2. Slide 2, Cannabis Harm Reduction Course
**Definitions**

*Cannabis sativa L.* = *Cannabis*

**Cannabinoids** = bioactive compounds in cannabis

- Cannabidiol (CBD) = non-psychoactive
- Tetrahydrocannabinol (THC) = psychoactive (hallucinogenic)
  - >0.3% = *Marijuana*
  - ≤0.3% = *Hemp*
  - *Strain* = type of cannabis with specific characteristics/genetics

**Figure D.3.** Slide 3, Cannabis Harm Reduction Course

**THC Vehicles**

- **Flowers:** 0.02-.25 mg THC/g
  - Smoking
  - Vaping

**Figure D.4.** Slide 4, Cannabis Harm Reduction Course
**Figure D.5.** Slide 5, Cannabis Harm Reduction Course

**Figure D.6.** Slide 6, Cannabis Harm Reduction Course
**Figure D.7.** Slide 7, Cannabis Harm Reduction Course

**Figure D.8.** Slide 8, Cannabis Harm Reduction Course
Biphasic Curve

Effects of using cannabis:
- Positive?
- Negative?
- Neutral?

Note: This study was conducted with rats. A “low” dose was 1 mg THC/kg of body weight, and a “high” dose was 5 mg/kg.


Figure D.9. Slide 9, Cannabis Harm Reduction Course

Effects of THC Intoxication
- Increased prefrontal cortex activity (cognitive and social)
  - May heighten risk sensitivity
- Impairments:
  - Motor skills
  - Response time
  - Increase with alcohol, also memory
- Assigned sex differences inconclusive
- Different strains have different effects
- Other drugs further affect perceptions

Figure D.10. Slide 10, Cannabis Harm Reduction Course
Tolerance & Dependency

- Tolerated effects:
  - Pain relief
  - Diuretic
  - Cognitive (not with alcohol)
- Tolerance lasting 14 days, with daily use
- Different strains may produce different tolerances
- Use history may strongly affect response to single doses
- Sex differences inconclusive
- “Cannabis withdrawal syndrome”

Figure D.11. Slide 11, Cannabis Harm Reduction Course

Other health concerns

- Spreading illness (COVID-19)
- Contaminants
  - Tobacco
  - Homemade pipes
  - Other drugs/synthetic cannabinoids
  - Toxins or pathogens
- Smoking
  - Asthma
  - Carcinogens
  - Lung irritation
- Vaping vitamin E acetate poisoning

Figure D.12. Slide 12, Cannabis Harm Reduction Course
Making Empowered Choices

- Consumption strategies to try
  - Plan ahead: bring what you are going to use
  - Be stingy, be a snob; only consume what you want to and know where you get your weed
  - Legality concerns
  - CBD does not necessarily reduce THC impairment
  - Take a “tolerance break”

- Want to quit smoking?
  - Try tapering off your dose with edibles.

- Quitting cannabis
  - Make a plan
  - Dispose of your paraphernalia
  - Understand your triggers
  - Build a support network
  - Therapy or treatment

- Community safety
  - Bystander intervention
  - MAGS
  - Second-hand smoke/vape


Figure D.13. Slide 13, Cannabis Harm Reduction Course

Resources

- SWell
  - um.swell@maine.edu
  - um.mindspa@maine.edu
  - umaine.edu/wellness/
  - Livewell Peer Mentoring
  - abigail.wiegand@maine.edu

- Legal Assistance – Sean O’Mara, sean.omara@maine.edu

- Volunteering – Bodwell Center, um.bodwellcenter@maine.edu

- Recovery groups and meetings
  - Black Bears for Recovery (contact SWell)
  - Al-Anon Mondays @ 6 p.m., DTAV

Figure D.14. Slide 14, Cannabis Harm Reduction Course
Acknowledgements & Closing

- Dr. Jen Perry, Dr. Brian Perkins, and the members of their labs
- Dr. Robson Machado and Dr. Rachel Schattman
- TJ England, Alyce Lew, Lauri Sidelko, and everyone at SWell

- Your kind attention and participation!

abigail.wiegand@maine.edu

Figure D.15. Slide 15, Cannabis Harm Reduction Course
APPENDIX E: CHAPTER 3 POST-COURSE SURVEY QUESTIONS

1. As of today, are you 18 years of age or older?
   a. Yes
   b. No

2. Which of the following best describes your student status?
   a. First-year undergraduate
   b. Second-year undergraduate
   c. Third-year undergraduate
   d. Fourth-year or more undergraduate students
   e. Graduate
   f. Why did you take this cannabis course?
   g. Volunteered
   h. Required/sanctioned

For the following statements, please indicate your level of agreement using the following scale:

Strongly agree

Somewhat agree

Neutral

Somewhat disagree

Strongly disagree

Don’t know
3. I felt confident to make an informed decision about using cannabis before taking this course.
4. I feel confident to make an informed decision about using cannabis having taken this course.
5. I am comfortable with others knowing about my cannabis use.
6. I have experienced stigmatization of my cannabis use.
7. Increased legalization reduces stigmatization of cannabis use in general.
8. My use of cannabis has increased during the COVID-19 pandemic.
9. My use of cannabis has increased during college.
10. I consume cannabis alone for enjoyment.
11. I consume cannabis with others for social benefit and enjoyment.
12. I consume cannabis for treating symptoms of illness or disease.

13. Do you have a medical cannabis prescription card? Select one.
   a. Yes
   b. No
   c. Other (please explain)

14. On average, how many days out of a week do you use cannabis?
15. On average, how much money do you spend on cannabis per week?
16. Which forms of cannabis do you consume? Select all that apply.
   a. Smoking flowers (i.e., buds)
b. Vaping flowers (i.e., buds)

c. Smoking concentrates (i.e., dabbing)

d. Vaping concentrates (i.e., dab pens)

e. Edibles

f. Tinctures

g. Topicals

h. Other (please explain)

17. Do you believe there are benefits from using cannabis? If desired, please share your opinions here.

18. Do you believe there are adverse effects from using cannabis? If desired, please share your opinions here.
BIOGRAPHY OF THE AUTHOR

Abigail Wiegand was born in Norwalk, Connecticut on August 23, 1993. She was raised in southwestern Connecticut and graduated from F.S. Bunnell High School in Stratford in 2011. She attended Southern Connecticut State University and graduated in 2016 with a Bachelor’s degree in Chemistry. She entered the Food Science and Human Nutrition graduate program at The University of Maine in the fall of 2018. After receiving her degree, Abigail will be working in the adult-use cannabis industry developing products and learning more about policy and compliance. Abigail is a candidate for the Master of Science degree in Food Science and Human Nutrition from the University of Maine in December 2021.