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The Mechanisms Connecting State Marijuana Policies to Parent, Peer, and Youth Drug Perception Leading to Youth Marijuana Use

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The Mechanisms Connecting State Marijuana Policies to Parent, Peer, and Youth Drug
Perception Leading to Youth Marijuana Use

by

Eunbyeor Sophie Yang

A dissertation submitted in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy
in
Social Work and Social Research

Dissertation Committee:
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Portland State University
2022

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Abstract

Youth marijuana use, which can lead to numerous health problems, is significantly associated with youth drug perception, which is greatly influenced by state marijuana laws such as medical marijuana legalization and penalty severity. The mediating impact of social drug perceptions on the association between state marijuana laws and youth drug disapproval is not well known. Based on theory of change and primary socialization theory, this study examined the impact of state marijuana laws on youth drug disapproval, the mediating factors of parent and peer drug disapproval, the direct effect of youth drug disapproval on youth marijuana use, and the moderating roles of gender and race. Data were derived from the 2019 National Survey of Drug Use and Health (n = 1,910; average age = 15.71 years old; 49.2% female; 49.5% White) with youth aged 12–17 years old. Using structural equation modeling, this study demonstrated that medical marijuana legalization significantly reduces parent, peer, and youth drug disapproval, whereas the penalty severity on marijuana possession significantly reinforced parent and peer drug disapproval among the whole sample. The finding also indicates that parent and peer drug disapproval significantly mediates the relationship between medical marijuana legalization/penalty severity and youth drug disapproval. Moreover, youth drug disapproval, which is affected by the mediating pathways, reduces youth marijuana use. Additionally, the impact of state marijuana laws has different effects on parent, peer, and youth drug disapproval depending on gender and race/ethnicity. Acknowledging the contributions of state marijuana policies and social perceptive resources furthers the youth marijuana use knowledge base by providing a

more integrated model of improving explanatory mechanisms and clarifying the role of socio-structural factors in drug perceptions and further marijuana use.

Dedication

I dedicate this dissertation to God, who is always my mountain, my comfort, my strength, and all.

I also dedicate this work to my husband, Paul D. Chung, who has been a constant source of support and encouragement during the challenges of graduate school life. I am truly thankful for having you in my life.

This work is also dedicated to my parents who loved me unconditionally and set a good example for me to work hard for what I aspire to achieve. I also want to dedicate this work to my precious sister, whom I dearly love.

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I am grateful for the insightful comments and encouragement of the remaining members of my dissertation committee: Professor Mary Oschwald, Professor Michele Morales and Professor Tessa Dover. Their difficult, yet critical questions also pushed me to expand my research from different perspectives, and they were extremely valuable for me and this dissertation. I would like to express my gratitude for Professor Mary Oschwald for her continuous support, encouragement, and positive viewpoints. I am so grateful to have an opportunity to meet her and work with her for several projects. I was able to learn a lot about how wonderful she is as a teacher and leader. I really enjoyed working with her and felt fortunate to have met her. I hope that in the future I can be someone like her who is caring, supportive, rational, and decisive for someone I need to supervise. I am very grateful for her and her time and guidance as a member of my committee.

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social work. As I changed the major from engineering to social work, his mentoring allowed me to immerse myself in the field of social work, particularly the vulnerable youth population and the risky behavior of youth. He always emphasized my strengths and helped me to find what I had more than others and to be interested in research on youth problems. He helped me understand how the questions actually relate to the research paper. I have full fortunes to have him, great teacher in my life.

This is truly a blessing to have these people in my dissertation process.

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Chapter 1

Introduction

Marijuana use among adolescents is one of the serious problematic behaviors in the United States (SAMHSA, 2019) because it can contribute to youths' poorer cognitive and behavioral health and development (Hasin, 2018; Scheier & Griffin, 2020). Youth marijuana use is significantly associated with changes in perceptions of drug use (Hasin, 2018; Ladegard et al., 2020). Current behavioral theories have confirmed that subjective perceptions determine behavioral intentions and consequent behaviors (Ajzen, 1991; Willis et al., 2020); therefore, individual perceptions of drug use contribute to the development of a specific behavior, such as marijuana use, throughout a person's life (Willis et al., 2020). Research has indicated that having disapproving perceptions toward drugs has significant protective effects and is consistently associated with reduced prevalence in marijuana use during adolescence (Willis et al., 2020). While numerous studies acknowledged youth drug disapproval as a significant predictive factor in marijuana use (Hames et al., 2012; Neighbors et al., 2011; Willis et al., 2020), the sociostructural pathways contributing to the development of youth drug disapproval closely linked to marijuana use have been underexplored. Consequently, there is a need for research identifying the factors explaining and influencing youth drug disapproval to potentially support the intervention into or prevention of youth marijuana use.

The implementation of state marijuana policies influences the establishment of adolescents' approval or disapproval of drug use (Bailey et al., 2020; Cerdá et al. 2017; Patrick et al., 2019). There are two representative marijuana policies in the United States, medical marijuana legalization (MML) and penalty severity on marijuana possession,

which convey completely different messages about marijuana, for example, either of “marijuana is socially acceptable” or “marijuana is punishable” (Cerdá et al. 2017; Schuermeyer et al., 2014). These either decrease or increase youth marijuana disapproval, respectively (Chiu et al., 2021; Hames et al., 2012; Willis et al., 2020). Studies have also indicated that marijuana-related policies can influence adolescents’ perceptions of other drugs, such as alcohol and cigarettes, which have several common characteristics, such as being considered gateway drugs (Bailey et al., 2020; Cerdá et al. 2017; Schuermeyer et al., 2014). Hence, this study is focused on the drug perceptions of three drugs—alcohol, cigarettes, and marijuana. Many people consider these drugs equally harmful because they are prevalent and highly accessible (Badiani et al., 2015; Estoup et al., 2016; Patrick et al., 2019, Patrick et al., 2018).

Theories of change posit that certain policy tools can make changes in youth drug perceptions in a given society by intersecting with the actual process that individuals hear and learn about benefits and risks of marijuana use or possession (de Waal et al., 2020), and then establish positive or negative reactions to the drug based on which marijuana policies are implemented (Choi et al., 2017; Shin & Miller-Day, 2017; Stone, 2020). However, this policy structure conveys a much more elaborate picture than just the lawful status of one’s home state; it also carries various forms of social problems, trends, and perceptions (e.g., increased prevalence of drug use among youth, favorable trends in marijuana legalization, lower level of drug risk perceptions) within that state (Cerdá et al., 2017; Chiu et al., 2021; Hasin et al., 2015). For those with exposure to marijuana policies, the policy context provides important information about approving or

disapproving messages that are present within the policy (Chandio & Ali, 2019), which may better explain why youth with certain drug perceptions are more likely to develop/reduce marijuana use (Keyes et al., 2011; Stone, 2020). However, marijuana policies both influence youth drug disapproval and may affect drug perceptions of other important people for youth, such as parents and peers (Cerdá et al. 2017). Specifically, MML may contribute to decreased parent and peer drug disapproval, whereas perceived penalty severity for marijuana possession may contribute to increased social drug disapproval, which also leads to youth drug disapproval (Cerdá et al. 2017; Hames et al., 2012; Willis et al., 2020).

Primary socialization theory suggests that youth adopt a set of particular norms that later impact on the level of prosocial or antisocial behavior through social learning interactions with the proximal sources, parents and peers (Oetting & Donnermeyre, 1998; Tyler & Trinkner, 2017). Studies have shown that parent and peer injunctive norms regarding drugs (e.g., drug disapproval) significantly influence youths' perceptions of drugs (Pearson et al., 2018; Pedersen et al., 2017; Su et al., 2018), which further lead to youth marijuana use (Hasin, 2018; Ladegard et al., 2020). Hence, by assessing the influence of parent and peer drug disapproval in their lives and having someone to consistently convey disapproving messages, we can begin to understand the impact of social-level forces on youth drug disapproval in the structural relationship between marijuana policies and youth drug disapproval. The relationship between parent and peer drug disapproval and the development of drug disapproval among youths makes the specific mechanism connecting marijuana policies and youth drug disapproval plausible.

Thus, this study tested the hypothesis that parent and peer drug disapproval mediates the relationship between marijuana policies and youth drug disapproval.

Because most research on youth drug use has focused separately on individual-, social-, or policy-level explanations of youth drug disapproval (Villagrana & Lee, 2018; Wong et al., 2020), this present study aims to fill the gap in the literature by identifying the sociostructural mechanisms (social and policy levels) influencing the establishment of youth drug perceptions (individual level) that lead to marijuana use. In doing so, this study seeks to transform perspectives on youth drug perception; it is to contextualize and implicate systemically contributions by understanding youth marijuana use as a result of decreased drug disapproving perceptions, which is greatly influenced by micro-level factors as well as macro-level factors (Oetting & Donnermeyre, 1998; Tyler & Trinkner, 2017). Placing individuals in micro- and macro-level contexts expands the range of potential solutions to include the systemic changes needed to improve drug disapproval and prevent youth marijuana use (Chandio & Ali, 2019; Tyler & Trinkner, 2017). To further articulate these differences in marijuana use outcomes, the present study suggests that social and change theoretical models should be extended to incorporate policy and social relationships and address multilevel determinants within sociostructural settings to provide a holistic view of understanding youth drug perceptions and consequent behaviors - marijuana use (Bruner, 2017). Accordingly, marijuana-related policies are significant factors in individual drug perceptions and that the drug disapproval of parents and peers is a mediating source (Bruner, 2017).

An overarching premise of this study is that marijuana policies differently affect youth drug disapproval directly or indirectly through changed parent and peer drug perceptions. In states with MML, this exposure to individuals likely explains the lower perceptions of drug disapproval and may challenge the ability to buffer the establishment of drug disapproval. In contrast, for youth in states with higher levels of penalty severity, this exposure explains the greater perceptions of drug disapproval and may buffer the establishment of approving perceptions of drugs, contributing to the lower likelihood of marijuana use. Also encapsulated within this premise is that recent studies indicated youth have differences in marijuana use behavior depending on gender and racial differences (Azofeifa et al., 2016; Keyes et al., 2017). This necessitates exploration of gender and race as moderators on the causal pathway between marijuana policies and establishment of youth drug disapproval mediated by parent and peer drug disapproval.

Another significant contribution of this study is that using structural path models, this study could connect macro-level factors (e.g., marijuana policies), micro-level factors (e.g., parent and peer drug disapprovals), and individual-level factors (e.g., youth drug disapproval, youth marijuana use behaviors) by integrating the theory of change and primary socialization theory, which helps one better understand the macro- and micro-processes leading to youth marijuana use (Oetting & Donnermeyre, 1998; Tyler & Trinkner, 2017). The study findings specifically demonstrated that as the theory of change suggested, policy tools can make substantial impacts on individual drug perceptions. This is significant because it shows that MML and the punishment system itself are highly important to develop drug prevention strategies or approaches. The

results clearly demonstrate it is imperative for policy and law makers to acknowledge that how individuals perceive policy tools can cause them to perceive either drug as approvable or disprovable (Cerdá et al. 2017).

A final significance of this present study is that social perception plays an important role in mediating the influence of marijuana-related policies on youth drug perception outcomes and acts as a protective resource. It is well established that parent and peer perceptions of drugs have significant importance following any type of drug exposure because they can protect against marijuana-approving messages embedded in certain policies (Pedersen et al., 2017; Zapolski et al., 2019). For example, following exposure to approving messages, parents are particularly critical in buffering the development of drug-approving perceptions (Campbell & Oei., 2010; Pedersen et al., 2017), and the absence of parent disapproval is one of the biggest risk factors for the establishment of appropriate drug perceptions (Pedersen et al., 2017). Peer drug disapproval also appears to have a relationship with the likelihood of developing drug disapproval among youth with higher self-rated peer disapproval (Schultz et al., 2007; Su et al., 2018). Because social research continue to show that social relationships have causal influence on perceptions of drugs, which in this study are alcohol, cigarettes, and marijuana (Estoup et al., 2016; Pearson et al., 2018; Su et al., 2018), it is important to investigate how social norms interact with marijuana policy exposures and understand if social norms have buffering potential and how they interrelate with youth drug perceptions.

The findings in the present study are based on secondary data from the 2019 National Survey of Drug Use and Health (NSDUH), a cross-sectional study based on a state-based design (SAMHSA, 2019). The NSDUH is a nationwide survey of adolescents and adults aged 12 years or older that examines self-reported lifetime and past month drug use of all main drug categories (marijuana, alcohol, and cigarette): drug-related disorders, perceived drug disapproval from parents, peers, and youth, MML and penalty severity of marijuana possession throughout the 50 states and Washington D.C. The data was collected in the place where survey participants resided (SAMHSA, 2018). The purpose of this study is to (a) examine how perceived opposing marijuana policies contribute to the development of perceived drug disapproval among parents, peer, and youth (alcohol, cigarette, and marijuana), (b) identify whether the association between perceived multiple marijuana policies and resulting youth drug disapproval is explained or mediated by the level of parent and peer disapproval, (c) examine if higher levels of youth drug disapproval lead to increased marijuana use among youth, and (d) examine if gender and race moderate the relationship between exposure to marijuana policies and youth drug disapproval resulting in higher youth marijuana use.

Chapter 2

Literature Review

This literature review covered two theoretical backgrounds (theory of change and primary socialization theory), a review of youth marijuana use and consequences, and an overview of state marijuana policies. The influence of parent and peer drug disapproval on youth drug disapproval, the link between state marijuana policies and individual drug disapproval, and the paths from youth drug disapproval to marijuana use are followed. Lastly, group differences (gender and race) in youth marijuana use are reviewed.

Theoretical Orientation

This study was oriented with two theoretical frameworks (a) theory of change to understand why and how certain policy tools (MML and penalty severity) intersect with the actual processes of change in drug perception in a given society, and (b) primary socialization theory to understand the processes of how the change of drug perceptions among primary socialization agents (parents and peers) influence drug perception among youth, which directly affects marijuana usage.

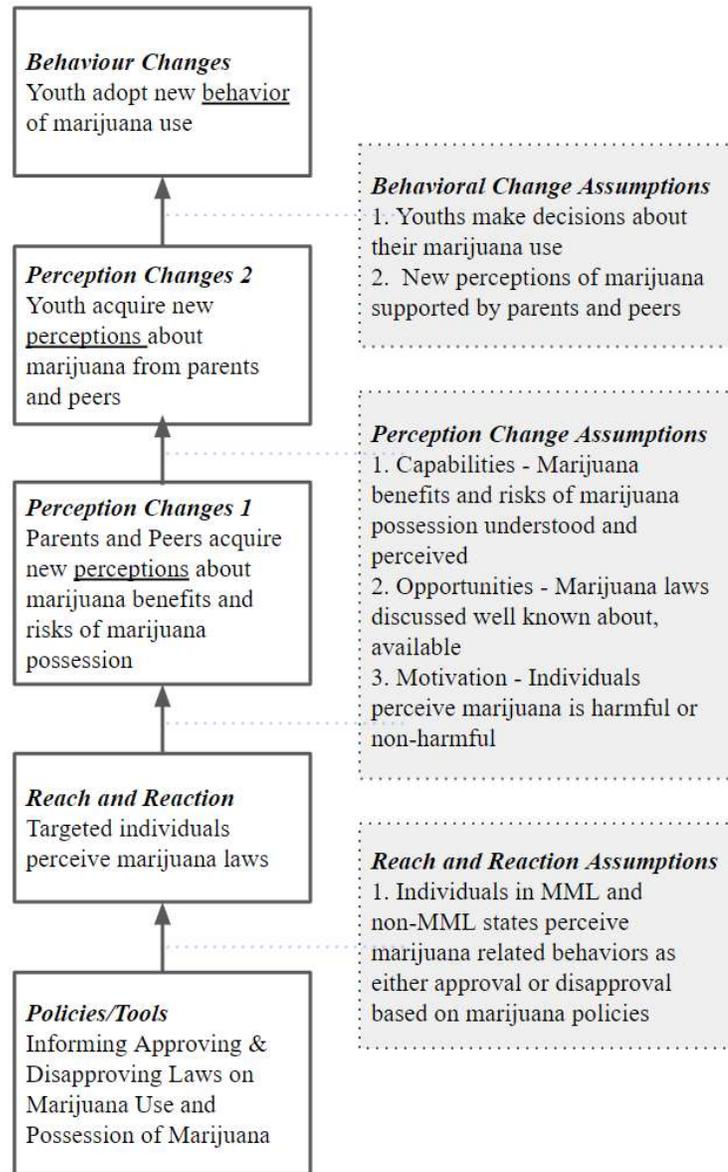
Theory of Change

Theory of change explains why and how certain policy tools produce the actual processes of change or achieve specific policy outcomes, in this case drug perception (de Waal et al., 2020). The theory of change consists of a chain of inputs, outputs, and outcomes that are connected by arrows to suggest causal connections, which can be tested empirically (de Waal et al., 2020). The common inputs and outcomes described in Figure 1 allow us to utilize a theory of change that describes how the marijuana policies worked. Figure 1 depicts key initial marijuana policy tools (see the boxes 1 and 2) and the

resulting initial outcomes of these tools (see the boxes 3 and 4), which lead to change in the motivation of youth to engage in the subsequent marijuana use (see the box 5).

The specific explanations of the causal paths are as follows. First, MML and punishment systems have been established in many states. For example, marijuana policies can result in several changes for individuals who have heard about the laws and/or participated in at least one educational session about marijuana laws. Marijuana policies may influence individual perception toward drugs as approving or disapproving, meaning that individuals had a positive or negative reaction to drugs based on which marijuana policies were implemented. Second, parents and peers may acquire new perceptions about the benefits and risks of marijuana use or possession via marijuana policies, and these perception changes among parents and peers may lead youth to acquire new perceptions about marijuana via interactions. These changes are assumed to have occurred with the three aspects: capabilities, opportunities, and motivation. It could indicate that individuals (parents, peers, and youth), who are capable of understanding and perceiving benefits and risks of marijuana use and possession, have opportunities to learn that marijuana laws can be discussed and understood. They then may have different motivations by perceiving marijuana as a harmful or benign drug. Third, youth adopt a new behavior of marijuana use. The assumption underlying the behavior of youth might be explained in that youth make decisions about their marijuana use based on new perceptions of their marijuana use supported by parents, peers, and general marijuana policies.

Figure 1 *Conceptual Framework based on Theory of Change*



Primary Socialization Theory

For this study, primary socialization theory (PST) was used to better understand youth drug disapproving perceptions within the socialization processed by parents and peers, whose perceptions are greatly influenced by state marijuana policies. PST proposes that individuals learn their attitudes or norms through social interactions with proximal

sources such as parents and peers (Oetting & Donnermeyre, 1998; Tyler & Trinkner, 2017). In the socialization processes, parents and peers and other agents such as social institutions (e.g., policies, laws) can play important roles in supporting individuals to adopt a set of particular norms that later impact on the level of prosocial or antisocial behaviors during adolescence (Casaló & Escario, 2016). Please see the Figure 2 below.

Parent Influence. Parent perception toward drugs have been presented as a crucial factor in the development of youth drug perceptions that later impact behaviors. According to PST (Oetting & Donnermeyer, 1998), parents influence youth to establish prosocial and antisocial norms toward drugs via interaction (Guttmanova et al., 2019) and communication with their children (Akers & Jennings, 2019). Norms in the family are primarily communicated verbally and through modeling in terms of the acceptability of drug use, and the norms become intensified to youth when parents model specific attitudes of drug use (Colder et al., 2018; Maggs et al., 2019). Studies demonstrated that prodrug norms among parents increase the likelihood of adopting the prodrug norms among youth (Choi et al., 2017; Shin & Miller-Day, 2017; Stone, 2020). In contrast, strong interactions with parents in terms of anti-drug norms are associated with the increase of anti-drug norms among youth (Walters, 2020).

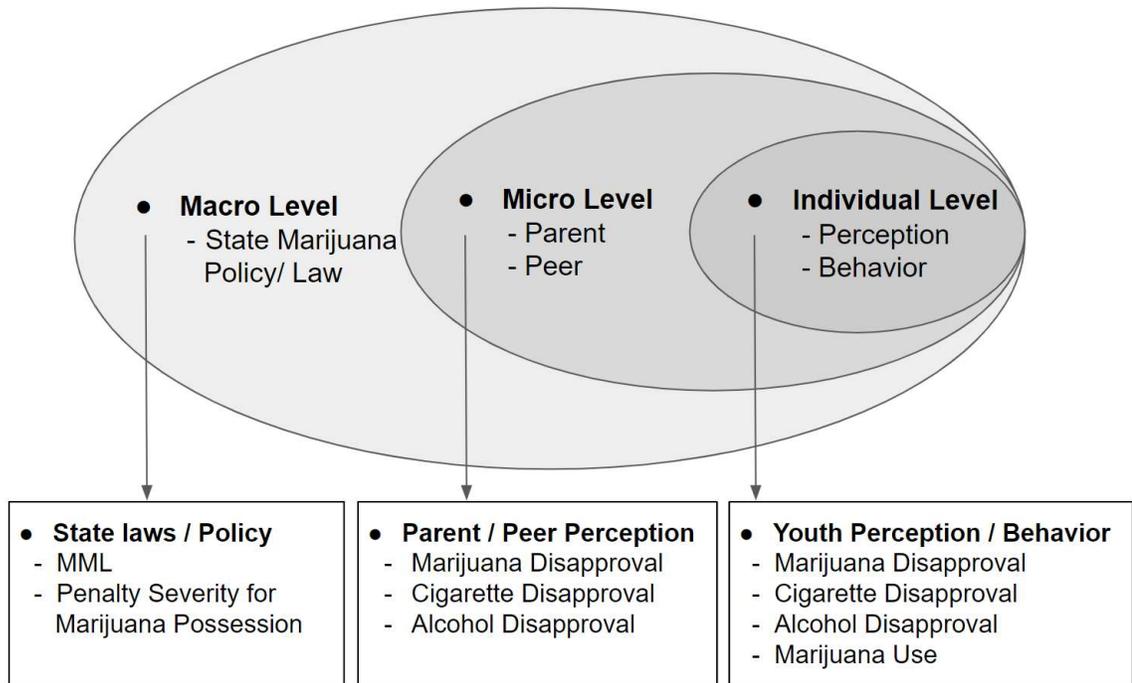
Peer Influence. During mid-adolescence, learning of social behaviors is generally dominated by interactions with a group of peer clusters as they spend most of their time in schools (Lee et al., 2017). Along with this trend, peer perception toward drugs becomes important for youth to change their drug perceptions. Because peer pressure is also increasing during adolescence (McCoy et al., 2019), the way for youth to perceive

drug use among their peer clusters is closely related to their own drug perceptions (Schuler et al., 2019). Association more often with drug approving peers is closely tied to youth drug use since drug norms can be transmitted via peer group interactions (Farrell et al., 2017; Walters, 2020). Thus, positive primary socialization is extremely important for youth to lay the foundation for drug perception and behavior.

Policy Influence. While parents and peers are primary socialization sources, state marijuana laws can also serve as an important normative influences on youth drug perceptions that impact youth marijuana use (Chandio & Ali, 2019). Individual perceptions may be different depending on where they live and which laws have been established in the states. Individuals who reside in states legalizing marijuana (i.e., MML) and lower punishment for marijuana possession (i.e. approving of marijuana) may conform to different norms on drugs from the prevalent non-legalizing or non-approving laws of marijuana (Keyes et al., 2011; Stone, 2020). The different state marijuana laws may influence youth as well as their surrounding micro-level sources (i.e., parents and peers) in terms of drug perceptions.

Figure 2

Conceptual Framework based on Primary Socialization Theory



Youth Marijuana Use and Consequences

Although marijuana is banned for anyone under the age of 21, it is a common illegal drug among American youth (The National Institute on Drug Abuse, 2021). Approximately 23.1% of 8th, 10th, and 12th grade students said they have used marijuana in their lifetime. Additionally, 17.9% and 11.0% of students said they had used marijuana at least once in the last 12 months and the last 30 days, respectively (The National Institute on Drug Abuse, 2021). As adolescence involves complex biological, psychological, and social changes, regular use of marijuana during this important period could have lifelong negative effects on various aspects of health, development, achievement, and behavioral problems (D’Amico et al., 2016; Hasin, 2018; Ladegard et

al., 2020; National Institute on Drug Abuse; NIDA, 2019; Scheier & Griffin, 2020). In this regard, the detrimental effects of marijuana use among adolescents will be discussed.

Mental Health

Youth marijuana use can cause several mental health concerns, such as increased anxiety, depression, suicidality, and onset of psychosis (Ladegard et al., 2020). For example, some studies found that marijuana use during adolescence significantly influences later anxiety and depression (Chadi et al., 2019; D'Amico et al., 2016). Individuals using marijuana are at a higher risk of depressive symptoms than nonusers (Chadi et al., 2019). Other studies found the important causal relationship between marijuana exposure in adolescence and the increased risk for suicidality and psychosis. Levine et al. (2017) found a growth of risk for suicidal thoughts/ideation among adults who used marijuana during adolescence. The effects of marijuana intoxication may also lead to the development of psychotic disorders (Gage, 2019). Youth exposure to marijuana is anticipated up link to a twofold increased risk of promoting psychosis in adulthood (Levine et al., 2017). These studies imply that the more youth are exposed to marijuana, the greater chances of developing negative mental health conditions.

Cognitive Development and Academic Performance

Adolescent marijuana use has negative impacts on cognitive development (Ladegard et al., 2020). Specifically, marijuana use can influence youth adverse brain development including altered brain structure, function, and neuropsychological performance (deShazo et al., 2019). The effect of marijuana intoxication also includes deficiency in concentration, decision-making, recognition and working memory (Levine et al., 2017). Hence, frequent marijuana use can cause decreased effective decision-

making and learning capacity, especially for youth who first try at an earlier age (Castellanos-Ryan et al., 2017). Among youth using marijuana frequently, studies found a decreased integrity associated with cortical activity and more impulsivity during cognitive tasks and with worse reaction times and more mistakes on jobs performing the executive attention network (Cyrus et al., 2020; Gruber et al., 2014). In a similar context, marijuana use has negative impacts on academic performance and school involvement (Cyrus et al., 2020; Hutchinson et al., 2015). For example, youth who use marijuana, compared with those who do not use, on average, have less academic achievement and are 60% more likely to withdraw from high school (Cyrus et al., 2020; Hutchinson et al., 2015). Adolescent school suspensions and displacements due to marijuana use further interrupt academic performance and high school completion (Colorado Department of Education, 2019). Taken together, youth who used marijuana at an early age performed worse in cognitive development and school involvement.

Delinquency and Other Illicit Drug Use

Studies indicated the coexistence of drug use and delinquency (Monahan et al., 2014). Marijuana use particularly appears linked with increased drug addiction occurrence and co-use of different drugs (Fairman et al., 2019). Marijuana has been examined as a gateway drug to experimentation and regular use of other illicit drugs (Kandel & Kandel, 2015; Williams, 2020). Studies have found a great deal of association between marijuana use and use of other illicit drugs (Fairman et al., 2019; Williams, 2020), and this was found to be especially strong among youth (Secades-Villa et al., 2015). From the perspective of gateway hypothesis, drug use can be explained by a

particular growth pattern of legal drugs consumption (e.g., alcohol, cigarette, marijuana) at the first place, then illegal and conceivably more addictive and disruptive drugs (e.g., cocaine, opiates, methamphetamine; Kandel & Kandel, 2015; Wall et al., 2011).

State Marijuana Policy

Medical Marijuana Legalization

As of 2022, 38 out of 50 states and District of Columbia have decriminalized medical marijuana use and 19 states out of the 38 states have extended MML to recreational use for adults (National Conference of State Legislatures, 2022) (see Appendix). Marijuana is federally classified as a Schedule I drug, which is the highest classification under the Controlled Substances Act. The Act criminalizes the use and possession of marijuana for any purposes in the United States (Hoffmann & Weber, 2010). However, since statewide decriminalization legislation was introduced in the early 1970s, states have reduced criminal penalties for possession of small amounts of marijuana. In 1996, medical marijuana was first legalized in California, and it led marijuana legalization to consistently expand in other states (Guttmanova et al., 2019). A major concern of marijuana legalization is that it will affect views on the potential harms of marijuana consumptions, and elevate the risks of adverse health consequences of increased marijuana use (Chiu et al., 2021).

Purposes and Significance of MML. There are several purposes of the marijuana legalization, including protecting young people from being criminalized, especially people of color (e.g., Todd, 2018). MMLs have particular legislative intents to provide limited legal protection and marijuana access to selected patient groups (D'Amico et al., 2017). In the states legalizing medical marijuana, patients can be

protected from state prosecution for use of medical marijuana (Maurer, 2016). Another purpose is reducing the cost involved in law enforcement and criminal justice systems (e.g., Csete et al., 2016), and another is providing economic opportunities through the formal market (e.g., Krishna, 2017).

Although recreational marijuana legalization might be important to consider as part of state marijuana laws, this study only focuses on MML for several reasons. First, MML has changed the legal landscape in marijuana use. After the first medical marijuana law was passed in 1996, the legalization facilitated the diverse forms of marijuana (edible, vaporized). As a result, more states have expanded marijuana laws to recreational purposes and other forms of marijuana use (National Conference of State Legislatures, 2022). Second, formal acknowledgement of marijuana's medical value may go beyond the therapeutic realm and lead to normalization of marijuana use to general behavior, and adolescents are prone to public opinion change (Hathaway et al., 2011; Wen et al., 2019). Third, limited legal protections for medical marijuana use supported by the MMLs could be understood as an existing decriminalization of recreational marijuana use (Wen et al., 2019). Young people tend to adopt the notion of de facto decriminalization, especially in states where a marijuana offense is less prioritized in law enforcement (Wen et al., 2019). Finally, MMLs affect youth marijuana use by promoting favorable norms and beliefs that marijuana use is not physically or psychologically harmful, thereby increasing availability through a variety of social sources, such as advertising and social media (Paschall et al., 2017). Based on the four reasons, MML can embrace the landscape of

state marijuana legalization sufficiently along with the penalty severity on marijuana possession.

Penalty on Marijuana Possession

The statutory penalties contain communication that the punishments potentially ensure individuals will comply with the lawful behaviors. The central purpose of the penalty system is to discourage individuals from committing criminal behaviors with the transmission of deterring information (Altman, 2021; Chalfin & McCrary, 2017). It is based on the belief that strengthening criminal sanctions can lower crimes through deterrence (Abrams, 2012; Altman, 2021). Because the federal law still illegalizes possession of any amount of marijuana as a Schedule I drug, marijuana possession by any mean can lead to civil penalties, denial of federal benefits and so on. Simple possession starts as a misdemeanor but can end up as a felony offense (21 U.S.C. Code §§ 812, 844, 844a, 862, 862a, 2021). Some states follow federal laws and ban the possession of marijuana, but an increasing number of states have legalized laws that are separated from federal laws and permit possession of a certain amount of marijuana for certain uses. For example, in 1973, Oregon became the first state to lower penalties for possession of marijuana only to fines, which were later adopted by several other states (Houser & Rosacker, 2014).

Each state has its own specific laws and punishments for marijuana possession, and the regulations vary widely between states ranging from no penalty, a fine, probation, community service, and possible prison sentence to mandatory prison sentence. Even in states that have enacted or decriminalized permitted uses of marijuana, laws still manage

(a) who are permitted to use marijuana (usually adults age 21 and older), (b) what amount of marijuana is too much to possess (two ounces is a common legal limit), and (c) which locations marijuana can be smoked (e.g., not in public) (Initiative Measures No. 71, 2014; Thompson, 2017). This indicates that a prohibited person will be penalized for possessing in a prohibited place in excess of the legal limit. Therefore, a person who possesses small amounts of personal marijuana may face a civil offense (fine) or a misdemeanor (often imprisonment of up to one year). Possession is almost always a felony if the quantity is large enough to demonstrate that it is kept for sale rather than personal use (Thompson, 2017).

State Marijuana Policy and Individual Drug Perception

Marijuana policy changes can influence individual's perceptions on marijuana by sending approving (e.g., "Marijuana is socially acceptable and is not subject to legal punishment.") or disapproving messages (e.g., "Marijuana is socially unacceptable and is subject to legal punishment"; Cerdá et al. 2017). Perception implies the judgments individuals make about the consequences related to a given behavior (Becker, 1974). Perceived results of behavior are connected to subjective intention to engage in such behavior (Becker, 1974). The perceived consequences of a behavior are then associated with the subjective intentions to engage in the behavior (Becker, 1974). In the context of marijuana use, MMLs and penalty severity may affect marijuana-related perception including perceived acceptance and availability of marijuana use. Given the high overlap between marijuana use by adolescents and alcohol and cigarette use (Badiani et al., 2015; Patrick et al., 2019, Patrick et al., 2018), MML and penalty severity may also influence

adolescents' perceptions of alcohol and cigarette use (Bailey et al., 2020). Although some consider marijuana to be more harmful than other gateway drugs or vice versa, many people consider these drugs equally harmful (Estoup et al., 2016). In this regard, marijuana policies have not only influenced marijuana perceptions among parents, peers, and youth but also potentially influenced perceptions of alcohol and cigarettes in a similar regard. Therefore, these sections focus more on the impact of state marijuana policies on “drug perceptions” among parents, peers, and youth.

Medical Marijuana Legalization.

MML Influences Drug Approval. There are several possibilities to explain how MML can influence perceived acceptance toward drugs among individuals. First, the official recognition of marijuana as an effective medical treatment for alleviating symptoms and treating disease may encourage people to minimize the potential physical and psychological harm associated with marijuana use (Paschall et al., 2017). A number of legalization proponents describe marijuana use as not harmful in domestic dialogue (Cerdá et al., 2017). For example, Schuermeyer et al. found that between 2009 and 2011, the perceived harms of 12-17 year-olds in Colorado have decreased in parallel with the rapid growth of the state's medical marijuana industry. A decrease in perceived harm is generally associated with an increase in marijuana use because favorable perceptions lead individuals to perceive marijuana as acceptable (Cerdá et al. 2017; Hames et al., 2012; Willis et al., 2020). Studies have indicated that perception of drug disapproval is a promising sign of preventing marijuana use among adolescents (Hathaway et al., 2011; Schuermeyer et al., 2014). Second, the recognition of marijuana' therapeutic value may

result in the normalization of using marijuana, and youth are particularly highly influenced by public opinions (Hathaway et al., 2011). Third, limited legal protection of marijuana use under the MML could be interpreted as an actual decriminalization of recreational use. For example, adolescents are more likely to misinterpret the legislative intent of MMLs and accept the actual concept of decriminalization, especially in areas where prosecuting crimes related to marijuana is a priority for law enforcement agencies (Sekhon, 2009; U.S. Department of Justice, Office of Public Affairs 2009).

Mechanisms. Mechanisms by which MML may decrease youth drug disapproval due to increased availability of marijuana and a shift toward pro-marijuana norms in the larger society (Ladegard et al., 2020). Some people oppose marijuana legalization generally because they believe it reduces the risk perception (Ladegard et al., 2020). This is because MMLs contradict antidrug messages and existing negative perceptions of marijuana as a harmful drug (Choo et al., 2014). Based on the circumstances, more positive views of marijuana among youth has become a trend in recent years with the rapid changes in the marijuana legalization across the United States (D'Amico et al., 2018). For example, more than half of U.S. 10th and 12th graders believe that smoking marijuana regularly does not cause a serious health risk. It clearly appears that MML has decreased disapproving perceptions of marijuana (or some other drugs) among youth (Miech et al., 2015a; Wong et al., 2020).

State Differences. Marijuana-related perceptions vary by states and change over time among youth (Khatapoush & Hallfors, 2004; Miech et al., 2015a). For example, some researchers have found that adolescents are less aware of marijuana risks in states

that have legalized medical marijuana (Wall et al., 2011). Khatapoush and Hallfors (2004) found a lower risk perception and higher acceptance rate among youth in California compared to states that did not legalize MML, but this difference was an obvious policy change (i.e., lower risk perception and higher approval than other states, even before legalization). Thus, the findings of the study do not necessarily imply that policy changes led to differences, and may reflect that states with higher usage rates and lower perceived risks are more likely to legalize MML (Harper et al., 2012); these factors suggest different temporal associations between them.

The presence and absence of MML could be systematically different because of the different levels of forces that drive MML. In particular, research has shown that “states that have legalized medical marijuana already have higher rates of marijuana use among adolescents before MML was implemented” (Cerdá et al., 2017; Hasin et al., 2015). Additionally, adolescents living in states with MML were more likely to use marijuana because of higher perceived availability (Martins et al., 2016) and lower perceived drug disapproval (Keyes et al. 2011; Lynne-Landsman et al., 2013). As noted by Cerdá et al. (2012), state MMLs indicate community norms on use of medical marijuana. Other studies have suggested that “MML is related to the state-level, and community norms about medical marijuana use as public opinion and policy decisions are often considerably relevant” (Nielsen, 2010). Community norms concerning drug use, such as drinking and smoking, have also proven to be policy-relevant (Lipperman-Kreda et al., 2010).

Penalty Severity on Marijuana Possession

Detering Effect. The core idea embedded in deterrence is that unlawful behavior is responsive to the severity of criminal sanctions, and each individual responds to the adjustment in the certainty and severity of punishment when it comes to committing crimes (Apel, 2022; Becker, 1968). As individuals respond to the threat of punishment, individuals who are deterred from engaging in unlawful behaviors in the first place with penalties generally tend to conduct lower criminal acts in the future (Chalfin & McCrary, 2017). Previous studies have addressed the effect of sentencing policy on crime to examine how crime rates vary in response to punishment severity that leads to either the chance or length of imprisonment (Abrams, 2012; Friehe & Micelie, 2017). Risk of detection by government (certainty, probability) and seriousness of subsequent punishment (severity, scale) seem related to potential offenders' risk perceptions on penalties (Nagin, 2018). Sanction risk perception is closely associated with self-reported offense or intention to commit crimes (Apel, 2022; Apel & Nagin, 2017), and criminality is lower between those who perceive a greater likelihood of threat of punishment (Apel & Nagin, 2017). In this regard, perceived punishment severity for marijuana possession has more likelihood of increasing the effect of the prohibition and potentially increasing drug disapproval due to the higher risk perception on penalties (MacCoun et al., 2009; Nagin, 2018). These findings indicated that lower legal penalties for marijuana possession may lead to the observed increased marijuana use among individuals in the United States. However, the legal penalty severity failed to wield a significant crime-reducing impact. Friehe and Micelie (2017) argued that the high crime rate may have occurred despite high

sanctions, which is inconsistent with the objective of deterrence. Taken together, studies have shown that the influence of either actual or perceived severity of punishment on marijuana possession needs to be further investigated.

Benefit and Cost of Increasing Penalty Severity. Increased punishment has deterrent effects on marijuana possession by improving social controls, and it has a specific purpose of sending a deterrent message, especially to young people (Houborg, 2017; Truelove et al., 2021). These effects are quite beneficial in that they prevent youth from possessing marijuana by sending the message that simply possessing marijuana in this society is unsafe and unacceptable. This is linked to the concept of stigma, as defined by Goffman (1963, p. 4). If drug use is stigmatized, people may be less willing to own/take drugs (McKeganey, 2010). However, it also comes with heavy costs, such as increasing the criminalization of nonviolent crime, which may also increase stigma among young people, leading to more risky behaviors (Tosh, 2021). In fact, the notion that mere possession of drugs (without intent) should be treated as a crime is no longer accepted (Stevens et al., 2022). Many countries look for alternative approaches by changing public and policies (Stevens et al., 2022). Because substance abuse is generally a health and social problem, it is often considered that growing access to treatment and social services will outperform criminal sanctions (Babor et al., 2018). This could be aided by alternative measures that clearly involve a transition to services (Babor et al., 2018; Stevens et al., 2022).

Parent and Peer Drug Disapproval on Youth Drug Disapproval

Social norms represent one's essential understanding of how to behave in specific situations, and are learned by observing the attitudes of those around them (Bicchieri et al., 2018). A social norms approach specifically emphasizes the significant influences of perceived injunctive norms, which stand for perceived disapproval of others' behaviors (i.e., what other people think; Pedersen et al., 2017). For youth, social injunctive norms are initially constructed by interactions with parents and further influenced by peers as youth age (Kremer et al., 2018). Applied to drug related attitudes, youth's predisposition to view drugs is developed based on whether their parents and close friends set approval or disapproval as a normal attitude (Schultz et al., 2007). Therefore, drug disapproving norms established by parents and peers (how much one's parents/close friends oppose the drug use) can play an important role in predicting youth drug disapproval (Pearson et al., 2018; Su et al., 2018) compared to norms of more distal groups (Borsari & Carey, 2001).

Parent drug disapproval has been particularly identified as a key etiological risk factor for youth drug disapproval and drug use during adolescence (Campbell & Oei., 2010). Abundant research has shown that parents transfer their (dis)approving perceptions about drugs to their children, which in turn affects drug use and other related consequences among youth and emerging adults (Abar et al., 2009; Campbell & Oei, 2010; Zapolski et al., 2019). This shows that parental injunctive norms about drug use naturally influence youths' intention for drug use by changing personal attitudes and behavior control. (Kam & Yang, 2014; Shin & Miller-Day., 2017). Parental injunctive norms can certainly affect youth's anti-drug norms, which leads to reducing their

intention to use marijuana. (Shin & Miller-Day., 2017). Evidence has shown the possibility for parents to directly or indirectly influence youth' personal norms and perceptions of drug use (Guttmanova et al., 2019). When parents more closely monitor their children's behavior to increase the proximity of relationships, perceived parental injunction norms are even more strongly associated with their use (Napper et al., 2014; Zapolski et al., 2019).

Studies have demonstrated that youth drug perception and behavior are strongly associated with perceived injunctive norms of peers on drug use (Goldstick et al., 2018; Schuler et al., 2019). This reveals that youth who perceive greater peer approval of drug use are more likely to have positive perceptions or attitudes toward drugs and experience lifetime drug use (Guttmanova et al., 2019; Schuler et al., 2019). Although peer perceptions are often inexact, these can influence youth to establish more approving attitudes and engage in risky behavior (Guttmanova et a., 2019; Mrug & McCay, 2013). For example, if a student believes that other similar students have drug-approving attitudes and they use drugs, the student is more likely to adhere to this social norm and develop a more approving attitude toward marijuana use and use (Guttmanova et al., 2019; Schuler et al., 2019).

Youth Drug Disapproval and Youth Marijuana Behavior.

Social norms influence drug use through injunctive norms (i.e., perception of the degree of approval of drug consumption; Neighbors et al., 2011; Perkins et al., 1999). Attitudes have played a central role in explaining and predicting a range of human actions (Crano & Prislina, 2006; Willis et al., 2020). The theory of planned behavior (TPB: Ajzen,

1991) explains the relationship between individual cognitive attributes and the development of behavioral tendencies. According to TPB, cognitive determinants of behavior are normative beliefs and behavioral intentions. Normative beliefs are particularly important in adolescents' perceptions of social (dis)approval on drug use (i.e., perceptions of others' approval for drug use) (Ajzen, 1991). The TPB presumes that beliefs and social (dis)approval anticipate one's intentions, and intentions anticipate actual behavior. TPB argues that both subjective perceptions, such as norms and attitudes, can determine behavioral intentions and subsequent behaviors such as marijuana use (Ajzen, 1991). Similar to studies based on TPB, drug attitudes toward approval are closely related to rates of drug use, so that with increased drug approval, marijuana use rates can increase (Bachman et al., 1998). Favorable attitudes and more approving attitudes (both rational and evaluative) are highly predictive of stronger intentions as well as increased use of marijuana during adolescence (Hames et al., 2012; Willis et al., 2020).

Gender and Racial Differences in Marijuana Use Prevalence.

In regard to gender differences, male youth are often found to show higher marijuana prevalence for daily use than female youth (Azofeifa et al., 2016; Lanza et al., 2015). According to Keyes et al. (2017), 10th- and 12th- grade students who defined themselves as multiracial show the highest rates of marijuana use. In contrast, non-Hispanic White students tend to use marijuana more than Black and Hispanic students for a certain period (Keyes et al., 2017).

Chapter 3

Methods

Study Data and Participant

The current study used data from the 2019 National Survey on Drug Use and Health (NSDUH). The NSDUH is a series of annual cross-sectional surveys based on a state-based design funded by the Substance Abuse and Mental Health Services Administration (SAMHSA, 2019). The survey investigated the estimated prevalence of drug use and drug-related disorders among the U.S. youth population. The survey has items about lifetime and past-month drug use of all main drug categories (e.g., marijuana, alcohol, cigarettes, sedatives, stimulants) and perceptions of drug use among parents, peers, and youth. To protect privacy and increase the level of integrity reporting of sensitive behaviors such as illegal drug use (SAMHAS, 2019), the NSDUH employs a mixture of data collection efforts using computer and audio computer-assisted interviews. The data collection occurs where survey participants reside.

The NSDUH data contains 57,873 cases of youth from 50 states using multistage area probability for each state and DC. The data were assigned to age groups as follows: youth aged 12 to 17 (25%), young adults aged 18 to 25 (25%), and adults aged 26 or older (50%). For this study, a sample was selected based on two inclusion criteria: (a) participants ranged from 12 to 17 years old to focus on the mechanism of drug perception and marijuana behavior among middle and high school students, and (b) participants who responded “yes” to the specific question of “Have you ever used marijuana?” to focus on youth who are more at risk. Youth who have previously used marijuana may have more

chances to experience risky factors influencing marijuana use (i.e., parent marijuana use) (Scheier & Griffin, 2021), as well as to be exposed to the deleterious effects of marijuana use (i.e., mental health problems; D'Amico et al., 2016; Hasin, 2018; Ladegard et al., 2020). In fact, it was also necessary to set the second criterion in terms of methodological reasons to avoid extreme missing data proportions. The missing rate for the main variables might have exceeded over 70% if this study included youth who had never used marijuana in its cohort, which would lead to problems for the structural equation modeling. With these specific criteria above, only 2,293 participants were selected for the final sample, which is 15.85% of the total population of youth aged 12 to 17 years old.

Sample Characteristics

The sample demographics are summarized in Table 1. In this study, 50.8% of the participants identified as females and 49.2% of the participants as male. The average age was 15.71 years old ($SD = 1.274$), and 82.1% of the participants identified as aged 15–17 years old, and 17.9% of the participants in the sample were 12–14 years old. This finding is also consistent with Schuler et al. (2019) in that age was positively related to the increased marijuana use in their lifetime. According to the race composition, 49.5% of participants were White and 50.5% non-White, including 26.5% Hispanic, 12.5% African American, 6.5% multi-racial, 1.6% Asian, and less than 0.6% Native American.

Table 1*Demographic Characteristics of Study Participants (n = 2,293)*

Demographic characteristics	n	%
Age		
12-14 years old	411	17.9
15-17 years old	1882	82.1
Gender		
Male	1129	49.2
Female	1164	50.8
Race/Ethnicity		
White	1135	49.5
Non-White	1158	50.5
Hispanic	608	26.5
American Indian or Alaska Native	64	2.8
Black or African American	286	12.5
Native Hawaiian or Pacific Islander	14	0.6
Asian	36	1.6
Two or more races	150	6.5

Measures

This study used two observable variables of marijuana policies (status of MML and penalty severity on marijuana possession) and four latent variables (parent, peer, youth drug disapproval, and youth marijuana use). Latent variables, which are not readily observed and measured in reality, were used in this study to understand complex relationships between the variables.

State Marijuana Laws

Marijuana policies included two different variables: status of MML and penalty severity on marijuana possession. For MML, participants indicated if their interviews were held before their residing states had passed the law that permitted the use of

marijuana for medical reasons. This variable was dichotomized as 1 = “The state was legalized for medical marijuana” and 0 = “The state was not legalized for marijuana for medical reasons.” For penalty severity on marijuana possession, participants were asked to identify the perceived level of the legal penalty on the marijuana possession in the state where participants reside. Each state sets a different level of penalty for marijuana possession, and individuals may have differently acknowledged the maximum legal penalty for the possession of marijuana in their state of residence (Piquero et al., 2012). To measure this item, participants responded to the specific question: “What is the maximum legal penalty in the state where you are living for first offense possession of an ounce or less of marijuana for your own use?” The response categories were 0 = “no penalty,” 1 = “fine,” 2 = “probation,” 3 = “community service,” 4 = “possible prison sentence,” and 5 = “mandatory prison sentence.” A higher score reflects the greater perceived penalty severity when respondents were found guilty of marijuana possession in the state where they reside.

Parent Drug Disapproval

A latent variable of parent drug disapproval includes three variables: parental disapproval of alcohol, cigarettes, and marijuana. To assess parental drug disapproval, participants answered how they perceived their parents approved or disapproved of any alcohol, cigarette, and marijuana use by their children. The specific questions are as follows: “How do you think your parents would feel about you having one or two drinks of an alcoholic beverage nearly every day?” for *parental alcohol disapproval*; “How do you think your parents would feel about you smoking one or more packs of cigarettes per

day?” for *parental cigarette disapproval*; “How do you think your close friends would feel about you trying marijuana or hashish once or twice?” and “How do you think your parents would feel about you trying marijuana or hashish once or twice, or once a month or more?” for *parental marijuana disapproval* (Cronbach $\alpha = .92$). The response categories for parent drug disapproval variables are: 1 = “neither approve nor disapprove,” 2 = “somewhat disapprove,” and 3 = “strongly disapprove.” A higher score implies higher parental disapproval of alcohol, cigarette, and marijuana use.

Peer Drug Disapproval

A latent variable of peer drug disapproval includes three variables: peer disapproval of alcohol, cigarette, and marijuana. To assess peer drug disapproval, participants answered how the participants perceive their peers approve or disapprove alcohol, cigarette, and marijuana use. The specific questions are as follows: “How do you think your close friends would feel about you having one or two drinks of an alcoholic beverage nearly every day?”, for *peer alcohol disapproval* “How do you think your close friends would feel about you smoking one or more packs of cigarettes a day?”, for *peer cigarette disapproval* “How do you think your close friends would feel about you trying marijuana or hashish once or twice?” and “How do you think your close friends would feel about you using marijuana or hashish once a month or more?” for *peer marijuana disapproval*. For peer marijuana disapproval, the two items were calculated into a mean for analysis (Cronbach $\alpha = .95$). A three-point Likert scale for peer alcohol, cigarette, and marijuana was used ranging from 1 = “neither approve nor disapprove,” 2 = “somewhat

disapprove”, to 3 = “strongly disapprove.” A higher score implies greater peer disapproval toward alcohol, cigarette, and marijuana use.

Youth Drug Disapproval

A latent variable of youth drug disapproval includes three variables: youth disapproval of alcohol, cigarette, and marijuana. To assess youth drug disapproval, participants answered how the participants perceive someone their age using alcohol, cigarette, and marijuana. The specific questions are as follows: “How do you feel about someone your age having one or two drinks of an alcoholic beverage nearly every day?” for *youth alcohol disapproval*; “How do you feel about someone your age smoking one or more packs of cigarettes a day?” for *youth cigarette disapproval*; “How do you feel about someone your age trying marijuana or hashish once or twice?” and “How do you feel about someone your age using marijuana or hashish once a month or more?” for *youth marijuana disapproval*. For youth marijuana disapproval, the two items were calculated into a mean for analysis (Cronbach $\alpha = .92$). A three-point Likert scale for peer alcohol, cigarette, and marijuana was used ranging from 1 = “neither approve nor disapprove,” 2 = “somewhat disapprove”, to 3 = “strongly disapprove.” A higher score implies greater peer disapproval toward alcohol, cigarette, and marijuana use.

Youth Marijuana Use

A latent variable of youth marijuana use includes two variables: youth marijuana use in the past 30 days and in the past 12 months. Participants answered two specific questions. “During the past 30 days, how many days have you used marijuana or hashish?” for 30 days of marijuana use, and “In the past 12 months, how many days have

you marijuana or hashish?” for 12 months of marijuana use. The marijuana use frequency for each variable was assessed with open-ended items ranging from 1–30 for 30 days marijuana use and 1–365 for 12 months marijuana use. Higher scores indicate greater frequency of youth marijuana use.

Data Analysis Plan

The data were analyzed using SPSS software version 21.0 (SPSS Inc., Chicago, IL) and AMOS software version 28.0 (ADC, Chicago, IL). First, Little’s MCAR test was used to find the most appropriate method to address missing data, and preliminary tests were conducted to make sure that a structural equation model was adequate in this study, and to ascertain the data validity. The primary tests included skewness, kurtosis, and collinearity diagnostics. Second, descriptive statistics covering frequencies and central tendencies, and correlation analyses were used to summarize characteristics of the main variables and the associations between variables in interests.

Third, the hypothesized structural equation modeling (SEM) was used to evaluate the proposed theoretical study model and analyze the direct, indirect, and total effects of the major variables (Mueller & Hancock., 2018). The total effects that represent the sum of both direct and indirect effects between the investigated variables were calculated (Vettore et al., 2019). SEM is appropriate for this study because SEM can test all the hypothesized relationships in a structural model simultaneously. SEM can also estimate the extent to which an endogenous variable (e.g., adolescent drug disapproval) is attributable to the direct influence of an exogenous variable (e.g., marijuana policy). SEM

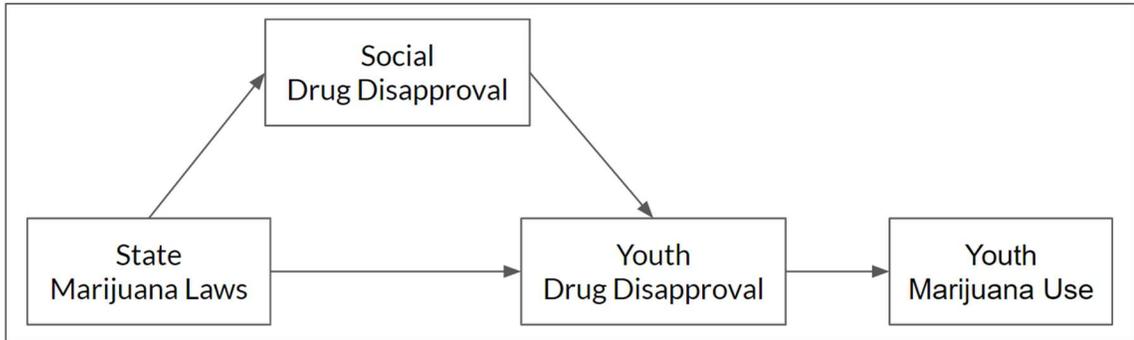
can more accurately estimate the indirect effect of exogenous variables on all endogenous variables beyond the information provided through path analysis (Tarka, 2018).

Fourth, the indirect effect was measured to identify and explain the mechanism or process that underlies the relationship between marijuana policies and youth drug disapproval via the inclusion of parent and peer drug disapproval. This indicates that marijuana policies influence parent and peer drug disapproval, which in turn influence youth drug disapproval. Thus, this mediation analysis can contribute to better understanding the relationship between marijuana policies and youth drug disapproval (MacKinnon, 2008). To determine whether mediation effects are present, bias-corrected bootstrapping (5,000 bootstrap samples) was used to test the 95% confidence interval of the mediating effect (Chen & Fritz, 2021). If the confidence interval does not contain the value of zero, the estimated indirect effect is considered significant, and p -value < 0.05 was set as a significant threshold.

Finally, multi-group analyses were conducted considering gender and race. The structural model mechanisms were conducted among groups between male and female youth, as well as between White and non-White youth to see if there is any difference in the mechanism based on racial and gender characteristics. The structural research model is seen in Figure 3.

Figure 3

Structural Research Model



Chapter 4

Results

Missing Data and Validity

Missing data in the model ranged from < 2% (i.e., status of MML, penalty severity on marijuana possession, youth drug disapproval index, peer drug disapproval index, and parent drug disapproval index) to < 8% (i.e., youth marijuana use). The original penalty severity variable had approximately 17% of missing data, including “don’t know” or “refused,” and the total rate of missing data exceeded 20%; therefore, the cases of these values were removed list-wise from the dataset for future imputation processes. After this process, the overall summary of missing values indicated that the average cases of missing data was 10.6%. To find the most appropriate way to address missing data, Little’s (1998) MCAR test was first used to examine whether the null hypothesis that the data are completely missing at random (MCAR) is accepted. Because the significance value was less than .05 from the MCAR test, the hypothesis that the data are MCAR was rejected, meaning that the data are not missing completely at random; thus, MAR is assumed. This result indicates that using listwise deletion would result in missing variable bias.

Then chi-square statistics was used to test the null hypothesis that the model fit the data (predicted model and observed data are equal). Because a nonsignificant χ^2 suggests that the theoretical model is well fitted to the sample data (Barrett, 2007), a value of $p > .05$, which means to fail to reject the null hypothesis, is recommended. The chi-square test result shows that it cannot reject the null hypothesis that the data fit well

with the significant value of less than .01. It indicates that the model fit is not excellent, but it is important to acknowledge that a well-fit hypothetical model commonly produces a significant χ^2 if the sample size is large because of the sensitivity of the likelihood ratio test to sample size (Byrne, 2010). The above results show that the data are not MCAR, and the percentage of missing cases is < 20% so MAR assumed, and the model fit is not excellent based on the chi-square test. Therefore, multiple imputations with 10 rounds were used to address the missing data. Multiple imputation is considered the best in the field of missing data as with full information maximum likelihood (FIML; Schafer & Graham, 2002).

To ascertain that a structural equation model was appropriate for this study and to ensure the validity of the data, preliminary tests were conducted. For example, the values of skewness and kurtosis of each for all continuous variables was examined separately to test for normality. For sample size greater than 300, values larger than 2 and 7 can be used as reference values for an absolute skewness and kurtosis to determine normality of data (Kim, 2013; Wulandari et al., 2021). The preliminary tests indicate that the values fell within the range of ± 2.0 for skewness and ± 5.0 for kurtosis. The variable of marijuana use frequency may not show higher skewness and kurtosis than usual because this study only selected participants who had used marijuana. In addition, collinearity diagnostics were examined for all study variables. Variance inflation factors (VIF) range from 1.010 to 2.509, falling below the common thresholds of 4 (Fox, 2005). This indicates that the multicollinearity problem was not found (Coakes, 2007).

Descriptive Statistics.

Table 2 shows descriptive statistics of state marijuana laws, parent, peer, youth drug disapproval, and youth marijuana use. First, in terms of state marijuana laws, 74.3% of youth among the sample have currently lived in states where MML has been approved; however, only 25.7% of the youth lived in states where MML had not been passed. The descriptive results of penalty severity indicate that a fine was the most prevalent penalty, and 27.3% of participants reported a fine was the penalty for marijuana possession in the state where they lived; 26.6% and 21.6% of youth reported that their states had probation and possible prison sentences as penalties for marijuana possession. Also, 11% of youth reported that their states enforced community service if individuals possess marijuana, and 8.2% of youth reported their states had no penalty for marijuana possession. Only 4.4% showed that their states had mandatory prison sentences for marijuana possession.

Second, the results showed the score of mean and standard deviation of parent drug disapproval toward alcohol, cigarette, and marijuana. The average parental drug disapproval was 2.72 ($SD = .613$) for alcohol, 2.81 ($SD = .547$) for cigarettes, and 2.32 ($SD = .765$) for marijuana. The level of parental drug disapproval is quite high, considering the maximum score is three, indicating that youth tend to perceive their parents disapprove of alcohol, cigarettes, and marijuana. Among those drugs, parental disapproval was particularly higher on cigarettes and alcohol than marijuana. Compared to the parent drug disapproval, the results showed that peer drug disapproval is relatively lower in general. The mean of peer drug disapproval was 2.26 ($SD = .825$) for alcohol, 2.56 ($SD = .736$) for cigarettes, and 1.56 ($SD = .764$) for marijuana. This indicates that

peer cigarette and alcohol disapproval was higher than marijuana disapproval among peers, which is consistent with the parent drug disapproval.

Finally, in terms of youth drug disapproval, the average was 2.28 ($SD = .821$) for alcohol, 2.63 ($SD = .696$) for cigarettes, and 1.54 ($SD = .759$) for marijuana, indicating that youth have the strongest disapproving perception toward cigarette and the least disapproval toward marijuana. This result indicates a similar pattern of drug disapproving perceptions among parents and peers. In terms of youth marijuana use, the mean score of youth marijuana use was 5.14 ($SD = 8.977$) for 30 days and 76.708 ($SD = 111.257$) for 12 months among youth who d used marijuana in their lifetime.

Table 2*Descriptive Statistics of the Whole Sample (n = 2,293)*

	n (%)	Mean	SD	Range
MML				0-1
Legalized	1420 (74.3)			
Not legalized	490 (25.7)			
Severity of Law				0-5
No Penalty	156 (8.2)			
A Fine	522 (27.3)			
Probation	508 (26.6)			
Community Service	228 (11.9)			
Possible Prison Sentence	412 (21.6)			
Mandatory Prison Sentence	84 (4.4)			
Parent Drug Disapproval				
Marijuana Disapproval		2.315	0.765	1 - 3
Cigarette Disapproval		2.805	0.547	1 - 3
Alcohol Disapproval		2.720	0.613	1 - 3
Peer Drug Disapproval				
Marijuana Disapproval		1.561	0.764	1 - 3
Cigarette Disapproval		2.557	0.736	1 - 3
Alcohol Disapproval		2.262	0.825	1 - 3
Youth Drug Disapproval				
Marijuana Disapproval		1.543	0.759	1 - 3
Cigarette Disapproval		2.628	0.696	1 - 3
Alcohol Disapproval		2.279	0.821	1 - 3
Youth Marijuana Use				
30 Days		5.141	8.977	0 - 30
12 Months		76.708	111.257	0 - 365

Bivariate Correlation

A bivariate correlation matrix between study variables is presented in Table 3. As noted in the table, MML was *negatively* and significantly correlated with penalty severity on marijuana possession ($r = -.084, p < .001$), marijuana disapproval among parents ($r = -.071, p < .01$), peers ($r = -.048, p < .05$), and youth ($r = -.058, p < .05$); but *positively* related to youth marijuana use for both 30 days ($r = .055, p < .05$) and 12 months (r

= .070, $p < .01$). Penalty severity on marijuana possession was *positively* related to alcohol disapproval among peers ($r = .064$, $p < .01$) and youth ($r = .058$, $p < .05$), but *negatively* associated with youth marijuana use for 30 days ($r = -.050$, $p < .05$) and 12 months ($r = -.062$, $p < .01$)

The parent drug disapproval variables were all *negatively* associated with youth marijuana use for 30 days and 12 months; peer drug disapproval variables are also *positively* and significantly related to youth drug disapproval, and *negatively* and significantly associated with youth marijuana use for 30 days and 12 months

Youth drug disapproval variables were *positively* and significantly related with each other, and *negatively* correlated with youth marijuana use for 30 days and for 12 months. Finally, youth marijuana use for 30 days was *positively* and significantly associated with youth marijuana use for 12 months ($r = .772$, $p < .001$), indicating that short-term marijuana use was associated with long-term use of marijuana among youth.

In summary, study findings indicated that MML was *negatively* correlated with drug disapproval variables of parents, peers, and youth, whereas, penalty severity on marijuana possession was *positively* correlated with the drug disapproval variables. This result shows that the direction of the relationship between the marijuana policies and drug disapproval variables are completely opposite. Furthermore, parent and peer drug disapproval were *positively* associated with youth drug disapproval. Finally, youth drug disapproval is *negatively* correlated with youth marijuana use variables.

Table 3*Correlation Analysis between Structural Model Variables (n = 2,293)*

	1	2	3	4	5	6	7	8	8	9	10	11	12
Variables													
Marijuana Law													
1. MML	1												
2. Penalty Severity	-.08...	1											
Parent Disapproval													
3. Marijuana	-.07..	.04	1										
4. Cigarette	.00	.02	.35...	1									
5. Alcohol	-.00	.03	.43...	.48...	1								
Peer Disapproval													
6. Marijuana	-.05.	.03	.37...	.03	.14...	1							
7. Cigarette	.04	-.02	.20...	.33...	.32...	.28...	1						
8. Alcohol	.02	.06..	.20...	.21...	.39...	.45...	.53...	1					
Youth Disapproval													
9. Marijuana	-.06.	.00	.40...	.02	.15...	.73...	.22...	.31...	1				
10. Cigarette	.03	-.00	.20...	.36...	.36...	.17...	.52...	.37...	.25...	1			
11. Alcohol	.01	.06.	.20...	.21...	.37...	.34...	.45...	.60...	.42...	.46...	1		
Marijuana Use													
12. 30 Days	.06.	-.05.	-.32...	-.14...	-.14...	-.23...	-.15...	-.16...	-.19...	-.11...	-.18...	1	
13. 12 Months	.07..	-.06..	-.31...	-.15...	-.17...	-.22...	-.17...	-.20...	-.18...	-.15...	-.22...	.77...	1

Note. * $p < .05$. ** $p < .01$. *** $p < .001$.

Factor Analysis and Model Fit Assessment

Factor Analysis

This study contained four latent constructs in the model. Factor loadings were significant and of acceptable size. Table 4 indicates that the factor loading for every item of the latent constructs is greater than the cut of point .6 (Farrell & Rudd, 2009), which also indicates that all the items used to measure latent constructs can be used for further analysis. Composite Reliability (CR) values and Average Variance Extraction (AVE)

values met the recommended values exceeding .7 and .5, respectively (Farrell & Rudd, 2009).

Table 4

The Validity and Reliability of the Measurement Model

Construct	Item	Factor Loading	CR ^a	AVE ^b
Parent Drug Disapproval	Alcohol Disapproval	0.74	0.82	0.6
	Cigarette Disapproval	0.82		
	Marijuana Disapproval	0.77		
Peer Drug Disapproval	Alcohol Disapproval	0.71	0.74	0.61
	Cigarette Disapproval	0.86		
	Marijuana Disapproval	0.77		
Youth Drug Disapproval	Alcohol Disapproval	0.82	0.74	0.61
	Cigarette Disapproval	0.83		
	Marijuana Disapproval	0.68		
Youth Marijuana Use	Marijuana Use (30 Days)	0.94	0.93	0.89
	Marijuana Use (12 Months)	0.94		

^a CR is composite reliability computed by $\frac{(\sum\lambda)^2}{(\sum\lambda)^2 + (\sum\eta)}$.

^b AVE is average variance extracted computed by $\frac{(\sum\lambda^2)}{(\sum\lambda^2) + (\sum\eta)}$; this value was fixed at 1.00 for model identification purposes.

Assessment of Model Fit

This study examined the structural equation pathways with different models – it was constructed to proceed with Model 1 for the whole sample, Model 2 and 3 for males and females, and Model 4 for white, and non-White youths in order to see the group differences within the pathways. Several model fit indices were utilized to evaluate whether the model fit the empirical data for model 1 to model 5. A nonsignificant chi-square test (χ^2) and a chi-square to degree of freedom ratio of less than five (Bollen, 1989) recommend that the model indicates the relationship in the data. However, chi-square tests are easily affected by the large sample size. Thus, this study also used

multiple fit indexes to determine the model fit, and all fit indices of the structural model indicate that model fits are satisfactory, as seen in Table 5.

The comparative fit index (CFI, Bentler, 1990) and TLI are in the similar group of comparative fit indexes; the proposed model's lack of fit is compared with the baseline model that presumes no relations among variables. TLI also adapts for brevity by paying a penalty for every added parameter; CFI and TLI range from 0 to 1. Values greater than .95 is considered a good fit and values between .90 and .95 are generally acceptable (Ullman & Bentler, 2003). The CFI compares the hypothesized model to the independence model by considering the effect of sample size. The CFI values greater than .95 indicates the model has an adequate model fit (Byrne, 2010).

The root mean square error of approximation (RMSEA, Byrne, 2010) has been highly recommended for evaluating model fit. As a measure of error of approximation, elaborating error of approximation in the population by questioning how well the model fits the population covariance matrix with ideally suggested parameter values. Models with perfect fit have RMSEA value of 0. RMSEA values smaller than .10 indicate acceptable fit. Well-fitting models should have RMSEA of .08 or below (Cudeck, 1993). For all three models, CFI and TLI are above .90, and RMSEA is lower than 0.05. Therefore, we can conclude that all the three models had good fits.

Table 5*Fit Indices for the Research Models*

Fit Index	Recommended level of fit index	Model 1 Total	Model 2 Male	Model 3 Female	Model 4 White	Model 5 Non-White
χ^2	Not significant at $p < .05$	2661.975 $p < .001$	1286.095, $p < .001$	1761.365, $p < .001$	1497.767, $p < .001$	1718.247, $p < .001$
CFI	$\geq .90$	.969	.971	.960	.967	.961
RMSEA	$< .05$ (good fit) $< .08$ (fair fit)	.057	.055	.066	.061	.064
TLI	$\geq .90$	.943	.946	.927	.938	.928

Structural Equation Model Analysis in Amos*Structural Path Model for the Whole sample*

After ensuring the measurement reliability and validity of the model, the structural path model examined the direct, indirect, and total effects of the exogenous constructs on the endogenous ones. In the structural equation model of this study, a total of 13 paths were set up between potential variables. A pathway predicting the influence of penalty severity on youth drug disapproval was rejected, but all the other hypotheses were supported (see Table 6). In terms of direct effects (see Figure 4), the results showed that MML has significant *negative* direct effects on parent ($\beta = -.094, p < .001$), peer ($\beta = -.130, p < .001$), and youth drug disapproval ($\beta = -.069, p < .001$). These results indicate that legalizing marijuana use for medical purposes in states significantly reduces the disapproving norms among parents, peers, and youth, meaning that youth, who are living in legalizing states, are less likely to perceive that their parents and peers disapprove drug use and are less likely to perceive the drug is harmful. To be more specific, the negative impact of MML was greater on peer drug disapproval than parent and youth drug

disapproval, indicating that MML specifically reduces disapproving perceptions among peers.

In contrast, penalty severity on marijuana possession has significant *positive* direct effects on parents ($\beta = .016, p < .001$) and peers ($\beta = .031, p < .001$), but did not have a significant impact on youth drug disapproval. These results revealed that the penalty severity may have a crucial role in increasing drug disapproval of the important socializing agents of youth such as parents and peers. It also indicates that youth, who are living in states with greater penalty severity, are more likely to perceive that their parents and peers disapprove of drug use. To be more specific, penalty severity has a greater *positive* impact on peer drug disapproval than parent drug disapproval. This indicates that MML significantly reduces parent, peer, and youth drug disapproval; on the other hand, penalty severity significantly increases parent and peer drug disapproval.

The result also showed that parent ($\beta = .247, p < .001$) and peer drug disapproval ($\beta = .699, p < .001$) had significant *positive* direct impacts on youth drug disapproval, indicating that the higher the level of parent and peer drug disapproval is, the higher the level of the youth's drug disapproval will be. The result demonstrated that peer drug disapproval has a greater impact on youth drug disapproval than the impact of parent drug disapproval, indicating that youth are highly influenced by their peers than their parents during adolescence as supported by several previous studies. Finally, the result indicated that youth drug disapproval significantly and *negatively* influenced youth marijuana use ($\beta = -3.245, p < .001$), indicating that youth drug disapproval has a potential to decrease marijuana use among youth.

Table 6 also presented details of the estimated specific mediation effects together with their confidence intervals. Total and indirect effect estimates indicated full mediation for all indirect paths. First, MML had a significant *negative* indirect effect on youth drug disapproval through its negative effect on parent (indirect $\beta = -.014$, $p < .01$, bias-corrected 95% CI = [-.029, -.017]) and peer drug disapproval (indirect $\beta = -.056$, $p < .001$, bias-corrected 95% CI = [-.117, -.065]). This result shows that both parent and peer drug disapproval have significant mediating roles in the relationship between MML and youth drug disapproval, but peer drug disapproval has a greater indirect effect in the relationship. Second, penalty severity also had a significant *positive* indirect effect on youth drug disapproval through its positive effects on parents ($\beta = .007$, $p < .001$) and peer drug disapproval ($\beta = .042$, $p < .01$). This result indicates that penalty severity predicted youth drug disapproval through increased parent and peer drug disapproval. Total and indirect effect estimates indicated full mediation for all indirect paths.

Summary. The result indicated that MML significantly reduces the drug disapproving norms among parents, peers, and youth; in contrast, penalty severity on marijuana possession significantly reinforces the disapproving norms among only parent and peers. The negative/positive impacts of MML and penalty severity was greater on peer drug disapproval than parent drug disapproval. Furthermore, parent and peer drug disapproval significantly increase youth drug disapproval, and peer drug disapproval has a higher influence on youth drug disapproval. In addition, youth drug disapproval significantly reduces youth marijuana use. Finally, MML and penalty severity had

significantly indirect effects on youth drug disapproval through the decreased/increased parent and peer drug disapproval.

Table 6

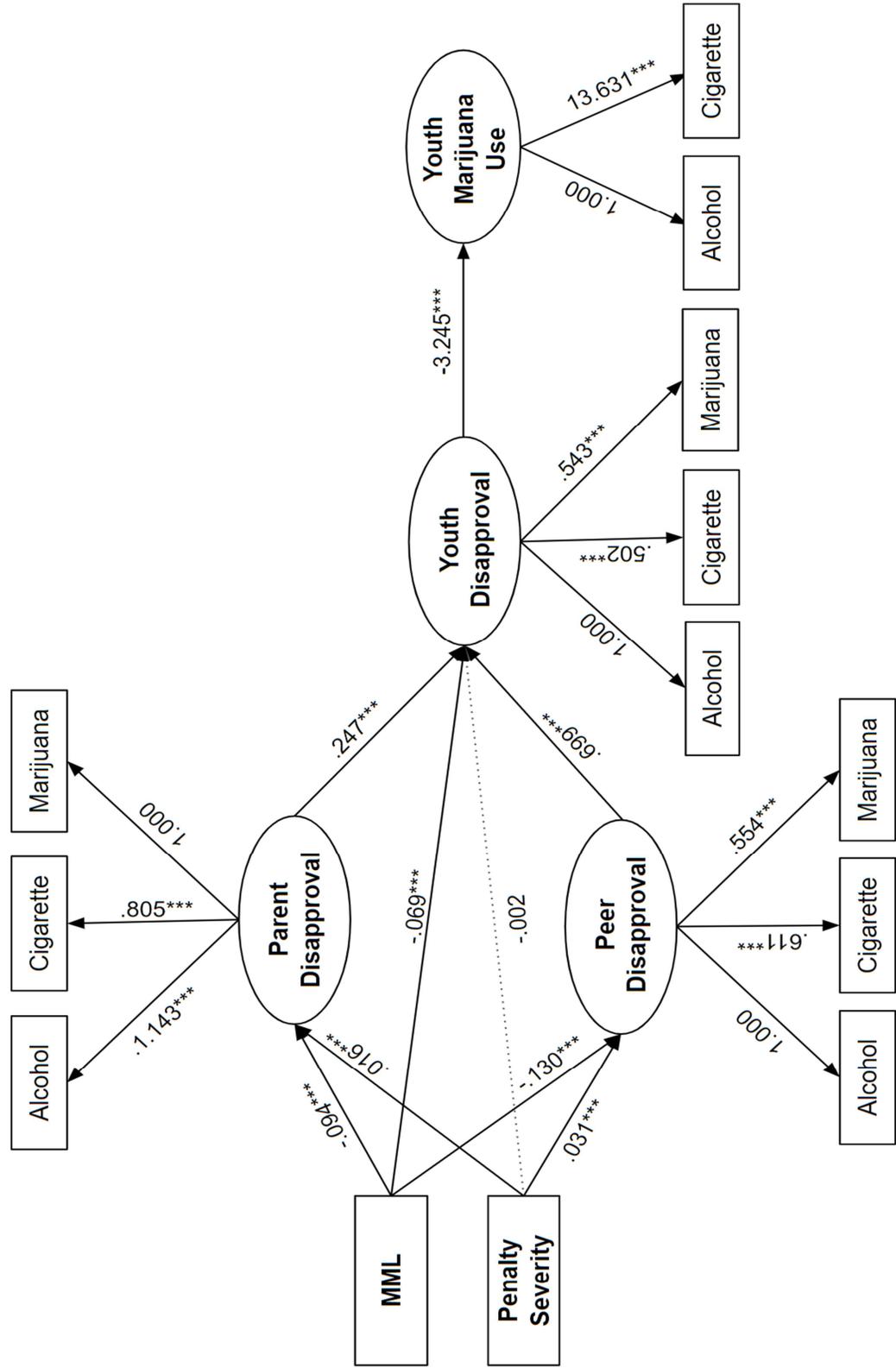
Direct, Indirect and Total Effects for the Whole Sample (n = 2,293)

Hypothesized path		Direct Effect	Indirect Effect	Total Effect	95% CI LL, UL
MML	→ Parent Disapproval	-.094***		-.094***	
	Peer Disapproval	-.130***		-.130***	
	Youth Disapproval	-.069***		-.069***	
	Via Parent Disapproval		-.014**	-.014**	-.029, -.017
	Via Peer Disapproval		-.056***	-.056***	-.117, -.065
Penalty Severity	→ Parent Disapproval	.016***		.016***	
	Peer Disapproval	.031***		.031***	
	Youth Disapproval	-.002		-.002	
	Via Parent Disapproval		.007***	.007***	.003, .005
	Via Peer Disapproval		.042**	.042**	.017, .026
Parent Disapproval	→ Youth Disapproval	.247***		.247***	
Peer Disapproval	→ Youth Disapproval	.699***		.699***	
Youth Disapproval	→ Youth Marijuana Use	-3.245***		-3.245***	

Note. Table 6 includes the standardized path coefficients for the variables included in the model.

CI = confidence interval; *LL* = lower limit; *UL* = upper limit

Figure 4. Structural Equation Model 1 for the Whole Sample (n = 2,293)



Structural Path Model for Groups by Gender

Male Youth. Table 7 showed the structural path model for male youth (see Figure 5). A pathway predicting the influence of MML on parent drug disapproval was rejected, but all the other paths were supported. The results showed that MML has significant *negative* direct effects on peers ($\beta = -.085, p < .01$) and youth drug disapproval ($\beta = -.118, p < .001$), but did not have a significant direct effect on parent drug disapproval. These results indicate that legalizing medical marijuana significantly reduces the disapproving norms among peers and youth, but did not significantly reduce parents disapproving norms of drugs. In contrast, penalty severity has significant *positive* direct effects on parent ($\beta = .012, p < .01$), peer ($\beta = .018, p < .01$), and youth drug disapproval ($\beta = .011, p < .01$), indicating that penalty severity on marijuana possession significantly increase drug disapproval among parents, peers, and youth. These results show that MML and penalty severity differently influence drug disapproval. Furthermore, the result also showed that parent ($\beta = .186, p < .001$) and peer drug disapproval ($\beta = .680, p < .001$) had significant *positive* direct impacts on youth drug disapproval, indicating that the higher level of parent and peer drug disapproval predicts higher level of youth drug disapproval. The result also demonstrated that peer drug disapproval has a greater impact on youth drug disapproval. Finally, youth drug disapproval ($\beta = -3.430, p < .001$) has a significant *negative* impact on youth marijuana use, indicating that youth drug disapproval decreases youth marijuana.

Table 7 also presented details of the estimated specific indirect effects along with their confidence intervals. First, marijuana MML had a significant *negative* indirect effect

on youth drug disapproval through changing peer drug disapproval (indirect $\beta = -.036$, $p < .01$, bias-corrected 95% CI = $[-.094, -.024]$). However, MML did not indirectly influence youth drug disapproval through parent drug disapproval. These results show that peer drug disapproval had a significant mediating role in the relationship between MML and youth drug disapproval, but parent drug disapproval did not have a significant mediating role in this association. Second, penalty severity had a significant indirect effect on youth drug disapproval through changing parent (indirect $\beta = .004$, $p < .01$, bias-corrected 95% CI = $[.001, .004]$), and peer drug disapproval (indirect $\beta = .024$, $p < .01$, bias-corrected 95% CI = $[.005, .019]$). This result indicates that penalty severity predicted youth drug disapproval through increased parent and peer drug disapproval.

Summary. The results showed that MML significantly reduces peer and youth drug disapproval, whereas penalty severity on marijuana possession significantly reinforces drug disapproval among parents, peers, and youth. Furthermore, parent and peer drug disapproval significantly reinforce youth drug disapproval, and peer drug disapproval has a higher impact on youth drug disapproval. In addition, youth drug disapproval significantly reduces youth marijuana use. Finally, MML has a significant indirect effect on youth drug disapproval only through decreased peer drug disapproval whereas, penalty severity indirectly influences youth drug disapproval through increased parent and peer drug disapproval. In comparison to Model 1 including all participants, with this only male participations model provide different results: (a) MML significantly influences peer and youth drug disapproval but does not influence parent drug disapproval; (b) penalty severity comprehensively influences parent, peer, and youth drug

disapproval; and (c) the indirect effect of parent drug disapproval is not significant in the relationship between MML and youth drug disapproval.

Table 7

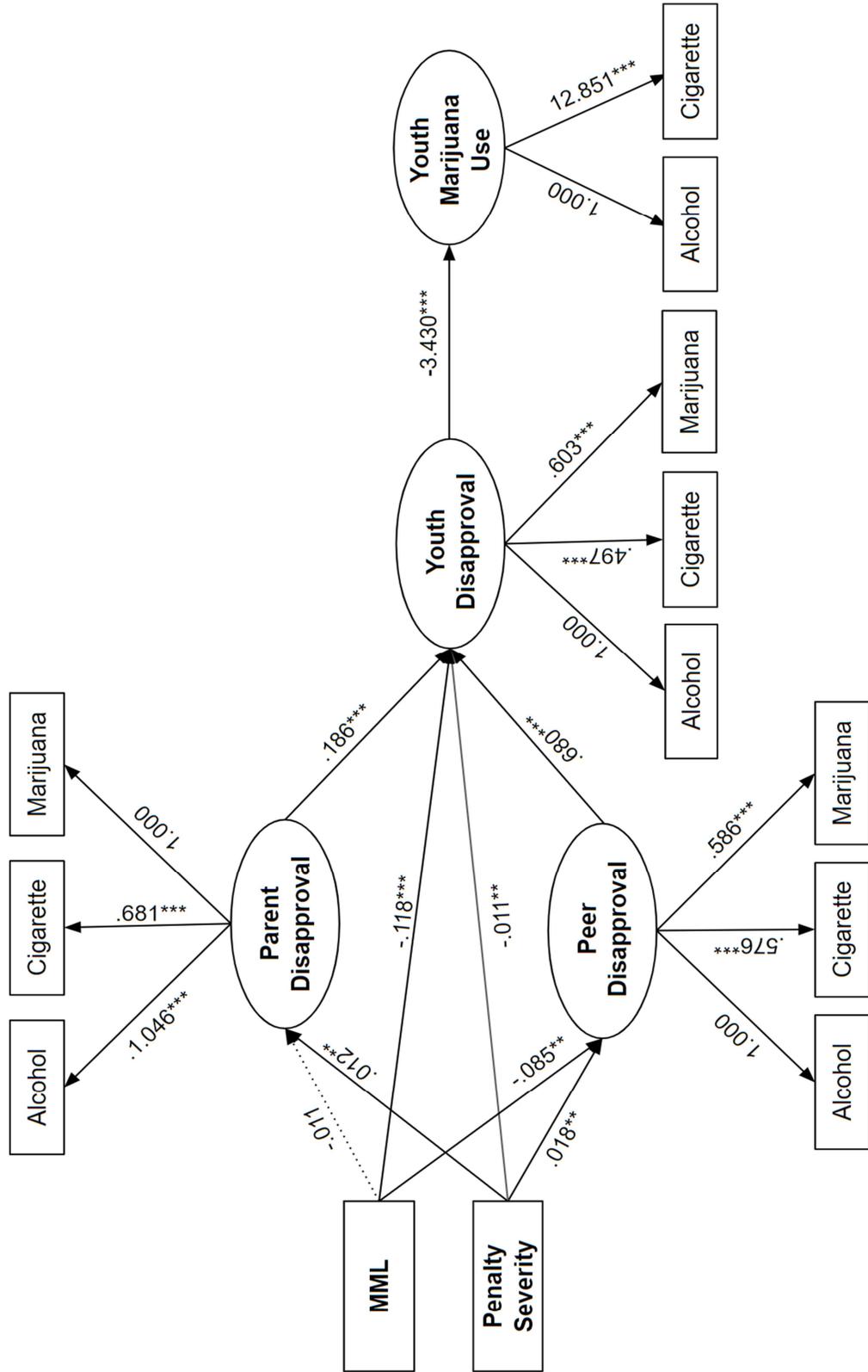
Direct, Indirect and Total Effects for Male Youth (n = 1,129)

	Hypothesized path	Direct Effect	Indirect Effect	Total Effect	95% CI
MML	→ Parent Disapproval	-.011		-.011	
	Peer Disapproval	-.085**		-.085**	
	Youth Disapproval	-.118***		-.118***	
	Via Parent Disapproval		-.001	-.001	-.008, .004
	Via Peer Drug Disapproval		-.036**	-.036**	-.094, -.024
Penalty Severity	→ Parent Disapproval	.012**		.012**	
	Peer Disapproval	.018**		.018**	
	Youth Disapproval	.011**		.011**	
	Via Parent Disapproval		.004**	.004**	.001, .004
	Via Peer Disapproval		.024**	.024**	.005, .019
Parent Disapproval	→ Youth Disapproval	.186***		.186***	
Peer Disapproval	Youth Disapproval	.680***		.680***	
Youth Disapproval	Youth Marijuana Use	-3.430***		-3.430***	

Note: Table 7 includes the standardized path coefficients for the variables included in the model.

CI = confidence interval; *LL* = lower limit; *UL* = upper l

Figure 5. Structural Equation Model 2 for the Male Youth (n = 1,129)



Female Youth. Table 8 showed the structural path model for female youth (see Figure 6). A pathway predicting the influence of MML on youth drug disapproval was rejected, but all the other paths were supported. The results showed that MML has significant *negative* direct effects on parents ($\beta = -.177, p < .001$) and peer drug disapproval ($\beta = -.166, p < .001$), but it did not have a significant direct effect on youth drug disapproval. These results indicate that MML significantly reduces the disapproving norms among parents and peers, but did not significantly reduce youth disapproving norms of drugs. In contrast, penalty severity has significant *positive* direct effects on parent ($\beta = .017, p < .001$), peer ($\beta = .041, p < .001$), and youth drug disapproval ($\beta = .011, p < .05$), indicating that penalty severity on marijuana possession significantly increase drug disapproval among parents, peers, and youth. These results show that MML and penalty severity differently influence drug disapproval. Furthermore, the result also showed that parent ($\beta = .326, p < .001$) and peer drug disapproval ($\beta = .708, p < .001$) had significant *positive* direct impacts on youth drug disapproval, indicating that the higher level of parent and peer drug disapproval predicts higher levels of youth drug disapproval. The result also demonstrated that peer drug disapproval has a greater impact on youth drug disapproval. Finally, youth drug disapproval ($\beta = -3.070, p < .001$) has a significant *negative* impact on youth marijuana use, indicating that youth drug disapproval decreases youth marijuana.

Table 8 also presented details of the estimated specific indirect effects along with their confidence intervals. Total and indirect effect estimates indicated full mediation for all indirect paths. First, MML had a significant *negative* indirect effect on youth drug

disapproval through changing parent (indirect $\beta = -.035$, $p < .001$, bias-corrected 95% CI = $[-.072, -.045]$), and peer drug disapproval (indirect $\beta = -.072$, $p < .001$, bias-corrected 95% CI = $[-.080, .001]$). These results show that parent and peer drug disapproval had a significant mediating role in the relationship between MML and youth drug disapproval. Second, penalty severity had a significant indirect effect on youth drug disapproval through changing parent (indirect $\beta = .011$, $p < .001$, bias-corrected 95% CI = $[.004, .008]$) and peer drug disapproval (indirect $\beta = .055$, $p < .01$, bias-corrected 95% CI = $[.022, .036]$). This result indicates that penalty severity predicted youth drug disapproval through increased parent and peer drug disapproval.

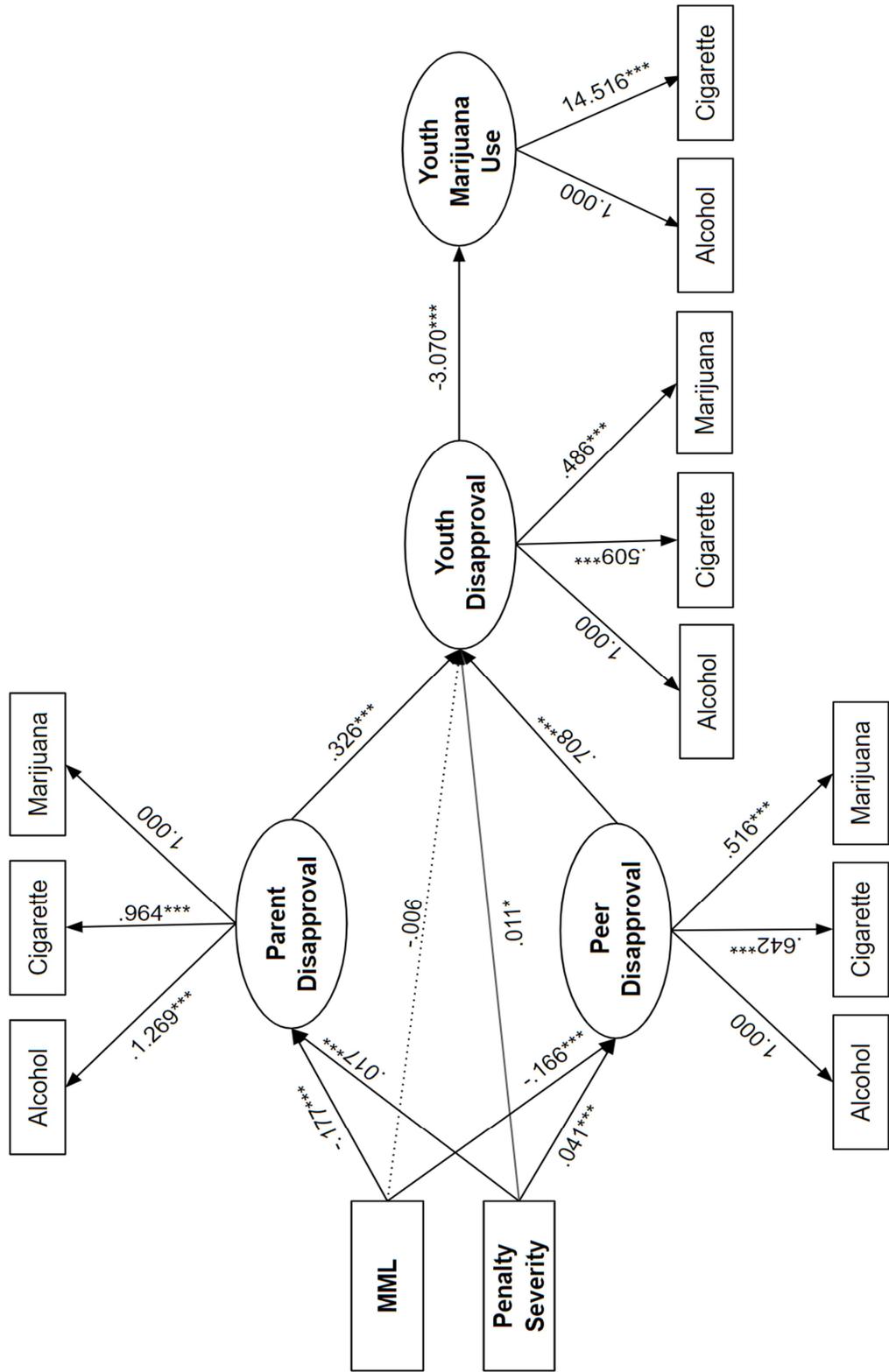
Summary. Model 3 shows that MML only significantly reduces parent and peer drug disapproval, whereas penalty severity significantly increases parent, peer, and youth drug disapproval. Furthermore, parent and peer drug disapproval significantly increase youth drug disapproval, and peer drug disapproval has a greater impact on youth drug disapproval. In addition, youth drug disapproval significantly reduces youth marijuana use. Finally, MML and penalty severity significantly reduces/increase youth drug disapproval indirectly through decreased/increased parent and peer drug disapproval.

Table 8*Direct, Indirect and Total Effects for Female Youth (n = 1,164)*

Hypothesized path			Direct Effect	Indirect Effect	Total Effect	95% CI LL, UL
MML	→	Parent Disapproval	-.177***		-.177***	
		Peer Disapproval	-.166***		-.166***	
		Youth Disapproval	-.006		-.006	
		Via Parent Disapproval		-.035***		-.072, -.045
		Via Peer Disapproval		-.072***		-.080, .001
Penalty Severity	→	Parent Disapproval	.017***		.017***	
		Peer Disapproval	.041***		.041***	
		Youth Disapproval	.011*		.011*	
		Via Parent Disapproval		.011***		.004, .008
		Via Peer Disapproval		.055**		.022, .036
Parent Disapproval	→	Youth Disapproval	.326***		.326***	
Peer Disapproval		Youth Disapproval	.708***		.708***	
Youth Disapproval		Youth Marijuana Use	-3.070***		-3.070***	

Note: Table 8 includes the standardized path coefficients for the variables included in the model.
 CI = confidence interval; *LL* = lower limit; *UL* = upper

Figure 6. Structural Equation Model 3 for the Female Youth ($n = 1,164$)



Summary of Gender Differences. The results show the significant differences in the pathways of the study model. First, a significant negative effect of MML was found on peer and youth drug disapproval for male youth. However, its effect of MML was significant on parent and peer drug disapproval for female youth. In particular, the influence of MML on peer drug disapproval was greater among female youth ($\beta = -.166$, $p < .001$) than male youth ($\beta = -.085$, $p < .01$). Second, the impact of parent disapproval on youth drug disapproval was stronger for female youth ($\beta = .326$, $p < .001$) than male youth ($\beta = .186$, $p < .001$), and the impact of peer drug disapproval on youth drug disapproval was also higher for female youth ($\beta = .708$, $p < .001$) than male youth ($\beta = .680$, $p < .001$). Third, youth drug disapproval reduces youth marijuana use both for male and female youth, but its impact was stronger for female youth ($\beta = -3.430$, $p < .001$) than male youth ($\beta = -3.070$, $p < .001$). Finally, in terms of the differences in indirect effects, parent drug disapproval significantly mediated the relationship between MML and youth drug disapproval for female youth but not for male youth.

Structural Path Model for White vs. non-White Youth

White Youth. Table 9 showed the structural path model for white youth (see Figure 7). A pathway predicting the influence of penalty severity on youth drug disapproval was rejected, but all the other paths were significant. The results showed that MML has significant *negative* direct effects on parent ($\beta = -.122$, $p < .001$), peer ($\beta = -.213$, $p < .001$), and youth drug disapproval ($\beta = -.174$, $p < .001$). These results indicate that MML significantly reduces the disapproving norms among parents and peers, particularly peer drug disapproval. In contrast, penalty severity has significant *positive* direct effects on parent ($\beta = .014$, $p < .001$) and peer drug disapproval ($\beta = .045$, p

< .001), indicating that penalty severity on marijuana possession significantly increase drug disapproval among parents and peers. However, penalty severity has not a significant effect on youth drug disapproval. Furthermore, the result showed that parent ($\beta = .399, p < .001$) and peer drug disapproval ($\beta = .646, p < .001$) had significant *positive* direct impacts on youth drug disapproval, indicating that the higher level of parent and peer drug disapproval predicts higher level of youth drug disapproval. The result also demonstrated that peer drug disapproval has a greater impact on youth drug disapproval. Finally, youth drug disapproval ($\beta = -3.341, p < .001$) has a significant *negative* impact on youth marijuana use, indicating that youth drug disapproval decreases youth marijuana.

Table 9 also presented details of the estimated specific indirect effects along with their confidence intervals. Total and indirect effect estimates indicated full mediation for all indirect paths. First, MML had a significant negative indirect effect on youth drug disapproval through changing parent (indirect $\beta = -.029, p < .001$, bias-corrected 95% CI = [-.063, -.036]) and peer drug disapproval (indirect $\beta = -.082, p < .001$, bias-corrected 95% CI = [-.176, -.101]). These results show that parent and peer drug disapproval had a significant mediating role in the relationship between MML and youth drug disapproval. Second, penalty severity had a significant indirect effect on youth drug disapproval through changing parent (indirect $\beta = .011, p < .001$, bias-corrected 95% CI = [.004, .008]) and peer drug disapproval (indirect $\beta = .055, p < .01$, bias-corrected 95% CI = [.023, .036]). This result indicates that penalty severity predicted youth drug disapproval through increased parent and peer drug disapproval.

Summary. MML significantly increases parent, peer, and youth drug disapproval, whereas penalty severity on marijuana possession reduces parent and peer drug disapproval, and MML and penalty severity has greater impacts on peer drug disapproval than parent drug disapproval. Furthermore, parent and peer drug disapproval significantly increase youth drug disapproval, and peer drug disapproval has a greater impact on youth drug disapproval. In addition, youth drug disapproval significantly reduces youth marijuana use. Finally, MML and penalty severity indirectly influence youth drug disapproval through the decreased/increased parent and peer drug disapproval. The result is consistent with the Model 1 for the whole sample in overall.

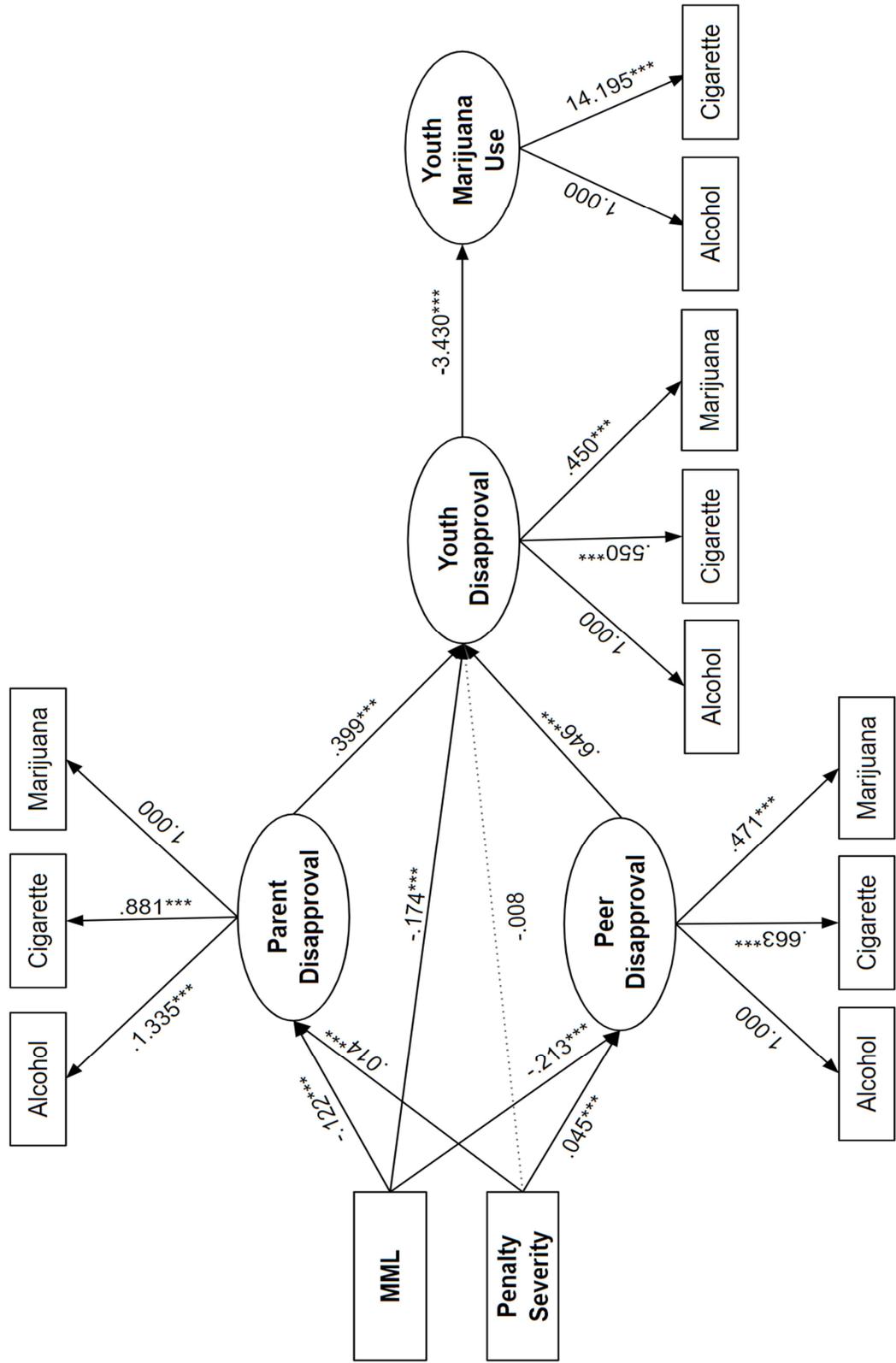
Table 9

Direct, Indirect and Total Effects for White Youth (n = 1,135)

	Hypothesized path	Direct Effect	Indirect Effect	Total Effect	95% CI
MML	→ Parent Disapproval	-.122***		-.122***	
	Peer Disapproval	-.213***		-.213***	
	Youth Disapproval	-.174***		-.174***	
	Via Parent Disapproval		-.029***	-.029***	-.063, -.036
	Via Peer Drug Disapproval		-.082**	-.082**	-.176, -.101
Penalty Severity	→ Parent Disapproval	.014***		.014***	
	Peer Disapproval	.045***		.045***	
	Youth Disapproval	-.008		-.008	
	Via Parent Disapproval		.011***	.011***	.004, .008
	Via Peer Disapproval		.055***	.055***	.023, .036
Parent Disapproval	→ Youth Disapproval	.399***		.399***	
Peer Disapproval	Youth Disapproval	.646***		.646***	
Youth Disapproval	Youth Marijuana Use	-3.340***		-3.340***	

Note: Table 9 includes the standardized path coefficients for the variables included in the mode. CI = confidence interval; LL = lower limit; UL = upper.

Figure 7. Structural Equation Model 4 for the White Youth ($n = 1,135$)



Non-White Youth. Table 10 showed the structural path model for non-White youth (see Figure 8). Three pathways predicting the direct influence of MML on peer and youth drug disapproval and the influence of penalty severity on youth drug disapproval were rejected, but all the other paths were significant. The results showed that MML has a significant *negative* direct effect on parent drug disapproval ($\beta = -.060, p < .001$) but did not have significant direct effects on peer and youth drug disapproval. These results indicate that MML significantly reduces the disapproving norms among parents but did not significantly reduce peer and youth disapproving norms of drugs. In contrast, penalty severity has significant *positive* direct effects on parent ($\beta = .018, p < .001$) and peer drug disapproval ($\beta = .020, p < .001$) but did not significantly influence youth drug disapproval, indicating that penalty severity on marijuana possession significantly increases drug disapproval among parents and peers, but it does not significantly increase youth drug disapproval. Furthermore, the result showed that parent ($\beta = .157, p < .001$) and peer drug disapproval ($\beta = .746, p < .001$) had significant *positive* direct impacts on youth drug disapproval, indicating that the higher level of parent and peer drug disapproval predicts higher levels of youth drug disapproval. The result also demonstrated that peer drug disapproval has a greater impact on youth drug disapproval. Finally, youth drug disapproval ($\beta = -3.063, p < .001$) has a significant negative impact on youth marijuana use, indicating that youth drug disapproval decreases youth marijuana.

Table 10 also presented details of the estimated specific indirect effects along with their confidence intervals. Total and indirect effect estimates indicated full mediation for three indirect paths. First, MML had a significant negative indirect effect

on youth drug disapproval through changing parent drug disapproval (indirect $\beta = -.006$, $p < .001$, bias-corrected 95% CI = [-.015, .005]), but it did not indirectly influence youth drug disapproval through peer drug disapproval (indirect $\beta = -.023$, $p > .05$, bias-corrected 95% CI = [-.075, .001]). These results show that parent drug disapproval had a significant mediating role in the relationship between MML and youth drug disapproval, but peer drug disapproval did not play as a mediator in the relationship. Second, penalty severity had a significant indirect effect on youth drug disapproval through changing parent (indirect $\beta = .005$, $p < .001$, bias-corrected 95% CI = [.002, .004]) and peer drug disapproval (indirect $\beta = .029$, $p < .01$, bias-corrected 95% CI = [.007, .022]). This result indicates that penalty severity predicted youth drug disapproval through increased parent and peer drug disapproval.

Summary. MML significantly only reduces parent drug disapproval but did not influence peer and youth drug disapproval. In contrast, penalty severity significantly reinforces parent and peer drug disapproval, but did not significantly influence youth drug disapproval. Furthermore, parent and peer drug disapproval significantly increases youth drug disapproval, and peer drug disapproval has a greater impact on youth drug disapproval. Youth drug disapproval significantly reduces youth marijuana use. Finally, MML indirectly influences youth drug disapproval only through changed parent drug disapproval, but peer drug disapproval did not have a mediating effect. On the other hand, penalty severity indirectly influences youth drug disapproval through changed parent and peer drug disapproval. This result for non-White youth is different compared with the Model 4 for white youth: (a) MML only influences parent disapproval for non-

White youth (b) peer drug disapproval did not have a mediating role in the relationship between MML and youth drug disapproval.

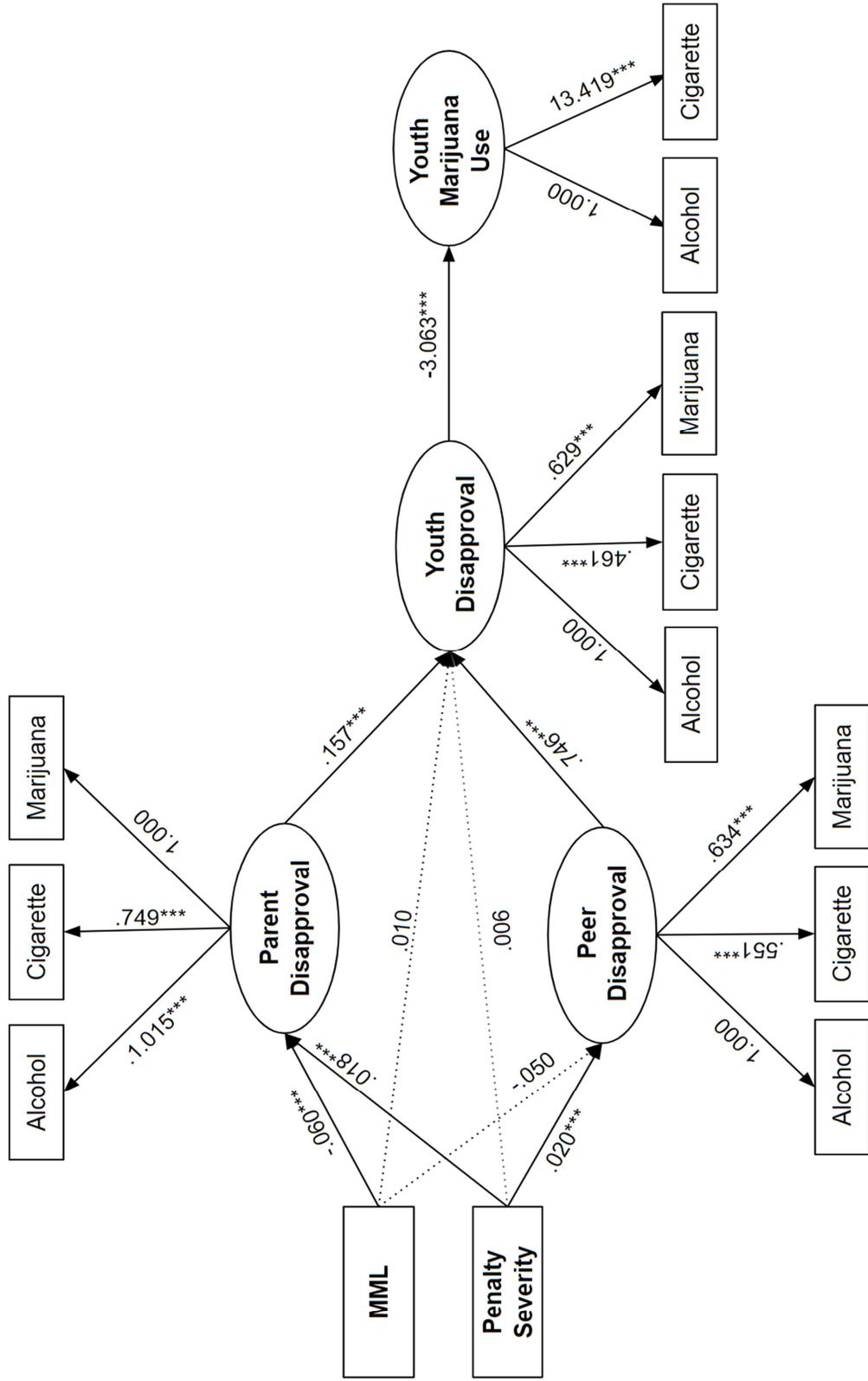
Table 10

Direct, Indirect and Total Effects for Non-White Youth (n = 1,158)

	Hypothesized path	Direct Effect	Indirect Effect	Total Effect	95% CI LL, UL
MML	→ Parent Disapproval	-.060***		-.060***	
	Peer Disapproval	-.050		-.050+	
	Youth Disapproval	.010		.010	
	Via Parent Disapproval		-.006***	-.006***	-.015, .005
	Via Peer Drug Disapproval		-.023	-.023	-.075, .001
Penalty Severity	→ Parent Disapproval	.018***		.018***	
	Peer Disapproval	.020***		.020***	
	Youth Disapproval	.006		.006	
	Via Parent Disapproval		.005***	.005***	.002, .004
	Via Peer Disapproval		.029**	.029**	.007, .022
Parent Disapproval	→ Youth Disapproval	.157***		.157***	
Peer Disapproval	Youth Disapproval	.746***		.746***	
Youth Disapproval	Youth Marijuana Use	-3.063***		-3.063***	

Note: Table 10 includes the standardized path coefficients for the variables included in the model

Figure 8. Structural Equation Model 5 for the Non-White Youth ($n = 1,158$)



Summary of Race Differences. The results show the significant differences in the pathways of the study model. First, the significant negative effect of MML was found on parent, peer, and youth drug disapproval for white youth. However, its effect of MML was only significant on parent disapproval for non-White youth. Second, penalty severity has significant positive effects on parent drug disapproval, but not on youth drug disapproval for both White and non-White youth. Third, the impact of parent disapproval on youth drug disapproval was stronger for White youth ($\beta = .399, p < .001$) than non-White youth ($\beta = .157, p < .001$), but the impact of peer drug disapproval on youth drug disapproval was higher for non-White youth ($\beta = .746, p < .001$) than White youth ($\beta = .646, p < .001$). Fourth, youth drug disapproval reduces youth marijuana use both for White ($\beta = -3.341, p < .001$) and non-White youth ($\beta = -3.063, p < .001$), but its impact was stronger for non-White youth than White youth. Finally, in terms of the differences in indirect effects, parent drug disapproval significantly mediated the relationship between MML and youth drug disapproval both for White and non-White youth. However, peer drug disapproval significantly mediated this relationship only for White youth, and is missing for non-White youth.

Chapter 5

Discussion

This discussion chapter revisits the purpose of the study and then discusses the major findings in light of theories and previous research. This section specifically includes a summary of study significance, implications, study limitations, recommendations for future research, and conclusion. The current study was designed to examine the several paths of direct impacts: influence of MML and penalty severity on parent, peer, and youth drug disapproval; influence of parent and peer disapproval on youth disapproval; and influence of youth disapproval on youth marijuana behavior. Furthermore, this study investigated the indirect impacts of MML and penalty severity on youth drug disapproval through parent and peer drug disapproval. Group comparisons depending on gender and race were also implemented. As theoretical backgrounds, theory of change and primary socialization theory were used to understand these processes: a) policy tools can make changes on individual perceptions that closely link to changes in behaviors, and b) youth are greatly influenced by drug perceptions of parents and peers by interacting and modeling processes. Structural equation modeling was used to examine a series of hypothesized paths with a sample of youth aged 12 to 17 years old who have ever used marijuana.

Significance of Major findings

This study demonstrated the role of macro-level factors (i.e., marijuana policies) in shaping drug perceptions among parents, peers, and youths, and the role of micro-level factors (i.e., parent and peer perception) in changing youth perceptions toward drugs

which lead to marijuana use. There were several major significant findings. First, MML significantly reduces parent and peer drug disapproval, while penalty severity significantly increases parent and peer drug disapproval. This indicates that youth, living in MML states, are less likely to perceive drug disapproval from their parents and peers. On the other hand, youth, living in states with higher penalty severity, are more likely to perceive drug disapproval from their parents and peers. In addition, MML directly reduces youth drug disapproval, but penalty severity did not directly impact on youth drug disapproval. Furthermore, MML and penalty severity indirectly reduce/reinforce youth drug disapproval through decreased/increased parent and peer drug disapproval.

These results demonstrate that the marijuana policies influence individual perceptions, and the direction of influence is completely opposite between MML and penalty severity. This result is consistent with the previous study indicating that marijuana policies can influence individual perceptions of marijuana as well as other drugs by sending approving or disapproving messages (Bailey et al., 2020; Cerdá et al., 2017). For example, MML may convey approving messages that marijuana is not targeted for legal punishment and/or is socially acceptable as marijuana is portrayed as harmless (Cerdá et al., 2017). On the other hand, penalty severity may send disapproving messages and the threat of punishment and sanction, and hence, individuals may perceive that the drug is subject to legal punishment and/or not socially approvable (Chalfin & McCrory, 2017).

Theory of change specifically is useful to explain how certain policy tools intersect with the actual processes of change in perception (Choi et al., 2017; de Waal et

al., 2020; Stone, 2020). Based on theory of change, individuals are capable of understanding and perceiving benefits and risks of marijuana use via opportunities to learn and discuss marijuana laws that are available to them (de Waal et al., 2020). Based on which marijuana policies are implemented, individuals may have different motivations and reactions to drugs (i.e., positively or negatively), so they can perceive marijuana differently as harmful or benign drugs (Shin & Miller-Day, 2017; Stone, 2020).

Second, parent and peer drug disapproval have significant positive impacts on youth disapproval, indicating that youth, who perceive higher parent and peer drug disapproval, are more likely to perceive higher drug disapproval. This is consistent with the previous studies arguing that drug disapproving norms set by parents and peers (e.g., how much one's parents/close friends disapprove of drug use) particularly play an important role in predicting youth drug disapproval (Pearson et al., 2018; Su et al., 2018) as mentioned earlier. Previous literature also suggested that individual perceptions are learned through observing attitudes of crucial proximal individuals, such as parents and peers (Pedersen et al., 2017) by transmitting perceptions of approval or disapproval about drugs to their children and friends (Campbell & Oei, 2010; Pedersen et al., 2018; Su et al., 2018).

Furthermore, the results demonstrated that peer drug disapproval has a higher impact on youth drug disapproval compared to parent disapproval. This result proves the previous studies indicating that youth are more likely to be impacted by peer clusters as youth spends more time with peer clusters and seeks to differentiate themselves from parents during adolescence (Chung et al., 2017). Although parent drug disapproval is still

influential on youth drug disapproval, peer clusters' disapproval becomes more strongly associated with perceived drug disapproving norms of youth (Napper et al., 2014; Schuler et al., 2019). These results can also be explained by PST, which is helpful to understand the processes of how the change of drug perceptions among primary socialization agents influence drug perceptions among youth. PST emphasizes that via interactions and communication with parents and peers, youth can establish prosocial and/or antisocial norms toward drugs because drug norms can be transmitted by interpersonal communication (Guttmanova et al., 2019; Akers & Jennings, 2019). Thus, positive norms about drug use increase the likelihood of adopting the prodrug norms among youth (Choi et al., 2017; Stone, 2020), while prosocial interactions with negative norms about drugs with parents and peers are associated with the increase in disapproving norms toward drugs (Oetting & Donnermeyer, 1998; Walters, 2020).

Third, parent and peer drug disapproval display significant mediating effects in the relationship between MML/penalty severity and youth drug disapproval within the overall sample. The results show that marijuana policies can not only directly influence youth drug disapproval but also indirectly influence it through changing social drug disapproval. Understanding the indirect effects is significant because it expands and strengthens the main causal explanations of the relationship between marijuana policies and youth drug disapproval, and it can also aid with understanding the mechanisms by which exposure leads to youth drug disapproval, which can be helpful for improving interventions.

Fourth, youth drug disapproval had a significant negative direct impact on youth marijuana use, indicating that youth who disapprove of drug use are less likely to use marijuana. This result shows that perceptions play a central role in explaining and predicting human behavior (Crano & Prislin, 2006). Previous studies indicated that social injunctive norms, which refer to perception of the degree of disapproval of drug consumption, significantly influence drug use (Neighbors et al., 2011; Perkins et al., 1999) because social perceptions (approval or disapproval) anticipate one's intentions and actual actions (Ajzen, 1991). Another study also argued that increased disapproving perceptions concerning drugs results in decreased rates of marijuana use among young people (Hames et al., 2012; Willis et al., 2020).

Finally, there are differences in the structural paths between male and female youth. MML significantly reduces peer and youth drug disapproval for male youth, but it only decreases parent and peer drug disapproval for female youth. Consistent with this result, MML indirectly influences youth drug disapproval only through changing peer drug disapproval for male youth, but MML had a significant negative indirect effect on youth drug disapproval through changing parent and peer drug disapproval for female youth. Penalty severity directly increases parent, peer, and youth drug disapproval, and indirectly influences youth drug disapproval through changing parent and peer drug disapproval for both male and female youth. This result is supported by earlier research that females are more likely influenced by family factors, because they are more likely to get parental monitoring and have communicative relationships (Javdani et al., 2011; Kerr et al., 2010; McAdams et al., 2014).

The most important difference in the MML to drug disapproval process is that MML significantly decreases juvenile drug approval for male youth, but has no significant effect on juvenile drug approval for female youth. This result can be understood through various marijuana penetration rates (e.g. gender differences), which also indicate differences in drug disapproval levels. For example, male students were more likely to use it, but female students were less likely to start and continue using it (Degenhardt et al., 2007; Earle et al., 2020; LaBrie et al., 2009). When marijuana becomes legal, it can be expected that a small number of women who would not have used marijuana will start, but with legalization more women are protected to some degree from use (Palamar et al., 2014). In fact, marijuana prevalence and intention to use marijuana are higher among male youth than among female youth (Azofeifa et al., 2016; Degenhardt et al., 2007; Lanza et al., 2015). Considering that higher marijuana use prevalence is strongly associated with lower disapproval (Hames et al., 2012; Willis et al., 2020), male adolescents have lower drug disapprovals than female adolescents. The impact of MML sending the message (marijuana is socially approved) may have a greater impact on reducing adolescent drug approval in males than female youth.

There are also differences in structural pathways between white and non-white adolescents. MML significantly reduces parental, peer, and adolescent drug disapproval for white adolescents, but significantly reduces parental drug disapproval for non-white adolescents. In contrast, penalty severity significantly increases only parental and peer drug disapproval for both white and non-white adolescents, and indirectly affects adolescent drug disapproval through parental and peer drug disapproval. When studying

the differences in adolescent drug disapproval between white and non-white adolescents, several explanations stand out. First, non-white youth, primarily African American and Hispanic Latino youth (almost 80%), are more likely to be exposed to marijuana stores near their residence (Sabet, 2018; Thomas & Freisthler, 2017). With the advent of legalization, communities of color may disproportionately be the target of marijuana facilities. For example, most dispensaries opened primarily in the African-American community in Los Angeles (Thomas & Freisthler, 2017). Overlaying the geographic location and socioeconomic data of pot shops in Denver revealed that marijuana shops were predominantly located in disadvantaged areas (Sabet, 2018). Second, it is important to note that racial disparities exist when it comes to criminal justice intervention (Pettit & Gutierrez, 2018; Tate, 2013). African-Americans are more likely to be arrested than Whites (Gelman et al., 2007; Pettit & Gutierrez, 2018) and are more likely to encounter marijuana arrest, pretrial detention, custody, conviction, and marijuana-related sentences (Golub et al. al., 2007; Corvera, 2019). Thus, marijuana use could have more legal implications for non-White youth who have a more approving perception of the drug, even if marijuana is legalized.

To sum up, the most important finding was that representative marijuana policies, MML, and penalty severity significantly make changes on individual perceptions on drugs. This indicates that marijuana policies should be considered important, because these policies could transmit specific solid messages whether drug use is approved or disapproved that may eventually influence individual perception processes of drugs. These results are specifically explained by theory of change, which provides the process

of perception change which leads to behavioral change. In addition, this study found that parent and peer drug perception significantly influence youth drug perception in general, which shows that youth are influenced by how their parents and peers perceive drugs. Primary socialization theory especially focuses on the important role of parents and peers and emphasizes that youth develops their perceptions and further behaviors by constructing relationships with their primary socialization agents, parents and peers. This study also emphasizes that youth behavior is significantly influenced by youth perception and is indirectly influenced through parent and peer drug perception. Finally, this study explored the differences in the mechanisms comprised of marijuana policies, social disapproval, and youth disapproval among different groups between male and female, and White and non-White youth and showed minor differences in the mechanism between groups.

Strength of the Study

Several specific strengths of this study are worth noting. First, using structural path models and latent variables, this study could connect macro-level factors (e.g., marijuana policies), micro-level factors (e.g., individual drug disapprovals), and individual-level factors (e.g., youth marijuana use behaviors) by integrating the theory of change and primary socialization theory; it helps better understand the macro- and micro processes leading to youth marijuana use. Combining theory of change and primary socialization theory was helpful to understanding youth drug disapproval based on structural (policy) levels and social (parent and peer) levels. The findings specifically demonstrated that, as theory of change suggests, policy tools can make significant

changes in individual drug perceptions. This result is significant because it shows MML and the punishment system itself are essential to developing drug prevention strategies or approaches. The results clearly demonstrate it is imperative for policy and law makers to acknowledge that policy tools have the ability to make individuals perceive that drugs are either approvable or disprovable.

Furthermore, the current study incorporated drug approvals for three different gateway drugs, taking into account that marijuana-related policies are likely to affect adolescents' perceptions of substances other than marijuana, such as alcohol and tobacco (Bailey et al., 2020; Cerdá et al. 2017; Schuermeyer et al., 2014). This approach would be helpful to comprehensively understanding how individual drug disapproving perceptions are influenced by sociostructural factors. The current study also integrated drug disapproval from multiple sources of primary socialization agents, parents, and peers and examined the mediating roles of drug disapproval in the relationship between marijuana laws and youth drug disapproval. Because youth are highly influenced by how their parents and peers perceive drugs, as mentioned in primary socialization theory, examining mediating roles of drug disapproval among their important ones would be crucial to provide efficient strategies and approaches to reduce youth marijuana use. This specifically shows that drug prevention strategies not only need to consider the influence of policy tools but also consider parent and peer context, indicating that it is necessary to integrate the macro- and micro-context sources to develop more efficient strategies for drug prevention programs.

While a large number of prior studies have focused on the influence of marijuana legalization (medical or recreational) on youth marijuana use (Anderson et al., 2019; Bailey et al., 2020; Cerdá et al. 2020; Zuckermann et al., 2021), only a small number of researchers emphasized the deterrent effect of sanctions and punishment along with marijuana legalization. Because it is so important for youth to clearly acknowledge that drug use is not socially accepted and is punishable during adolescence, understanding the deterrent messages of the penalty system would be helpful to prevent youth marijuana use. In this sense, the present study used two different marijuana policies conveying opposite messages about drugs (MML and penalty severity on marijuana possession) to better understand the influence of marijuana laws on individual drug disapproval. This study has clearly shown that different laws have different impacts on individual perceptions. For example, medical marijuana legalization reinforces drug approving perceptions while penalty severity reinforces drug disapproving perceptions. These results suggest that balanced information for not only marijuana legalization but also the penalty system needs to be publicized and broadcasted to youth via diverse tools such as policy advertisement and educational opportunities; they could increase drug disapproval among individuals.

This study has a significant finding confirming that perception significantly leads to behavior. As the results show that youth drug disapproval significantly reduces youth marijuana use, this study suggests that changing youth drug perception, which is greatly influenced by parents and peers, is the core idea to prevent youth marijuana use. Because youth drug disapproval is directly or indirectly influenced by marijuana legalization and

penalty severity, correcting drug perception among youth considering the impacts of marijuana policies is necessary.

Finally, this study makes a comparison in the hypothesized paths between different groups: male and female youth and White and non-White youth. This is significant because the results based on gender and race can provide useful information when it comes to drug-prevention strategies. For example, the result shows that there is a significant difference between groups; specifically, MML significantly reduces peer and youth drug disapproval for male youth, whereas MML significantly reduces parent and peer drug disapproval for female youth. Because MML differently influences social drug disapproval, prevention approaches need to consider the differences impacts of MML and penalty severity on drug disapproval.

Implications for Policy

This present study draws several implications for social work policy. This section discusses implications for MML regarding focused intervention focusing on educational and preventive strategies and penalty-focused intervention focusing on the deterrent effects of the punishment system.

MML-Focused Intervention

A number of contributions from the literature have suggestions for prevention and education strategies. Programs for prevention and intervention focusing on marijuana use and its deleterious effects on youth appear to be needed (Hunt & Miles, 2015). Perhaps unintentionally, MML and its use has possibilities to downplay the severity of the problem (Wen et al., 2019). This is possible because MML increases the social supply

through change in a course, promoting normative changes in favor of marijuana, and underselling the risks of marijuana use (Wen et al., 2019). Some states already have approved medical marijuana legalization, and there are growing concerns that more states will follow the trend of legalizing marijuana in the near future (Guttmanova et al., 2019). Hence, it would be important to actively share appropriate information about MML and the potential problems of drug use to reinforce the disapproving perceptions toward drugs.

Education. State governments can make specifically designed audiovisual educational materials or programs to increase accessibility to adolescents and parents. In particular, educational support should be strengthened for young people to minimize misunderstandings about marijuana and marijuana-related laws. For this, the educational programs may include the contents of the actual purpose of MML (e.g., protecting patients from being criminalized, especially people of color; Todd, 2018) and the specific intent (e.g., providing marijuana access as well as limited legal protection for selected patients, therefore, general populations are not permitted to possess marijuana; D'Amico et al., 2017). The educational programs could prevent young people from misunderstanding MML, the negative consequences of marijuana use (e.g. mental health, cognitive development) and furthermore the possibility of being legally punished when possessing marijuana. The state governments can create YouTube channels to provide individuals the educational information and send paper materials to the households specifically that have children at risk. It is also important to consider the differences between adolescents and adults, indicating that educational contents, materials and tools

should be different based on the needs for targets. Thus, the information should be made in different versions for adults such as parents, teachers and community partners, and for young adolescents to help better understand marijuana and MML. Specifically, these educational dissemination need to pay more attention to special populations such as individuals living in MML states, living in poverty, living with parents who currently use drugs or had used drugs in the past, or living with parents who have ever committed crimes or been in prison. In these cases, adolescents may have more likelihood to be exposed to drugs. Therefore, the state government should create a specific monitoring system to find and closely observe adolescents who need particular care or protection from drugs.

Campaign and Anti-Drug Messages. Furthermore, state governments can create anti-drug campaigns that target young people (Hunt & Miles, 2015) to give anti-drug messages and promote disapproving perceptions on drugs considering that individuals are highly influenced by information from the media (Paschall et al., 2017). The Anti-Tobacco campaign can be an appropriate example of a successful preventive approach to cut down youth tobacco usage (Biener, 2000; Sly et al., 2001). Although some anti-smoking campaigns and programs mostly paid attention to anti-industry advertising, others have considered multiple aspects such as school and community based organizations, in-school education and enforcement (Sly et al., 2001). Similar approaches may be successful in cutting the marijuana usage among youth. In addition, because this study's findings considered the type of drugs (i.e, alcohol, cigarettes, and marijuana) in terms of drug disapproval, preventive efforts should target specific drugs used. In

particular, governments can post various flyers and messages, advertisements presenting drugs as highly detrimental particularly among youth around schools, academic organizations, playgrounds, and other places where young people and parents frequently visit to reinforce the negative perceptions of drugs. Each legalizing state should consider and/or distribute efficient and effective public services or campaigns via television or other e-tools such as Facebook and Twitter. State government could actively use these different tools to disseminate the legal information to youth.

Monitoring. To protect adolescents from being exposed to marijuana, state governments either in MML or non-MML states can establish specific policies/laws to not allow marijuana stores to be located in areas near to elementary, middle, high schools, and neighborhoods with the higher youth population. The state government may impose particular punishment if the stores are located in those areas without permission by the government. This measure would play a role as a protective measure for youth to be less exposed to marijuana.

Penalty-Focused Interventions

This study strongly implies that severity of punishment significantly deters parents and peers from approving illegal drugs, such as alcohol, cigarettes, and marijuana for youths. This finding has important public health implications for deterrence. However, the important thing to point out is this study is not arguing that increasing penalty severity is the only way to deter youth marijuana use through increasing drug disapproving perceptions. Although increasing penalty severity has been shown to be effective in curbing adolescent marijuana use (Apel, 2022; Becker, 1968; Chalfin &

McCrary, 2017), it may also contribute to criminalizing youth rather than preventing and/or protecting them from marijuana use (Greer et al., 2022; Houborg et al., 2020). In this regard, the following penalty-focused interventions do not focus on how to improve penalty severity to deter young people. Rather, the interventions are mostly based on the approaches for improving perceived deterrence and disapproving perceptions toward drugs through improving awareness that youth can be punished if they use or possess marijuana, depending on the laws in the areas in which they live.

Promoting Perceptual Deterrence. Penalties for marijuana possession are presumed to enhance public health by limiting youth marijuana possession and use. Promoting perceptual deterrence—the idea that offenders notice an expansion of police presence and behave accordingly—is significant because antisocial behavior, marijuana use for this case, responds to specific policies such as the punitiveness of sanctions or the number and effectiveness of police officers (Chalfin & McCrary, 2017; Nagin, 2018). Although marijuana possession among youth is an offense that often leads to a variety of punishments (i.e., from a fine to mandatory prison sentences), individuals living in states where medical marijuana is legalized are often unaware they can be imprisoned for marijuana possession (MacCoun et al. 2009; Willis et al., 2020). For the policies to succeed in deterring young people from possessing and using marijuana, young people and their parents must understand they could be arrested and punished for marijuana possession. Thus, to promote perceptual deterrence, the level of the potential threat needs to be properly communicated or announced via advertising or media tools to effect a change in perceptions of the severity of the sanction. This would help enhance young

peoples' and parents' risk perception, which is a perceived risk of being captured and punished when they or their children possess marijuana (Apel, 2013; Pedersen et al., 2017).

Police Deployment and Hot-Spot Policing. Because large and easily noticeable change in police deployment and strategies can significantly affect the number of offenses committed, expanding police presence helps establish the perception that individuals who possess marijuana will be apprehended. Previous studies demonstrated that an increase in the number of uniformed and undercover officers were likely to produce greater deterrent effects, even if the actual level of interventions remained unchanged (Chalfin & McCrary, 2017). Fostering drug disapproval awareness among individuals requires specific interventions that focus on police deployment and strategy.

Intensive policing of "hot spots" can promote awareness of drug disapproval and potentially deter young people from using marijuana and other drugs (Chainey et al., 2021). The purpose of hot spots should focus on helping young people better understand and acknowledge that marijuana is socially not accepted and allowed for young students. Hot-spot policing is a strategic approach for which police are overly located in urban regions with disproportionately higher levels of offense—youth drug use or marijuana possession (Weisburd & Telep, 2014). Two conditions must be met for hot-spot policing to be an effective offense reduction strategy. First, given limited resources, its viability depends on a sufficient concentration of officers in a small number of hot-spots. Second, the hot-spots must be sufficient to predict for youths and parents with reasonable accuracy the spatial distribution of offenses when there is no change in police

deployment. Therefore, hot-spot policing should start with a depiction of the geographic concentration of juvenile marijuana use and possession and an assessment of the permanent extent of the hotspot. This method will inform young people and their parents that marijuana use or possession is socially unacceptable and could potentially help reduce marijuana use.

Problem-Oriented Policing. Problem-oriented policing is another deterrence-based approach, which engages community members to identify the most prevalent crime problems in the local areas, and design strategic plans to deter the problematic behavior (Eck & Spelman, 2019; Hinkle et al., 2020). This aim to use local resources to solve local problems and effect deterrence through advertising; that makes potential criminals absolutely aware of the risk of serious crime, which is adolescent drug use in this case (Braga et al., 2019; Hinkle et al., 2020). As noted by Kennedy et al. (2019), Boston's Operation Ceasefire can be used as a useful example of a problem-oriented policing strategy. Ceasefire's stated purpose was to reduce gun violence among youth in Boston with a variety of strategies such as disrupting the illicit arms supply from other states. The police also sent a direct message to gang youth that the authorities would use all possible ways to collectively punish any violent gang actions. As a result, Boston experienced a more significant reduction in youth violence than other U.S. cities included in the study. One of the most significant consequences of the apparent impact of focused deterrence strategies is that a fundamental idea of deterrence has been rehabilitated (Kennedy et al, 2019). Based on this example, the problem-oriented policing approach might be expanded and developed, perhaps to promote drug disapproval among

adolescents and adults. Police could disrupt all illegal drugs to youth and directly convey the message to potential offenders and parents that authorities will use every possible tool to monitor and punish young people if they possess marijuana or use drugs.

Implications for Social Work Practice

There are various findings from the present study that might be used to inform practical implications focusing on parents and peers. Thus, this section discusses implications for parent- and peer-focused social work considering that parent and peer drug perceptions influence youth drug perception, which may lead to further marijuana use. Because PST strongly suggests that parents and peers are important contexts in which youth learn about drug attitudes (Hill et al., 2018; Yap et al., 2017), the main implication of these findings is that prevention programs targeting youth should be aligned with factors that can mitigate use such as parent and peer drug disapproval.

Parent-Focused Prevention

The results of this study suggest that prevention and intervention efforts may also benefit from using parents as a means of targeting youth. It is recommended that interventions for parents should occur at an early age of their children because parent perceptions of drug use can be transmitted directly to their children, and parent attachment to youth is helpful to mitigate marijuana use during early adolescence in particular. Family interventions have a greater likelihood of success for adolescents if parents become more involved before the peer clusters have stronger impacts on youth during adolescence, particularly in MML states.

Parent Drug Education. Each state and community partners can actively support educational programs targeting parents to help them to learn more about drugs. The educational approach may include disseminating important information on long-term effects of youth marijuana use, the ways to protect children from drug use, stores/places where marijuana is sold, brands/products using marijuana as a main material, and diverse videos related to teaching/monitoring/educational methods for drug prevention supported by drug experts/social workers/counselors. In particular, the educational strategy should emphasize the importance for parents to have a higher disapproving perception toward drugs, because parent disapproval can prevent their children from having favorable perceptions toward drugs. For this, parents can establish their family culture around marijuana and help their children perceive marijuana (and other drugs) as harmful and not accepted in the family, because children can learn about drug use attitudes within the family (Hill et al., 2018; Yap et al., 2017). To provide more efficient educational support, it would be important to create new apps or websites to share parent-targeting drug educational information and to provide a variety of educational videos with parents. From this website, the state government can conduct bimonthly or annual surveys focusing on drugs with a sample of parents, so it can find at-risk households in drugs to connect them to necessary treatment or interventions.

Parent-Child Drug Communication. The educational approach may include parent-child communication methods. Effective oral communication about drug use is extremely significant for parents to minimize the risk of drug use behaviors by providing feedback on acceptable behaviors to their children (e.g., “Drug use is not allowed at all”;

Shin et al., 2020). For example, Millder-Day and Dodd (2004) suggested that parent-child drug communication particularly about the negative effects of drug use can help to reduce drug use behaviors and establish ways to avoid drug use proposals. This sort of communication approach has been indicated to promote anti-drug beliefs and to reduce drug use (Miller-Day & Kam, 2010). For stimulating more effective communications between parent and children, supported by state governments, family-focused social workers, and drug abuse experts/counselors, can provide counseling for parents to have more effective communications with their children about drugs.

Culture Specific Intervention. Most importantly, because parental perceptions of drug use may vary depending on cultural influences, programs should coordinate preventive and interventional aspects to focus on the cultural influences of the household. For example, the majority of effective prevention and treatment programs have been family-based targeting negative and positive processes within families (Szapocznik et al., 2007). This model was also culturally specific for each group due to the differences in exposure to risk and protective factors (e.g., racial identity for African Americans, cultural adaptation for Hispanics; p. 91).

Peer-Focused Intervention

The findings of this study demonstrate that close friends' drug perceptions are potent predictors of youth drug disapproval that may indirectly lead to marijuana use. Because the influence of peers becomes more significant particularly during adolescence and more students spend a great deal of their time and interact with their friends in schools (Verhoeven et al., 2019), school-based education/classes may be more effective

and accessible to students or school-aged adolescents in terms of establishing appropriate drug perceptions among peer clusters.

School-Based Education. For effective drug education, schools should actively educate teachers about the marijuana laws and penalty systems, as well as the intention of laws. Drug classes can be implemented on a regular basis to help students acknowledge a basic understanding of drugs, particularly marijuana and other soft drugs, and establish a more appropriate attitude toward drugs. The classes may include specific contents such as history of medical marijuana legalization, purpose, problems of marijuana use, and the support/help for marijuana using students. For this purpose, schools can actively hire well-trained social workers and counselors that know about drugs and establish the role of management between social workers, counselors, and class teachers for the development of drug education. For example, class teachers or homeroom teachers could regularly conduct a survey about drug use to figure out if any student needs help such as mental support, drug treatment sessions, and etc. If classroom teachers discover students who use marijuana, have tried to use marijuana, or have a hard time because of marijuana, they could connect those students with social workers or counselors and provide necessary treatment or counseling sessions. It is extremely important to give more attention to vulnerable populations such as adolescents in poverty, adolescents having parents or siblings who use marijuana, adolescents who have deviant peers, or adolescents who do not attend school because these groups are more susceptible to drug behaviors.

Peer Discussion Sections. Peer-focused discussion sections for students in particular can be implemented as an after-school program to cultivate anti-drug attitudes among youth and close friends. Because young people tend to misunderstand medical marijuana legalization specifically, legalizing marijuana in many states may mean to them that marijuana is not harmful and is socially acceptable; it is highly important for schools to put more effort into efficiently conveying the actual intention and purpose of the medical marijuana legalization (i.e., helping patients for certain medical purposes and preventing young people from being criminalized; D’Amico et al., 2017; Todd, 2018).

Interventions for Subgroups

Recommendations for prevention and intervention programs generally focused on inclusive programming of all subgroups. However, the findings represent youth marijuana use and peer drug attitudes, thus providing a justification for programming tailored to diverse youth subgroups. Preventive programming may need to focus on other interventions in various subgroups (e.g., expanded time and resources emphasizing to choose positive peer groups or assertiveness training for white females vs. effective parenting and better communication between family members in black or Hispanic subgroups). Peer impact-based interventions may also target subgroups by substance type for which data-driven differences exist. Scrutinizing the level of peer effect for specific subgroups can “inform intervention implementation as well as development of targeted (focused on peer or family influence), subtle gender and culturally sensitive interventions” (Mason et al., 2014).

Study Limitations

While the study had many strengths, there were also several limitations that merit attention. First, the measures of marijuana laws, drug disapproval, and the marijuana use, involved youth self-reporting. Although self-reporting has strengths, such as investigating hidden or undetected experiences, it may produce biased results since teens may be hesitant to disclose use (Donaldson & Grant-Vallone, 2002). For example, self-reported marijuana use information and marijuana policies might be inaccurately reported due to the social bias toward substance use. To be more specific, there is a possibility that perceived penalty severity is different from the actual penalty severity in the state where participants live, and the impact of penalty severity on drug disapproving perceptions can be different, depending on its perceived and/or actual status. However, the majority of NSDUH interviews were conducted in a highly private and confidential manner, encouraging honest reporting on sensitive topics using self-managed audio-assisted self-interviews. Additionally, because the data were captured at a single time point, our ability to understand longitudinal variations by subgroups is reduced and our ability to provide causal explanations related to outcomes are limited.

Moreover, this study did not examine state-level differences in the study mechanisms as the NSDUH data were not originally designed to be representative of specific U.S. states. In other words, the number of youth included in each state were not selected to be representative of the state. Since the timing of passage and implementation of marijuana laws are different depending on states, examining the differences in the mechanisms would be important to create a specific prevention strategy of youth

marijuana use. Recent evidence suggested that due to state-level variation in legalization in terms of marijuana, examining state level differences may yield important information (Miech et al., 2015b). However, the data were derived from an enormous sample across various geographic areas in the 48 contiguous states of the United States, and thus they represent the generalization of youth drug-related disapproval and marijuana use. Finally, this study did not use covariates that might influence youth marijuana use. Although the results indicated the direct and indirect effect of marijuana laws on youth drug disapproval via parent and peer drug disapproval, the causal association should be cautiously interpreted considering youth drug disapproval and further marijuana use may be associated with other hidden factors (e.g., parental monitoring, school environmental factors, individual personality factors).

Future Study

The findings of this present study provide implications for future studies. First, future studies should focus on the differences in the mediating paths between youth living in MML and non-MML states. Comparing these differences would be helpful to consider the implications of the changes in the marijuana laws and the resulting changes on the patterns of youth drug disapproval and further marijuana use and to raise issues about potential implications of medical marijuana use for drug research. Furthermore, future researchers could also study the relative influences of marijuana policies on the disapproval of each drug: alcohol, cigarettes, and marijuana. This is because marijuana policies would be more associated with marijuana disapproval than disapproval of

alcohol and cigarettes. Understanding the relative influences would be helpful to better understanding the relationship between marijuana policies and drug disapproval.

Second, future studies can examine parent and peer disapproval as moderating factors to see whether these disapproval variables can buffer the negative influence of MML on youth drug disapproval and reinforce the deterrent influence of penalty severity on youth drug disapproval. The moderating effects might show that the influence of marijuana laws on youth disapproval might be different depending on the level of parent and peer disapproval; hence, these studies can provide important implications for parent- and peer-focused interventions, particularly for improving drug disapproving perceptions.

Third, considering that young people have many opportunities to interact with teachers during mid-adolescence, future studies can extend the causal paths connecting from marijuana policies to both schools and teacher related indicators in addition to parents and peers as important primary socialization sources. It is significant to consider all the possible mediating sources surrounding youth to better understand the influence of marijuana-related laws on youth drug perception leading to marijuana use. Further studies can also examine the direct effect of marijuana laws on youth marijuana behavior.

Although this study solely focused on the significant influence of marijuana laws on drug perceptions, it would be important if there is a significant direct effect of marijuana laws on youth marijuana behavior to provide useful implications for the development of marijuana laws to prevent youth marijuana use.

Finally, using a mixed-method approach to extend theory of change and primary socialization theory would be useful to extend our understanding of the relationship

between each pathway (e.g., marijuana laws and drug disapproval; drug disapproval and youth marijuana use) and importance of social disapproval. For example, qualitative methods could deepen our understanding of the specific paths of the relationship most impactful for adolescents who have used marijuana. In particular, qualitative research can investigate thoughts and messages from adolescents that might be helpful to understand drug use as a phenomenon as contextually situated. Hence, future studies with an added qualitative approach may provide multiple possibilities to understand a particular process or phenomenon (Fletcher et al., 2016).

Conclusion

This study examined the mechanisms between state marijuana policies, social drug disapproval among parents, peers, and youth, and youth marijuana use. Results highlighted the importance of marijuana policies' impacts on individual's perceptions that may lead to marijuana behaviors and, hence, emphasize the importance of preventing youth from setting disapproving attitudes toward drugs and delaying the initiation of marijuana use among youth. This study built on literature demonstrating a link between marijuana policies and social perceptions as well as social perceptions and marijuana behaviors. Both marijuana legalization and penalty policies for marijuana possession appear to be influential to parents, peers, and youth perceptions toward drugs, which are often related to marijuana behavior of youth. Consistent with the findings, evidence increasingly indicates that parents' and peers' perceptions play crucial roles in preventing youth marijuana use.

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Appendix

Legal Medical and Recreational Marijuana Adopting States

	State (N=50)	Year of MML (N=38)	Year of RML (N=19)
1	Alabama	2021	.
2	Alaska	1998	2014
3	Arizona	2010	2020
4	Arkansas	2016	.
5	California	1996	2016
6	Colorado	2000	2012
7	Connecticut	2012	2021
8	Delaware	2011	.
9	Florida	2016	.
10	Georgia	.	.
11	Hawaii	2000	.
12	Idaho	.	.
13	Illinois	2013	2019
14	Indiana	.	.
15	Kansas	.	.
16	Kentucky	.	.
17	Louisiana	2016	.
18	Maine	1999	2016
19	Maryland	2014	.
20	Massachusetts	2012	2016
21	Michigan	2008	2018
22	Minnesota	2014	.
23	Mississippi	2020	.
24	Missouri	2018	.
25	Montana	2004	2020
26	Nebraska	.	.
27	Nevada	2000	2016
28	New Hampshire	2013	.
29	New Jersey	2010	2020

30	New Mexico	2007	2021
31	New York	2014	2021
32	North Carolina	.	.
33	North Dakota	2016	.
34	Ohio	2016	.
35	Oklahoma	2018	.
36	Oregon	1998	2014
37	Pennsylvania	2016	.
38	Rhode Island	2006	.
39	South California	.	.
40	South Dakota	2020	.
41	Tennessee	.	.
42	Texas	.	.
43	Utah	2018	.
44	Vermont	2004	2018
45	Virginia	2021	2021
46	Washington	1998	2012
47	West Virginia	2017	.
48	Wisconsin	.	.
49	Wyoming	.	.
50	District of Columbia	2010	2014