

Recreational Cannabis Use: Regulatory Aspects, Public Opinion and Concerns for Public Health

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Abstract: Cannabis represents the most used substance in the young population after alcohol and tobacco. The consumption of the substance undoubtedly represents an emerging public health issue, and the regulatory aspects are quite heterogeneous. Alternatives to drug prohibition, such as legalization or decriminalization, are a topic of growing debate among researchers, policy makers and the public. Limiting harmful use and combating illicit trafficking are the main objectives of legalization for recreational purposes, although liberalization raises critical issues that have not yet been resolved despite the experience gained in many countries. In the context of legalization, it is essential to allow the lawful production of cannabis, guarantee a supply of controlled quality cannabis, and ensure that the population understands the risks associated with the consumption of the substance. At the same time, it is essential to protect the safety and health of the population by limiting access to cannabis and preventing accidental exposure to fragile categories and children. Incomplete knowledge of law enforcement can create further complications. Incomplete knowledge of the implementation of the laws can create further complications; therefore adequate information must be favored. Scientific evidence helps to understand the potential harms and benefits of cannabis, but the impact of legalization - even in terms of reducing consumption - is not clearly documented. So, far more efforts need to be made in the future to broaden awareness of the general population on the recreational use of cannabis.

Keywords: cannabis, recreational use, legalization, safety, public health, United Nations.

1. INTRODUCTION

Over the years, the use and marketing of abusive substances, in particular cannabis, have had considerable judicial interest, so that they deserve constant regulatory updating [1-7]. Cannabis sativa or hemp finds application in the construction and textile fields but also in the pharmaceutical sector. For centuries, the cultivation of the plant has also been widespread due to the psychotropic effects of the vegetable product; at present, such a manner has significant implications for illicit purposes, including cannabis as a narcotic substance.

Internationally, United Nations Conventions state that the use of these compounds must be limited to medical and scientific aims and that the acquisition and possession, as well as distribution and sale, represent punishable offenses. In the last decades of the last century, the United Nations specifically asked different countries to establish as a crime the possession and purchase of drugs for personal consumption.

In many countries, the prohibitionist approach to the issue has led to the emergence of a punitive climate based on massive arrests and incarcerations, especially of blacks, with no results in terms of use reduction [8-10].

Since 1989, the "drug courts" have developed a greater sensitivity towards the issue, trying to direct people arrested for these crimes towards rehabilitative treatment.

The lawful applications of cannabis are gaining increasing interest, placing themselves at the center of countless debates in the medical, political, and legal fields. Even in the recreational ambit, many countries have implemented legislative changes aimed at legalization. Obviously, such an attitude of openness cannot fail to consider the health implication that derives from it; therefore, several international organizations have intervened to reduce health damage through preventive and information actions. For the same purpose, European administrations have stimulated individual countries to take measures against the cultivation and marketing of cannabis, as well as against online sites that favor its spread. In relation to the legislative approach to cannabis-related offenses, the different European countries have national laws in place that are sometimes different. In some

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countries, because the entity of the penalty is directly proportional to the harm related to the use of such a substance, cannabis is viewed differently than other drugs, often related to greater health damage; on the contrary, in other states, the use of cannabis is equated with that of other substances of abuse regardless of the related harmful effects or social problems.

The rationale for promoting the legalization of cannabis consists of a series of objectives aimed at increasing the safety of consumers but also of the general population; in particular, the set aims are represented by the improvement of the quality of the marketed substance, the eradication of cannabis from the black market with the consequent reduction of related violence, as well as the increase in tax revenues through taxation [11-16]. Legalization would also increase consumer safety by informing them about the dosages and quality of the compound and limiting the consumption by minors [17].

The reduction of offenses related to the illegal trafficking of this substance of abuse would lead to a progressive decrease in arrests and consequent prison crowding, as well as costs relating to legal expenses [18,19]. In the same way, consumers would also benefit from the legalization of both in terms of personal freedom and economic terms; the economic saving affects both the legal costs and the purchase cost of cannabis; in fact, legalization, on the one hand, al-

lows the spread of cultivation by multiple authorized producers and, on the other hand, eliminates the accessory costs added by the marketing on the black market [20-22].

To extend these advantages, it would be advisable to implement legislative changes with retroactive power and to obtain a legitimate market with low costs.

The present paper aims to outline the topics of debate and emerging public health issues as well as provide useful evidence and support to those involved from different perspectives in the regulatory aspects of recreational cannabis.

2. PUBLIC OPINION

A substantial proportion of adults around the world have experimented with cannabis regardless of the illegality of the substance. Public support for legalization has increased significantly over the decades and has culminated in some countries choosing to liberalize the substance for recreational use. Despite the increase in consensus, the topic still remains a heated social debate with opposing arguments in order to different issues (Fig. 1).

Essentially, proponents of the legalization of recreational cannabis emphasize economic benefits, job creation, facilitating law enforcement, and limiting racial disparities in law enforcement. In addition, the benefits of regulation are sustained in terms of crime reduction and product safety. Final-

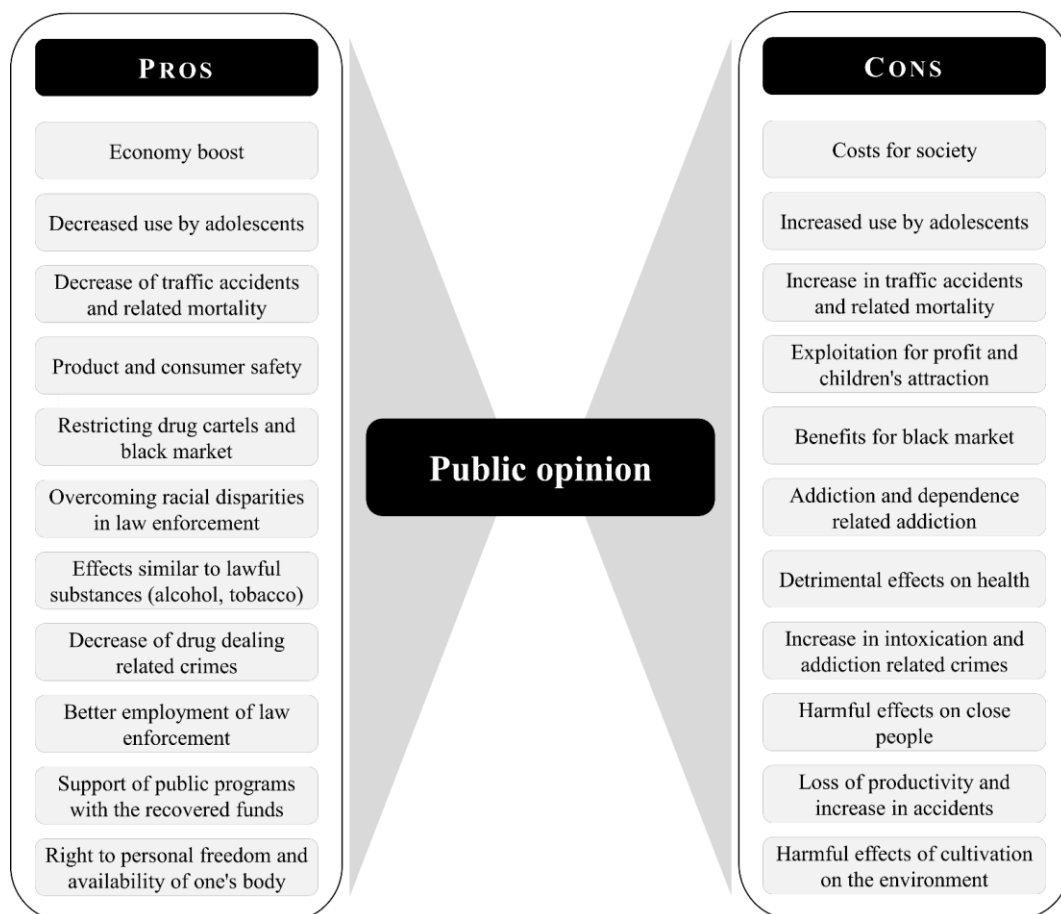


Fig. (1). Public opinion positions.

ly, it is argued that the use should be liberalized due to the comparability of cannabis with legal products such as alcohol and tobacco.

On the contrary, opponents of legalization say it will increase the prevalence among adolescents, direct and indirect use of health care, addiction-related problems, environmental exploitation, accidents at work, and unproductive conduct. The damage to the physical and mental health of the subject is among the most sustained arguments against legalization.

The main reason for opposition to the legalization of cannabis is the multiple negative health effects of the substance. First, cannabis is addictive - with symptoms such as insomnia, depression, anxiety, and nausea - and its spread through legalization can lead to an increase in the incidence of the phenomenon. Secondly, legalized consumption leads to an increase in medical emergencies related to cannabis; in particular, the enhancement of products intended for sale in terms of tetrahydrocannabinol (THC) concentrations determines an increase in admissions to emergency departments for anxiety attacks or psychotic symptoms; in essence, the phenomenon is responsible for an increase in intoxication due to the intake of quantities of THC greater than those expected or not expected at all. Finally, the spread of recreational cannabis raises some concerns about the exposure of subjects around the consumer; in particular, in addition to the sensitivity aroused by passive smoking, the effects related to the use of vaporizers are perceived as worrying due to the possibility of serious damage to the neurological (neurobehavioral compromise) and respiratory (pulmonary irritation and asthma) levels attributable to a probable increase in ammonia fumes.

With reference to the economic aspects, in permissive countries, the cannabis industry relaunches activities related to the real estate, tourism, construction, banking, and catering sectors; to this indirect phenomenon must be added the revenues directly deriving from taxes for producers. According to some, the tax revenues from the legal sale of cannabis could be used to implement public programs to support law enforcement, addiction prevention and treatment, rehabilitation programs, school social campaigns, etc. On the other hand, to evaluate the relationship between costs and benefits, the economic expenses deriving from medical emergencies, the treatment of addictions, the increase in road accidents, the increase in crimes, and the negative health impact of secondhand smoke. In comparison, for example, the annual social costs of alcohol and tobacco far outweigh the tax revenues from them. It is therefore essential to consider whether the legalization of recreational cannabis is equivalent to marketing a substance harmful to society that can lead to expenses greater than the revenue generated.

In reference to the criminalistic aspects and the workload for law enforcement, supporters highlight the positive effects of legalization. First of all, it is claimed that liberalization has annihilating effects on drug dealing crime; a similar argument is countered by opponents with data relating to the increase in crimes related to states of psychophysical alteration and addiction. Furthermore, according to many, legalization leads to a reduction in the overall commitment of the police and an increase in the resources to be used in other activities against crime.

Yet another focus is on the effects of recreational cannabis regulation on the black market. And so, while some argue that legalization can steal business from drug cartels, others argue that in the case of legalization the black market can be benefited in relation to the possibility of offering products at lower prices than legitimate ones.

Regarding adolescent prevalence, the possible effect of cannabis legalization is debated. In this sense, the data are in contrast with some statistics that show a decrease and others that document an increase in consumption among adolescents in liberal countries. In general, according to information released by the scientific community, opponents of legalization strongly perceive the risk of reduced short-term memory, decreased attention span, decreased learning ability, and impaired motor control.

Another topic of heated debate is that relating to the phenomenology of traffic accidents. Despite solid evidence regarding cannabis use, inability to drive, and traffic accidents, advocates of legalization argue that legalization does not lead to an increase in accident-related mortality.

A further strength, according to advocates of legalization, is the regulation of production processes and the safety of cannabis products. Legalization would allow governments to set age limits for buyers and to authorize and regulate the entire supply chain (growers, distributors, retailers, and testing labs). The possibility of tracing and regulating the production allows, unlike the purchase on the street, the distribution of products free of harmful agents packaged in such a way as to avoid accidental exposure.

To this argument, it is countered that legalization would lead to the affirmation of cannabis industries capable of exploiting people for profit and attracting children like the tobacco industries. In support of the thesis, it is pointed out, for example, that cannabis-based food products are packaged in a child-friendly way with colors and cartoons or wrappers that resemble familiar products.

The rights to personal freedom and the availability of one's body are also emphasized among the reasons for legalization. On this topic, opinions are extremely heterogeneous and favor an ethical and legal debate that has not yet been resolved.

The detractors of legalization also call into question the problems related to work capacity, especially as regards the possible reduction of productivity and dedication to work, as well as the increase in preventable accidents.

Finally, the environmental impact of legalization is not overlooked by the opposers. Specifically, it is stated that the intensive cultivation of marijuana can lead to deforestation, alteration of the ecosystem, and depletion of water resources; actually, growing marijuana requires almost double the amount of water needed to grow vegetables. Similarly, indoor growing is deemed harmful to the environment due to the high demands on electricity, lighting, heating and ventilation. According to multiple interlocutors, liberalization can prevent inequalities and racial discrimination in the enforcement of cannabis laws.

3. EMERGING ISSUES

In general, the legalization of cannabis for recreational use requires reflection on public health and safety issues worthy of brief characterization for the formulation of evidence-based proposals [23,24].

3.1. Health protection

The use of cannabis products, especially when repeated and heavy, has been linked to adverse effects on the individual and adverse health outcomes [25].

A large body of research demonstrates that cannabis use is linked to impulsivity, and studies suggest that impulsivity is an important factor in the early stages of addiction, such as drug experimentation [26-28]. Addiction is indeed a significant problem, with a significant portion of regular consumers experiencing difficulties in stopping use even when the negative effects on health and quality of life become evident. About 10% of people who have tried cannabis switch to daily use at some point and about 20-30% switch to consumption on a weekly basis [29-31]. Significant evidence from preclinical, clinical and epidemiological studies supports an association between cannabis use and the risk of psychosis and schizophrenia, particularly in individuals with predisposition and initial use in adolescence [32-36].

According to several research, the consumption of cannabis, as well as synthetic cannabinoids, has been associated with the risk of some cardiovascular pathological manifestations, including sudden cardiac death [37]. First of all, the consumption of cannabis is related to a hyperadrenergic state from which a reduction in the duration of the action potential depends on the possibility of microreentrant tachycardia and ventricular arrhythmias [38]. Furthermore, cannabis has been identified as the possible single precipitating factor for atrial fibrillation in subjects under 45 with AF recurrence after each exposure [39]. Cannabis use has also been linked to rhythm disturbances and electrocardiographic changes such as premature ventricular contractions (PVCs), as well as reversible changes in the P wave and ST segment. The prevalence of arterial hypertension tends to be significantly higher among cannabis users, although the direct impact of the drug on the development of hypertensive heart disease is not clearly defined and needs further research [40]. Similarly, cannabis is known to cause a disproportion between myocardial demand and supply, but the long-term impact on ischemic cardiomyopathy is not clearly described. Currently, there is also scarce evidence relating to the pathogenetic mechanisms of cannabis-related myocardial infarction; among the hypotheses formulated there are vasospasm (with clinical findings of a heart attack in the absence of coronary artery anomalies) [41-44] and transient ischemia (from a mismatch between myocardial oxygen supply and demand) [45].

On the other hand, in recent years, numerous studies on middle-aged subjects have reported a lack of association between cannabis use and cardiovascular disease [46].

Regarding the respiratory system, although smoking is a relatively confounding factor, there is substantial evidence of an association between chronic cannabis use and respiratory symptoms or exacerbations of chronic bronchitis [47]. The

association between cannabis smoking and chronic obstructive pulmonary disease is supported by limited evidence with insufficient evidence regarding the development of asthma and its exacerbations.

Nonetheless, cannabis use has been associated with an increased risk of cerebrovascular accidents; in particular, some studies document a 3 times higher risk of stroke and transient ischemic attack [48-49].

It is not possible to demonstrate a solid and consistent association between cannabis use and the risk of neoplastic genesis or progression due to the existence of limited and conflicting evidence from epidemiological studies [50].

3.2. Public safety

The action of THC on the endocannabinoid receptor system at the level of the central nervous system induces cognitive and psychomotor slowdown as well as sedation, reducing the ability to drive and contributing to the occurrence of traffic accidents [51]. Experimental studies have shown that recent cannabis use can limit longitudinal and lateral vehicular control, prolong reaction time, extend braking time, as well as adversely affect speed variations and lane changes [52-63].

Measuring cannabis-associated cognitive impairment in drivers is difficult because there is a complex relationship between blood THC concentration and neurological effects; for example, some studies show that the effects on the central nervous system are more evident when the blood concentration of THC begins to decrease [64]. Due to the difficult correlation between blood concentration and neurological effects, even if the effects on driving ability are documented, the association between cannabis intake and the risk of accident is still controversial and uncertain [65-67].

Given the lack of a clear scientific definition of the issue, it is important to underline that any regulation of the recreational use of cannabis must provide for a systematic consideration, and in some cases revision, of the methods of assessing the psychophysical condition of drivers. Precisely, in cases where legal values are not established for the interpretation of toxicological data, it would be necessary to identify criteria, possibly related to clinical assessment procedures for medico-legal purposes, which would allow determining the inability to drive.

3.3. Adolescence

Marijuana can potentially affect young patients of any age [68]. Adolescence and young adulthood are characterized by critical and delicate transitions in brain development.

The adolescent age has a documented inclination to adopt risky behaviors, and the use of substances can determine the development of behavioral disorders or even interrupt the processes of maturation [69]. In concrete terms, a growing body of neuroimaging research shows, among other things, that early cannabis use can negatively impact the structure and function of developing brain circuits [70].

Nonetheless, there is epidemiological evidence to support a link between exposure to cannabis during adolescence and psychosis, as well as the development of motivational and

other acute and chronic adverse effects (e.g., short-term memory impairment and cognitive deficits), mainly related to cannabis potency and persistence in use [71,72].

A recent meta-analysis evaluated cannabis use and depression at various times, from adolescence to young adulthood [73].

In a further analysis of the behavioral risk factor surveillance system, a significantly higher probability of stroke was found in young marijuana users than in non-users [74-76].

Cannabis-related cognitive deficits can be both global and domain-specific and can be temporally framed as intoxicating effects and short- and long-term effects. Acute cannabis intoxication is associated with transient mood swings with euphoria, anxiety or paranoia, together with impaired cognitive function and sensory processing [77-79]. Many of the domain-specific cognitive deficits improve with abstinence, but some may persist beyond early abstinence and represent long-term deficits [80].

Cannabis use is associated with a worse course and prognosis in young people with psychotic disorders, with an increased risk of psychotic relapse, increased hospitalizations, and less adherence to drug therapy.

Regarding the correlation between cannabis and depression, the evidence is currently controversial, with studies that demonstrate a positive association and other contributions that do not highlight associations [81-83].

3.4. Pregnancy

According to several Authors, an increase in the use of recreational cannabis by women of reproductive age and pregnancy is demonstrated [84-87]. The National Survey on Drug Use and Health (NSDUH) found that over 4% of the women surveyed admitted using drugs during pregnancy; the same survey identified marijuana as the most used substance in such conditions [88]. Reasons for consumption included recreational activities (39%), nausea and vomiting (48%), pain (60%), as well as treatment of depression, anxiety, and stress (63%) experienced during pregnancy. Maternal marijuana consumption exposes the fetus to cannabinoids, such as the THC, as well as the metabolites 11-OH-THC and THC-COOH, which rapidly cross the placental barrier, entering the fetal bloodstream.

This exposure can cause the interruption of the fetal endogenous cannabinoid signaling system involved in multiple phases of intrauterine development [89,90]; in detail, it has been observed that this alteration can cause defects in the neuronal wiring and, therefore, have negative implications on neurological development [91,92].

The American College of Obstetricians and Gynecologists (ACOG), the American Academy of Pediatrics (AAP), the Food and Drug Administration (FDA), and the U.S. Centers for Disease Control and Prevention (CDC) recommend that women avoid the use of cannabis during pregnancy or breastfeeding [93,94].

Despite these recommendations, the belief that cannabinoid use during these particular periods of a woman's life is risk-free continues to rise.

Some authors have reported that the concentration of THC in umbilical cord blood was three to six times lower than that found in maternal blood [95,96]; further studies have made it possible to detect the presence of THC also in breast milk with concentrations 8.4 times higher than those in the plasma due to the high lipophilicity.

In view of the effects of fetal cannabinoid exposure, data on long-term follow-up are currently limited; furthermore, the set of evidence on prenatal and breastfeeding transmission is limited and the duration of stay of THC in breast milk after cessation of cannabinoid use has yet to be determined [97].

The need to implement long-term follow-up is also substantiated by many authors who suggest that harmful effects are frequently unnoticeable and may become manifest during mid-childhood or adolescence [98]. In some subjects, a hyperactive and impulsive attitude, as well as attention disturbance, was found [99]. Further studies found deficits in visual-motor coordination and in the interhemispheric transfer of information, as well as the reduction in visual memory and the slowdown in processing speed [100,101]. Innumerable studies have made it possible to highlight the relief of a decrease in height [102-107]. Most of the studies have not produced evidence essential for identifying an association between maternal use of cannabis during pregnancy and the onset of congenital anomalies [108-110]. In the literature, also about the possible association between prenatal or perinatal exposure to marijuana and stillbirth, development of depression, delinquent behavior, congenital heart disease, as well as psychosis, and future intakes of substances of abuse, it is not possible to detect significant evidence [111-124].

A records analysis of data from the Stillbirth Collaborative Research Network cohort recently found that maternal cannabis use during pregnancy was associated with an increased risk of neonatal death [125]. Furthermore, some authors have shown how exposed fetuses may be more predisposed to the risk of prematurity and reduced birth weight [126-129].

3.5. Unintentional pediatric exposure

Marijuana-based food products represent a significant part of the market. Such products often exhibit organoleptic characteristics similar to cannabis-free equivalents, posing a unique challenge in the prevention of unintended pediatric exposure.

According to different Authors, from 2005 to 2011, 985 unintentional marijuana exposures were recorded in children under the age of 9, with an average age of exposure of 1.7 years and a significant difference in the incidence between prohibitionist and permissive countries [131,132].

The concentrations of tetrahydrocannabinol found in food products (5-100 mg in a single gummy candy or cookie) make the potentially ingested dose significant, determining a real risk of symptom manifestation and hospitalization [130].

Similarly, passive (or second-hand) exposure to marijuana smoke is a matter of fervent interest, especially in relation to the paucity of available scientific data on its effects. Es-

sentially, marijuana smoke has components similar to those found in tobacco smoke, especially as regards combustion derivatives and carcinogens [133]. At present, it is not demonstrated whether passive smoking of marijuana can determine in the pediatric population the risk of upper respiratory tract infections, asthma exacerbations, otitis media, and SIDS, effects described in passive exposure to tobacco smoke [134].

Therefore, undoubtedly, the pediatric population must be considered particularly vulnerable to marijuana smoking due to the generic effects of smoking, the increased number of breaths per minute, and the potential exposure to new preparations containing high concentrations of THC.

CONCLUSION

Actually, given the heterogeneous content and implementation, it is difficult to map the public health effects of existing cannabis regulatory frameworks.

Such variability makes it difficult to interpret trends of changes in cannabis products, use trends, and cannabis-related health problems.

Cannabis legalization represents a promising way to reduce the costs of prohibition related to justice, decrease the cannabis illicit market, facilitate the regulation of cannabis products, guarantee purity and safety of products, generate tax revenues, and increase access for individuals who use cannabis without experiencing significant negative consequences or impaired functioning.

However, cannabis use legalization increases the risk for mental health, medical and psychosocial problems, as well as the risk for public safety (e.g., driving under the influence of cannabis) and the request for emergency care [135-138]. Similar risks are of particular concern since the potency of cannabis has been consistently rising over the past two decades [139].

Legalization is leading to a dynamic, broad, and uncontrolled (concerning distribution and sale) cannabis market. Several products such as home grown cannabis, oils and infusions are currently available although the content, quality, labeling and control are not uniform. As a result, it is difficult to predict health risks that, in relation to new cannabis products, are largely unknown.

In any case, it is mandatory to harmonize the regulations in order to limit confusion and interpretability, but above all to better reflect the scientific evidence currently available.

At the same time, the negative health implications of cannabis should be formally and consistently emphasized by healthcare professionals, pharmacists, and caregivers; in this regard, specific training of stakeholders on the various cannabis products is therefore necessary.

The spread of commercial cannabis can lead to an underestimation of the risks associated with its use [140]; in particular, some evidence suggests that the perception of risks from cannabis use has decreased in adolescents following the approval of state recreational cannabis laws. Therefore, to implement awareness and global health, the public needs accurate information on cannabis products, the amounts of

THC, the risks and benefits of using more potent cannabis, and ways to minimize harm. Similarly, it is important to provide adequate information on the paucity of evidence available regarding many of the alleged medicinal uses of cannabis and cannabidiol, the risks of cannabis addiction, the use of cannabis during pregnancy, the ability to drive as well as the exacerbation of psychosis and other mental health disorders.

A generalized underestimation of risks associated with cannabis use may lead to an increase in consumer population, acute intoxications, hospitalizations, cannabis-related traffic accidents, as well as accidental exposure for young people.

Adequate information can help prevent the spread of false claims about the health effects of cannabis products. For these reasons, research funding needs to be increased proportionally in order to complement the expansion of cannabis use with solid evidence not only on potential therapeutic properties but also on public health implications. Precisely, it is imperative to favor the prospective study of the impacts of legalization in order to know the potential benefits, identify the risks, and guide political choices with a view to preventing public health problems.

Possible strategies for reducing the harm related to legal cannabis could include, inter alia, increasing the cannabidiol (CBD) content of cannabis, raising awareness of vulnerable populations, and discouraging assumption patterns involving combustion [141]. Programmes to prevent adolescent cannabis use might also be provided. The option of a minimum legal age for cannabis use is a critical and controversial issue in the context of recreational legalization [142]. In adolescence, media campaigns can reduce cannabis use and the resulting harm with moderate effectiveness [143,144]. Conversely, family-based prevention programs can certainly be more effective and possibly lead to greater long-term benefits [145]; similarly, through the combination of social competence and influence, school-based life skills programs can reduce cannabis use in the medium and long term [146].

Finally, the implementation of operational strategies for the collection and analysis of data relating to the consumption, frequency of use, exposure of categories at risk, and psychosocial effects is vital [147-152]. Such approaches are undoubtedly useful in monitoring and understanding the response of populations to changing regulatory trends. Large database modeling could provide an additional tool for learning about the benefits and costs of cannabis reforms, as well as allowing evidence-based health and public policies in the age of legalization [153-161].

CONSENT FOR PUBLICATION

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CONFLICT OF INTEREST

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