



Transcultural Aspects of Cannabis Use: a Descriptive Overview of Cannabis Use across Cultures

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Abstract

Purpose of Review This narrative review summarises cultural aspects of cannabis use across different (sub)cultures, nations, and gender, racial, and ethnic groups. Specifically, we aimed to overview historical and traditional contexts of cannabis use and physical and mental health-related correlates, as well as emerging cannabis-related policies and their impacts on medicinal and recreational use of cannabis. In addition, we discuss how cultural factors may affect cannabis use behaviours and sociocultural underpinnings of cannabis use disorder trajectories.

Recent Findings Cannabis is the most widely cultivated, trafficked, and used illicit drug worldwide, although cannabis is being legalised in many jurisdictions. More than 4% of individuals globally have used cannabis in the last year. Being traditionally used for religious and ritualistic purposes, today cannabis use is interwoven with, and influenced by, social, legal, economic, and cultural environments which often differ across countries and cultures. Notably, empirical data on distinct aspects of cannabis use are lacking in selected underrepresented countries, geographical regions, and minority groups.

Summary Emerging global policies and legislative frameworks related to cannabis use have impacted the prevalence and attitudes toward cannabis in different subcultures, but not all in the same way. Therefore, it remains to be elucidated how and why distinct cultures differ in terms of cannabis use. In order to understand complex and bidirectional relationships between cannabis use and cultures, we recommend the use of cross-cultural frameworks for the study of cannabis use and its consequences and to inform vulnerable people, clinical practitioners, and legislators from different world regions.

Keywords Cannabis · Cannabis use disorder · Culture · Cross-cultural · Drug policy · Addictive behaviours

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Introduction

Cannabis¹ is the most commonly used psychoactive regulated substance in distinct world regions with different cultures, with an estimated 4% (209 million) of the world's population having used cannabis in the last year, according to the World Drug Report [1]. Cannabis is the most widely used drug in the USA after alcohol and tobacco [2]. In Europe, 48 million males and 31 million females (27.3% of Europe's adult population) report ever having used cannabis for recreational purposes [3]. In Asia, it is estimated that the annual prevalence of cannabis use is 2%, representing roughly one-third (54 million people) of the people who use cannabis worldwide [4]. Cannabis also has a high prevalence of use in Australia and is the most widely used illicit drug (11.6% of individuals report past-year use [5]). However, only one in six Australian people who use cannabis report daily use [5, 6]. Moreover, cannabis is Africa's most consumed illegal substance, and Africans constitute a third of the people worldwide who use and cultivate cannabis [7].

Although cannabis use prevalence differs across countries and cultures, it is challenging to tease apart patterns of cannabis use in distinct world regions with specific cultures and norms due to cultural differences in geographical regions worldwide [8]. In this review paper, we consider various cultural aspects of cannabis use and discuss how cannabis use patterns and attitudes may be influenced by different cultural contexts.

A sole “national culture” in a distinct geographical region is often considered as the prevalent value framework that subjects all individuals within that society to the same cultural norms [9]. However, subnational cultural groups can be heterogenous—there may exist multiple subcultures within the same country or geographical region substantially influenced by religion, geography, social class, ethnicity, cohort, and gender [8]. This heterogeneity could potentially form and impact different values and behavioural patterns related to social and psychological phenomena, such as cannabis use [10••]. To be more specific, increases in the prevalence of cannabis use globally could potentially reflect multiple complex changes in the cultural, societal, and legal landscape surrounding cannabis [11].

The reasons and motives for individuals to use cannabis are often multifactorial and may vary across different populations and cultures. These can include desires to achieve subjective effects, including mood enhancement, conformity, perception-alteration, mind-expansion, and positive social and interpersonal effects, although coping strategies such

as negative reinforcement motivations (e.g. to escape from negative mood or uncomfortable states) also exist [12].

The *Cannabis sativa* plant produces over 400 chemical entities, 140 of which are unique to the plant as they are psychoactive in function and are usually referred to as “cannabinoids”—levels of which vary across different plants [13•]. Research to date has focused mainly on the two most common cannabinoids: Δ 9-tetrahydrocannabinol (THC) and cannabidiol (CBD). THC is the most abundant cannabinoid across most varieties of cannabis and is the primary intoxicating compound of the plant and the most widely studied [14].

To briefly overview the health-related effects of cannabis use based on empirical evidence, heavy cannabis use (defined as (near) daily use [15]) has been linked to adverse mental health measures, such as psychotic illness, cannabis use disorder (CUD), and cognitive impairment [16]. Studies have also found significant associations between cannabis use and depression, suicidality, and anxiety, although confounding factors may in part explain these relationships [17, 18]. Physical health concerns have also been linked to long-term cannabis use. These concerns include testicular cancer, gastrointestinal problems, cardiovascular concerns (evidence mainly from case reports), and respiratory conditions, although not with lung cancer [19, 20]. Studies show that long-term, regular cannabis use is associated with impairments in cognitive domains, including learning, memory, and decision-making [21]. Moreover, cannabis use is a risk factor for motor vehicle accidents [22]. Although a portion of cannabis-using populations will not experience significant harm from their use, 10–30% report developing symptoms suggesting dependence, including experiencing withdrawal symptoms, and consequences consistent with a CUD [23]. Furthermore, a recent meta-analysis showed that among people who use cannabis, 22% develop tolerance to the drug and fulfill diagnostic criteria for CUD [24•].

Conversely, emerging anecdotal and scientific evidence points to the therapeutic potential of cannabinoids. Cannabinoid-based medicine has been approved as a treatment option for nausea and vomiting in relation to chemotherapy, pain, and spasticity in patients with multiple sclerosis and as an antiepileptic for rare paediatric patients with epilepsies [25]. CBD has also shown potential as a treatment for schizophrenia as well as various substance use disorders, including those related to alcohol, opioids, and cannabis [13, 26, 27].

Given the high global prevalence of cannabis use and the related harms, it is crucial to understand psycho-socio-cultural considerations related to cannabis use. Since cannabis is a drug that has been initially used for traditional, ritualistic, and religious purposes, and in some societies, its consumption may still relate to social and cultural norms and influences, it is important to understand how different cultures and cannabis use may influence one another. Together,

¹ Synthetic cannabis products are out of scope of this paper.

public beliefs and general narratives of people who use cannabis about motives of consumption can be seen as a “cannabis culture”. There may be cannabis-related traditions, symbols, rituals, and narratives that are distinctive across societies and cultures [28]. Also, cultural aspects of cannabis use could potentially contribute to and stem from major global changes in cannabis regulation that are underway and make it easier to access the drug [29].

We contend that one key aspect often missing from conceptualisations, attempts for development, and implementation of prevention and intervention programs and research practices within the field is the role of culture. Based on *Purnell’s Model for Cultural Competence* [30], major influences that shape peoples’ worldviews and the degree to which they identify with their cultural group of origin are called the primary and secondary characteristics of the culture. This theoretical model suggests that the primary characteristics of culture comprise nationality, race, colour, gender, age, and religious affiliations [31].

The overarching aim of this paper is to outline primary characteristics and dimensions of culture (as proposed by *Purnell’s* theoretical model [30]) related to cannabis use from a cross-cultural perspective and provide an overview of the variations across populations and cultures. Moreover, this paper provides a brief historical and cultural account of cannabis across different cultures in light of different social, legal, and cross-cultural differences in cannabis use and discusses different perspectives in this context.

Methods

Articles for this narrative review were obtained by searching PubMed and Google Scholar databases. We considered relevant studies regardless of study design and year of publication (the review concluded in November 2022). However, we included only research reported in English. Additional articles were obtained from reference lists of existing papers and reviews. We also searched the relevant grey literature (UNODC, NIDA, EMCDDA) for the most up-to-date information on cannabis use prevalence and legal status internationally. Our aim was to provide a developmentally informed overview of existing studies and to highlight important areas of future research to enhance our understanding of the roles of different characteristics and dimensions of culture on cannabis use [30].

History of Cannabis Use: Ritualistic, Medicinal, and Recreational Modes of Consumption

In Asia, cannabis use dates back millennia. Cannabis seeds accompanied the migration of nomadic peoples and were involved in commercial exchanges. Possibly the

first reported medical use of cannabis was in 2700 B.C. in the Chinese *pen-ts’ao*, the world’s oldest pharmacopoeia. Hindu myths before Christ suggest that the god Shiva, the supreme Godhead of many sects, supposedly favoured cannabis, which had a religious role as an agent for mystic inspiration and experience. Under names such as *Vijaya*, cannabis has been used for thousands of years in ayurvedic medicine in India (i.e. a holistic system of traditional medicine native to India) to reduce pain, nausea, and anxiety, improve appetite and sleep quality, relax muscles, and produce a feeling of euphoria. Moreover, several traditional and therapeutic indications of cannabis are mentioned in the texts of the Indian Hindus, Assyrians, Greeks, and Romans [32]. In ancient Egypt, cannabis tinctures and anointments were consumed for spiritual and healing purposes. Known as a hieroglyphic word *Shemshemet* (sm-sm-t), cannabis was considered to have been created by the god of the sun, Ra, and was traditionally used in death ceremonies as well as for multiple medicinal purposes [33, 34].

In Europe, in the early nineteenth century, some physicians used cannabis seeds for homoeopathic medications. In 1840, William Brooke O’Shaughnessy, an Irish physician, introduced cannabis to Western medicine after having lived in Calcutta, India, and publishing his observations, including a case where cannabis stopped convulsions in a child [35]. In the second half of the nineteenth century, over 100 scientific articles were published in Europe and the USA about cannabis and its potential therapeutic effects, leading to increased medicinal use of cannabis in Western medicine in the late nineteenth and early twentieth century [36]. A series of legal obstacles, namely “the Marihuana Tax Act in 1937” [37], removal of cannabis from the American pharmacopoeia in 1941, and the 1961 United Nations Single Convention on Narcotic Drugs [38] that placed cannabis under the strictest control regime (Schedule IV) along with heroin, limited medicinal use and experimental research of cannabis.

In 1964, Raphael Mechoulam isolated and determined the structure of the main psychoactive phytocannabinoid, THC. This work stimulated exploration of a novel neural signalling system, the endocannabinoid system [39]. This discovery resulted in better knowledge of the plant’s chemical compounds, and a significant increase in scientific interest in cannabis happened in 1965. The number of research projects and publications on cannabis grew significantly in the early 1970s. Studies on cannabis increased again in the early 1990s, with the description of Devane and Mechoulam about specific receptors in the nervous system responsible for the pharmacological effects of THC, followed by the isolation of anandamide, an endogenous cannabinoid. Endogenous cannabinoids or “endocannabinoids” are natural ligands of cannabinoid receptors, mainly

responsible for the pharmacological effects of THC, which bind to these receptors [39].

After the passing of the Controlled Substance Act (CSA; also known for promoting the “War on Drugs” movement) in the USA in 1971, cannabis was listed as a Schedule I substance, and its consumption was tightly restricted and not socially or legally accepted, even under medical supervision [40]. The US government spent billions of dollars to legally address, often through arrest and incarceration, non-violent cannabis-related crimes and restrict cannabis research and medicinal applications through the enforcement of prohibitionist laws [41]. Outside of the USA, the legal climate surrounding cannabis use had become rather restrictive during the 1970s. For example, in August 1971, the French president George Pompidou invited European governments—namely the Netherlands, West Germany, Belgium, Luxemburg, Italy, and the UK—to participate in a collaborative effort to “combat” drugs, including cannabis [42]. By this time, the Dutch government was considering reframing its restrictive regulations on cannabis, differentiating it from drugs considered more harmful [42]. Influenced by the US government and the United Nations, in July 1973, Nepal closed down all its cannabis shops and cancelled all cannabis dealers and farming licenses, as did Afghanistan in the same year [43]. Despite the imposition of legal restrictions on the production and consumption of cannabis products in Africa, by the end of the 1970s, cannabis had become established as a popular illegal drug across Africa [44].

A considerable change in US cannabis policy history took place in 1996 when California allowed the medicinal use of cannabis (also known as *California Proposition 215*) [45]. Later, Colorado and Washington were the first US states to legalise the recreational use of cannabis [46]. After the USA, Uruguay was the first country globally to explicitly regulate recreational cannabis use in 2013 [47]. During the same decade, increasingly more US states established laws permitting cannabis use for medical and recreational purposes. As of April 2023, 38 US states, three territories, and the District of Columbia had laws permitting the medical use of cannabis [48]. As of June 2023, legal provisions allowing the production and sales of cannabis for non-medical (i.e. recreational) use had been approved in Canada, Uruguay, and Thailand, as well as in 23 states, two territories, and the District of Columbia in the USA² [49•].

The World Drug Report also shows that the global prevalence of cannabis use has increased in the past decade, from 147 million individuals (~2.5%) in 2010 to more than 210

million individuals (~4%) in 2022 [1]. There has been a considerable global increase in the past-year prevalence of cannabis use, and the proportion of past-year cannabis use reported by adolescents reached 43% in 2021 from 34% in 2016 [50]. The COVID-19 pandemic has also influenced trends in cannabis use. Amid the COVID-19 lockdowns in early 2020, a global survey reported that the use of cannabis had increased by 63% globally [51]. Furthermore, during the COVID-19 pandemic, feelings of boredom, depression, and anxiety, as well as the accessibility to cannabis, may have contributed to increases in the use of cannabis [52].

Importantly, longitudinal studies examining cannabis potency in the USA and Europe report significant increases in cannabis potency (i.e. higher THC concentration and lower CBD concentration) during the last two decades [53]. Findings suggest a higher risk of cannabis-use-related negative consequences on physical and mental health as well as dependency occurs with cannabis having such chemical constituents [54]. Given the high association of cannabis potency increment with an increased risk of mental health disorders [55••], this constitutes a significant public health concern regarding cannabis use.

To summarise, cannabis use dates back to at least the third millennium BC in written history for different traditional, medicinal, and recreational purposes throughout the world. The legislative changes in cannabis-related laws and unprecedented global issues, such as the COVID-19 pandemic, have influenced cannabis-use patterns globally, contributing to intertwined historical and cultural relationships involving cannabis use.

Social, Economic, and Legal Influences on Cannabis Use

Social Class and Cannabis Use

Cannabis use has become a cultural phenomenon in industrialised countries in the 1960s among White and middle-class youth [56]. For some, cannabis became a marker of their identities and a culture that resisted existing mainstream and social norms in Western societies. Cannabis use was associated with specific musical preferences, milieus, and lifestyles. In the wake of the youth rebellion of the 1960s, a so-called hang-loose ethic, and the advent of hippies, the substance took root in broader groups throughout Western societies [57]. In other words, the rituals, symbols, and stories of the contemporary cannabis culture were arguably shaped by and interwoven with the ideology of the social and cultural movements of the 1960s and 1970s in Western cultures. In most Western countries, cannabis was introduced and fostered by young people who were politically in opposition with their societies’ norms, advocating for the

² Including Alaska, Arizona, California, Colorado, Connecticut, Delaware, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, New Jersey, New Mexico, New York, Nevada, Oregon, Rhode Island, Vermont, Virginia, Washington and District of Columbia, Guam, and Northern Mariana Islands.

values of the broader culture entwined with Eastern philosophy and political opposition [28]. Hence, the introduction of cannabis consumption, and recreational use particularly, coincided with significant cultural changes in this period [58]. In the early 2000s, cannabis consumption contributed to “hip-hop culture”, often expressed along with a distinctive sort of style, clothing, language expressions, and lifestyle [59]. More recently, findings from a recent Swedish study indicate that young people tend to associate cannabis with freedom of choice, coping with demands of self-realisation, achievement, and happiness. Societal tendencies to depict cannabis as a “forbidden fruit” may enhance positive attitudes toward cannabis use [60].

Socioeconomic Status and Cannabis Use

Evidence-based research about cannabis use in different countries with a comparative approach is limited and scarce. A large survey conducted in 1999 explored national rates of cannabis use among young adults in 31 countries and their associations with per capita personal consumer expenditure (an indicator of economic prosperity), unemployment, and peer factors [56]. This study found that in wealthier countries across Europe and North America, young people used cannabis more frequently, potentially resulting from increased leisure opportunities for larger segments of the population in wealthier countries. This finding suggests that wealth and availability of cannabis may foster cannabis use, particularly among younger individuals. For instance, patterns of cannabis use in Anglo-American countries (Canada, the UK, and the USA) showed higher prevalence estimates relative to most countries in eastern and northern Europe (except the Czech Republic, Hungary, Slovenia, and Ukraine). In a separate large-scale survey involving adolescents living in different continents, prevalence of cannabis use was associated with higher income levels and lower urbanity rates in 73 low- and middle-income countries [61•].

Apart from studies that explored the link between cannabis use and socioeconomic status at a country level, several studies show an association between cannabis use and socioeconomic status at the individual level. For instance, findings from a longitudinal study showed that people who used cannabis among 947 participants had more financial difficulties relative to those who did not use [62]. More recently, a study of a longitudinal birth cohort (from birth to age 35 years) in New Zealand reported that high-frequency cannabis use was associated with poorer indices of socioeconomic well-being such as lower income and reduced odds of attaining tertiary qualifications in both early-onset and adult-onset participants [63]. Therefore, socioeconomic class factors may influence patterns of cannabis consumption and attitudes towards the drug. However, given limited empirical data investigating associations between socioeconomic

status and cannabis use patterns, particularly in Asian and African countries, future studies exploring country-level differences in cannabis use and social class are important.

Public Policy, Legal Environments, and Cannabis Use

Legal policies surrounding cannabis decriminalisation and legalisation across countries are important factors related to trends and prevalence of cannabis use across societies. Several studies have investigated whether the legalisation of cannabis may influence the prevalence of cannabis use, and findings remain inconclusive [64, 65]. For example, in those US states that have legalised cannabis consumption, the price of the drug has fallen, and both recreational cannabis use and CUD prevalence estimates have increased among adults [66, 67]. The ease of accessing cannabis as an intoxicating substance may impact individual- and population-level substance-use initiation, frequency, and amount of use, and consequently, the risk of developing CUD. However, evidence pointing to the effects of cannabis legalisation on cannabis use prevalence and related harms appears inconsistent. More recently, a prospective longitudinal study measured the effect of recreational cannabis legalisation on cannabis use frequency in samples of US twins [68]. Accounting for age, sex, and earlier cannabis use, a ~24% increase in mean cannabis use frequency attributable to legalisation permitting the recreational use of cannabis was observed. The findings indicate that in states with versus without legalized use residents used cannabis more frequently [68]. Another large-scale survey conducted in 38 countries with 172,894 adolescents showed that cannabis depenalisation was associated with higher odds of past-year use and regular use in both genders [65].

On the other hand, other studies have not demonstrated links between cannabis liberalisation, risk perception, and cannabis use, among neither the general population nor those with psychological distress [69, 70]. For instance, a recent study of recreational cannabis use among European individuals aged 15–34 years investigated changes in country-specific trajectories of prevalence over time and in relation to policy changes. Cannabis use was either stable or increasing among countries where cannabis legislation remained unchanged (Germany, Netherlands, Slovakia, Sweden) or had been implemented during the study period (Belgium, Norway, Portugal, Spain). On average, self-reported cannabis use seemingly increased by 0.08% per year in these countries and, by contrast, decreased in the countries where cannabis legislation had changed during the observable interval of the study period [71••]. Additionally, there exists limited and scarce empirical evidence in Asian and African countries about the influences of cannabis legalisation on the prevalence of use. This is particularly relevant considering that the recreational use of cannabis is still illegal in most countries in this region.

Another concern is the decline in percentages of adolescents and older adults who perceive cannabis use as risky (i.e. risk

perception), which has been suggested as potentially leading to an increase in cannabis use [72]. For instance, data from a 2002–2014 US national survey among adults who used cannabis once or twice a week fell from 50.4 to 33.3%, identifying cannabis as a low-risk drug [73, 74]. The decrease in risk perception may result from governmental jurisdictions around cannabis legalisation [73], which, if not monitored, could potentially shape individuals' attitudes and cannabis use behaviours in the future.

Attitudes and Stigma Toward Cannabis Use

Contemporary regulation of recreational cannabis and general liberalisation of its use have influenced cultural and societal views of cannabis use and attitudes toward the substance. Cannabis has undergone what may be conceptualised as a “civilising process” and modernisation due to altered social regulations [10••]. However, the transformation and modernisation of cannabis in different countries have not eliminated taboos, traditions, and rituals associated with cannabis. Medicalisation and legalisation may have helped to reduce cannabis-related stigmas, but these policy changes have not necessarily shifted all social perceptions [75]. People who use cannabis may experience stigmatisation that contrasts with perspectives that include the potential of “cannabis as a ‘natural’ drug and a gift from the earth,” medical cannabis ideologies and “cannabis for self-care” narratives. Nonetheless, countries at different stages of cannabis legalisation and the cultural appropriation of cannabis may involve stigma and tensions connected to its shifting legal status [76]. The values and cultural meanings linked with cannabis may relate partly to the changing cannabis landscapes and the legal atmospheres, both locally and globally. Therefore, divergent cultures, legal atmospheres (i.e. social and institutional adaptations to the liberalisation of cannabis), cannabis markets, and societies' attitudes toward cannabis may be factors that contribute to differences between various countries in cultural contexts and attitudes [10••].

Overall, the existence of different cannabis policies adds further complexity to understanding cultural aspects of cannabis use across different countries and social classes, highlighting the importance of having both global perspectives and local approaches when aiming to investigate cross-cultural aspects of cannabis use.

How May Gender, Race, and Ethnicity Influence Cannabis Use?

Racial and Ethnic Minorities and Cannabis Use

Social and political injustice related to cannabis prohibition, particularly to under-represented minority groups and people

of colour, is one crucial factor driving cannabis legalisation in the USA [77]. Similarly, in other regions such as Europe and the UK, cannabis prohibition has exacerbated racial injustice and led to various social costs involving unequal arrest and incarceration rates in communities of colour [78]. Thus, one of the stated goals of cannabis legalisation, in general, is to effectively combat racial inequalities in cannabis legislation enforcement in terms of racial and ethnic disparities in cannabis arrests and punishments. Nevertheless, little is known about whether race and ethnicity have potential influences on cannabis-related risk or protective factors among different populations. A recent review indicates that estimates of past-month cannabis use in the USA among Asian-Americans are lower than the national average (~5%), while rates are slightly higher among Hispanic (~10%) and Native Hawaiian/Pacific Islander populations (~10%), and considerably higher among White (~13%) and Black populations (~15%) and American Indian/Alaska Native individuals, followed by African American/Black Natives (~14%) [79].

Among young adults, cannabis risk perceptions and norms, community drug use levels, parental disapproval, and peer influences have been associated with adolescents' intentions and attitudes towards cannabis use [80]. However, these factors may differ across racial and ethnic groups [81]. For instance, an epidemiological study of US adolescents from different racial/ethnic groups showed that Black, Hispanic, Native-American, and mixed-race adolescents were more likely than White adolescents to use cannabis (≥ 2 days/year), while Asian-American adolescents were less likely than White adolescents to use cannabis. Also, Asian-American adolescents were more likely than White adolescents to report personal and parental disapproval of cannabis use, while mixed-race and Native-American adolescents were less likely than White adolescents to report disapproval of cannabis use [82]. In another study [83•] conducted among adolescents from multiple racial/ethnic groups, Asian-American adolescents showed the lowest rates of past-year and lifetime cannabis use. This finding may have been explained by lower access of adolescents to the cannabis market and higher cannabis risk perception, as well as the highest disapproval from their parents and peers.

A cultural factor potentially contributing to this finding is parenting style. Social psychology theories define four types of parenting styles known typically as authoritative (warmth and strictness), authoritarian (strictness but not warmth), indulgent (warmth but not strictness), and neglectful (neither warmth nor strictness) [84]. Several studies, conducted mainly in Anglo-Saxon contexts with European-American samples, suggest that the authoritative (warmth and strictness) parenting style or even, for certain minority groups, the authoritarian (strictness but not warmth) parenting style, both sharing strictness as a characteristic, have the

best positive effects for adolescent cannabis-use prevention. For instance, Asian-American groups, which showed lower cannabis-use rates, may preferentially employ authoritarian (strictness but not warmth) parenting styles, and this reflects a less common parenting approach in Western countries [83•].

Interestingly, related findings may contribute to substance-use prevention strategies among Hispanic adolescents (who show higher lifetime cannabis use), as Hispanic cultures may emphasise family values, which may act as a cultural protective factor with respect to adolescent substance use [85]. At the same time, findings from a European study on indulgent parenting style (warmth but not strictness) reported this style to be as protective as the authoritative style against adolescent substance use in a European cultural context [86]. These results seem to be consistent with previous studies in Southern European countries (Spain and Portugal), where strictness and impositions in socialisation practices are culturally perceived in a negative way [87]. Thus, protective factors associated with parenting styles may depend in part on the cultural backgrounds in which parent-child relationships develop.

Furthermore, it is speculated that among people from minority racial and ethnic groups, stressors such as political unrest, social and economic discrimination, and vulnerability among disadvantaged minority populations, particularly adolescents, may contribute to the initiation and continuation of cannabis use [88]. Intentions to co-use cannabis with tobacco/nicotine also may differ across racial/ethnic groups impacted by living in close proximity to neighbourhoods of cannabis outlets [89].

Another important factor contributing to regular cannabis use in racial and ethnic minorities is cultural racism. A study examining the relationship between cultural race-related stress and the number of years of regular cannabis use among incarcerated Black men suggests that cultural race-related stress may predict and explain years of regular cannabis use [90]. More recently, Zapolski and colleagues also found a significant effect of racial discrimination on mid-adolescent cannabis initiation in African American adolescents [91].

Together, multiple factors related to race and ethnicity may impact cannabis use. These factors should be considered when designing and implementing prevention and intervention programs for at-risk minority youth populations [83•].

Gender and Cannabis Use

Gender-related differences are significant regarding perceptions and experiences of cannabis use. In terms of experiences, females who use cannabis, in most societies, are more prone to experience social and cultural stigma than are males

[92]. Illegal substance use is a gendered practice that may be intertwined with social and cultural roles, norms, gender identities, and gendered rules and regulations. Gender-related differences in the prevalence of substance use may, in part, reflect men having greater access to substances relative to women [93]. According to data from the 2019 National Cannabis Survey conducted in Canada, past-3-month use of cannabis was more prevalent among men relative to women (20% vs 14%). Further, men were more likely to report a greater frequency of use and were twice as likely as women to report daily use of cannabis (8% of men vs 4% of women) [92]. Epidemiological studies have demonstrated that males have higher estimates of problematic cannabis use (marked by increased chronicity of cannabis use), more prolonged episodes of CUD, and use of greater amounts and dosages of cannabis [94••].

These gender-related differences may not extend to the medicinal use of cannabis. About 40% of chronic pain patients who sought legal qualification for medical cannabis to help manage their pain in Washington State were women, and nearly half of survey respondents who reported medical cannabis use to treat rheumatic condition symptoms were also women [95, 96]. An archival dataset of 629 people using medical cannabis seeking treatment for various conditions suggests that females consumed high-CBD products (mainly for pain management), and more frequently than males. Meanwhile, a greater proportion of males than females consumed cannabis products with a balanced (THC:CBD) ratio more frequently [97]. Moreover, a retrospective study of a database including 61,379 people seeking medical cannabis in the USA between 2018 and 2020 suggests that the patient population has evolved over time (compared to the results of a similar report in 2006 with only 27.1% of the 1746 patients being females [98]) to include more females, as 40% of the sample who reported gender/sex were female [94••]. An additional qualitative study of 23 people shows gender differences in how the health effects of medical cannabis are constructed and perceived. Specifically, women described their medical cannabis use as therapeutic self-care and an “endeavour to be self-sufficient” and men were less likely to explicitly frame medical cannabis as life-preserving [99].

Aspects of cannabis use among men compared to women are likely not solely due to biological underpinnings but also to social and cultural factors that limit exposure to cannabis and decrease the likelihood of frequent cannabis use in females. These factors for women may include social and cultural norms (such as the higher social stigma associated with females who use substances [100], greater perceptions of risk, lower cannabis use among peers, and greater child-care responsibilities [101]). Findings from qualitative studies show that cannabis may also be used in ways contrary to the cultural “dominant gender norms” (i.e. masculinity) as a way to revise gender norms [102]. Canadian and Norwegian

females who use cannabis have indicated that using cannabis is a demonstration of resisting dominant feminine ideals, leading them to be positioned and accepted as “one of the boys”, given that cannabis use is traditionally considered as a more masculine behaviour [92, 103].

Significant gender-related differences in methods of use also emerged during the last years in the USA, with more women reporting using edible (oral administration) cannabis compared to men. In contrast, men reported more frequently smoking cannabis using joints, blunts, vaporisers, and concentrates [94••]. Regarding cannabis purchase modes, a recent survey among Europeans who use cannabis showed that males often bought their own cannabis, while females preferred to obtain drugs through a friend who bought it for them with their money or to get it for free (aka “social supply”) [104••]. This reinforces gender-related differences in use attitudes toward modes of cannabis purchase—illegal direct buy vs indirect buy and free acquisition, with women potentially avoiding threats to personal safety and risks of physical violence [105].

Overall, findings suggest that gender-related differences in cannabis use may relate in part to social and cultural factors and differences in sociocultural experiences with cannabis. Existing evidence collectively highlights the complexity of how gender may be expressed through cannabis use and suggests its culturally specific, multi-faceted, and changing nature. It is also noteworthy that although pieces of evidence from trans and gender-diverse populations in the USA and Brazil show a significantly higher rate of cannabis use in these populations [106–108], there exists a general gap in evidence-based research on gender norms, roles, relations, and cannabis use in LGBTQ (lesbian, gay, bisexual, transgender, queer or questioning) populations and subcultures. Nevertheless, existing evidence indicates that in sexual minority groups—women, in particular—factors such as minority stress, particularly stigma, are associated with elevated cannabis use frequency as well as developing CUD symptoms [109••]. However, there is still limited evidence for the long-term prospective effects of sexual minority stress on cannabis use.

To summarise, multiple pieces of evidence suggest influences of individuals’ racial and ethnic backgrounds and their associated constructs (such as distinct parenting styles or cultural racism), as well as gender-related differences in cultural aspects of cannabis use and patterns. These findings highlight the importance of further investigations within minority groups and individuals with different gender identities using comparative cultural approaches.

Medicalisation of Cannabis

With the discovery of the endocannabinoid system [39], interest in therapeutic benefits and medicinal use of cannabis has increased, resulting in legislative, cultural, social,

and market changes related to cannabis use for medicinal purposes [13•]. Cannabis-based medical products can vary from purified single cannabinoid compounds (often THC or CBD) to plant extracts containing hundreds of cannabinoid molecules (most in minuscule quantities), with multiple formulations (e.g. oils, solutions, sublingual sprays, tablets, and capsules), with multiple delivery mechanisms (e.g. oral, nasal, rectal, and inhalation) [110]. Generally, cannabinoids have been used, often with limited evidence but in some cases with regulatory approval, for many health conditions: chronic pain, chemotherapy-induced nausea and vomiting, multiple sclerosis spasticity symptoms, and epilepsy, and with limited evidence for increasing appetite and decreasing weight loss associated with HIV/AIDS, Parkinson’s disease, Tourette syndrome, social anxiety disorders, symptoms of posttraumatic stress disorder, schizophrenia, cravings and anxiety for people with opioid use disorder, and following a traumatic brain injury or intracranial haemorrhage [111]. The three following beliefs are frequently repeated in public and policy debates on medical cannabis legalisation globally [111]. (I) Proponents of medical cannabis highlight the continuing emergence of largely anecdotal and scientific evidence that exhibits the potential therapeutic value of cannabinoids in treating multiple disease-related and mental health problems. (II) Opponents of medical cannabis highlight research that identifies harmful effects of recreational cannabis use, such as psychogenic effects, risks to mental health, and addiction. (III) The concern that medical cannabis legalisation may lead to increased recreational cannabis use and detrimental public health effects (so-called *spillover* effects) [112].

Another important consideration that should be considered given the emergence of prescribing cannabinoids medicinally is healthcare specialists’ attitudes and perspectives toward medical cannabis [113], and these should be considered across different nationalities and cultures. For instance, one cross-national study compared the attitudes of Maltese and Russian psychologists toward the therapeutic effects of medical cannabis for mental health issues and found a more positive attitude among Maltese relative to Russian psychologists [114••]. This finding may be explained in part by cross-cultural differences, the legal status of medical cannabis in Malta, the Russian policy of zero tolerance for the substance regardless of purpose, and prevailing drug policies in Russia [114]. A survey conducted among Russian medical students also reported zero support for cannabis legalisation for medical purposes among Russian medical professionals [115]. Another cross-national comparison study among American and Israeli social workers found that secular social workers, compared to religious ones, believed in more therapeutic benefits of cannabis for physical and mental health issues [116]. It is therefore suggested that medical cannabis popularity across countries can

potentially stem from possible cross-cultural differences in the attitudes of healthcare professionals toward cannabis.

With changing beliefs and attitudes toward the therapeutic effects of cannabis, which have partially contributed to the reconsideration of cannabis-related political and legal actions, researchers, clinicians, and policymakers have advocated for an evidence-based understanding of cannabis-related harms and making cannabis consumption safer [117]. Recently, the standard THC unit has been created to measure cannabis exposure universally, across cultures and cannabis types and modes of use, to help identify how much cannabis use constitutes “risky use” across multiple settings (e.g. research, clinical practice, public health and medicinal) [118••]. Important cross-regional and cross-cultural aspects have also been outlined to calibrate standard THC units based on cannabis potency, cannabinoid content, legal status, cultural customs, modes of administration, co-use of tobacco, and different labels for the same product, as well as inter-individual differences in bioavailability [119].

Cross-cultural Considerations for Future Work

Today, the use of cannabis, sometimes associated with strong cultural and traditional values and meanings, is widespread and diverse such that it does not constitute a sole culture globally. Cannabis use, whether for ritualistic, recreational, or medical purposes, may be conducted within socially and culturally organised contexts [10••]. Cannabis use and related factors, such as expectancies and mode of administration, may differ across genders, racial and ethnic groups, and geographical regions, with different cannabis-related “sub-cultures”. Research on cross-national differences in cannabis use is scarce. Nevertheless, it is often posited by findings from global surveys that cannabis liberalisation policies (including depenalisation, decriminalisation, and partial prohibition) may impact cannabis use prevalence and attitudes and, therefore, partially account for cross-national differences [65]. Importantly, evidence on cannabis use prevalence, sociocultural factors that may influence cannabis use patterns, and cross-national differences in cannabis use is often limited to so-called WEIRD (Western, educated, industrialised, rich, and democratic) countries. Therefore, more research is needed in other countries, particularly in African and Asian regions, regarding cultural aspects of cannabis use.

There have also been few attempts to link and integrate qualitative studies of cannabis cultures and symbolic meanings and narratives related to cannabis with evidence-based quantitative studies of cannabis-use expectancies and motivations. For instance, Prashad and colleagues proposed a novel integrative approach to understand how cultural factors

influence the neurobiology of CUD, including through a cultural neuroscience-informed lens [120••]. This approach suggests that cross-cultural differences in the manifestation of CUD may be driven by cultural differences that relate to specific neural mechanisms that may, in turn, impact psychopathological manifestations of cannabis use. This model provides a framework for how to identify cultural similarities and differences for a more precise understanding of intersections between culture and the neuroscience of cannabis use and CUD [120••].

An understanding of cross-cultural differences in cannabis use is important to develop and implement prevention and treatment strategies that target CUD. Cognitive behavioural and motivational enhancement therapies are the most common psychotherapeutic approaches for the treatment of CUD and have shown promising results [121]. However, these treatment approaches often do not consistently consider and incorporate cross-cultural differences into treatment protocols, potentially compromising their effectiveness [121]. Therefore, shortcomings related to cultural adaptations of existing psychosocial treatment strategies may result in suboptimal effectiveness of existing therapies in certain cultures, and consequently, may link to global health disparities [120, 122].

In addition, rapid changes in cannabis markets, such as emerging methods for purchasing cannabis via social media or *the Darknet* [123•], should be considered when exploring cannabis use from a sociocultural perspective. Legislative, cultural, and cannabis market changes intertwine with conflicts between advocates of cannabis use for medical and recreational purposes. The latter often maintains specific social and (sub)cultural meanings of cannabis use, while activists of the liberal use of cannabis for medical purposes often advocate for easier access to cannabis [10••]. Regulations governing cannabis supply markets have changed both for dark and surface webs. The expansion of the so-called emerging “big canna” industry and its sponsorship of social media influencers have also changed both the market and the cultural ideas associated with cannabis use [124]. For instance, a recent study investigated how cannabis-related content is portrayed on viral and publicly available social media videos (with over 756 million views and 143 million likes) from people using *TikTok*, a rising video-sharing platform popular among adolescents [125•]. Most videos were non-age-restricted and portrayed cannabis use positively or delivered pro-cannabis content through humour or entertainment [125•].

Overall, changes in cannabis-use cultures, such as legislative changes, may leverage consequent changes in perception and attitude toward cannabis through the potential neutralisation of perceived risks of cannabis use globally. Future research could usefully utilise cross-national and cross-cultural evidence-based approaches to help elucidate cultural and structural factors influencing cannabis use across different cultures.

Conclusions

This manuscript outlines a brief overview of the cultural aspects of cannabis use across different cultures, nations, genders, and racial groups, as well as historical and traditional background of cannabis use motives.

In conclusion, although cannabis may be one of the least stigmatised of illicit drugs globally, with cannabis currently undergoing global illicit designation changes and with increasingly emerging interconnected and multicultural societies, interactions between culture, public policy, and cannabis use should be better understood in order to guide global policies. Cross-cultural perspectives toward cannabis use may improve public health actions and mitigate health disparities. Much remains to be understood about the complex and bidirectional relationships between cannabis use and culture, and the question of whether culture shapes or contributes to different aspects of cannabis use or whether cannabis use could, by nature, form or influence distinctive subcultures, remains open. This topic would benefit from further exploration using a cross-cultural framework to study cannabis use and its consequences, particularly paying closer attention to countries and populations currently under-represented in research.

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Compliance with Ethical Standards

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References

Papers of particular interest, published recently, have been highlighted as:

● Of importance

●● Of major importance

1. U.N.O.D.C. World Drug Report 2022. 2022 Available from: www.unodc.org/unodc/en/data-and-analysis/world-drug-report-2022.html
2. Carliner H, Brown QL, Sarvet AL, Hasin DS. Cannabis use, attitudes, and legal status in the U.S.: a review. *Prev Med.* 2017;104:13–23.
3. European Monitoring Centre for Drugs and Drug Addiction. Publ Off. 2022; <https://doi.org/10.2810/75644>.
4. Areesantichai C, Perngparn U, Pilley C. Current cannabis-related situation in the Asia-Pacific region. *Curr Opin Psychiatry.* 2020;33(4):352–9.
5. Australian Institute of Health and Welfare. (2022). Illicit drug use. Retrieved from <https://www.aihw.gov.au/reports/illicit-use-of-drugs/illicit-drug-use>.
6. Chan GCK, Hall W. Estimation of the proportion of population cannabis consumption in Australia that is accounted for by daily users using Monte Carlo Simulation. *Addiction.* 2020;115:1182–6.
7. Kitchen C, Kabba JA, Fang Y. Status and impacts of recreational and medicinal cannabis policies in Africa: a systematic review and thematic analysis of published and “gray” literature. *Cannabis Cannabinoid Res.* 2022;7:239–61.
8. Minkov M, Hofstede G. Is national culture a meaningful concept?: cultural values delineate homogeneous national clusters of in-country regions. *Cross-Cult Res.* 2012;46:133–59.
9. Schwartz SH. Rethinking the concept and measurement of societal culture in light of empirical findings. *J Cross-Cult Psychol.* 2014;45:5–13.
10. ●● Wanke M, Sandberg S, Macit R, Gülerce H. Culture matters! Changes in the global landscape of cannabis. *Drugs Educ Prev Policy.* 2022;29:317–22. **This paper presents a global perspective of the importance of culture in cannabis use experience and practices, involving institutions and researchers from Turkey, Norway, Poland, and Portugal – —countries where liberalisation of markets and cultural appropriation of cannabis are at very different stages.**
11. Steppan M, Kraus L, Piontek D, Siciliano V. Are cannabis prevalence estimates comparable across countries and regions? A cross-cultural validation using search engine query data. *Int J Drug Policy.* 2013;24:23–9.
12. Patrick ME, Schulenberg JE, O'malley PM, Johnston LD, Bachman JG. Adolescents' reported reasons for alcohol and marijuana use as predictors of substance use and problems in adulthood. *J Stud Alcohol Drugs.* 2011;72:106–16.
13. ● Khalsa JH, Bunt G, Blum K. Review: Cannabinoids as medicinals. In: *Current addiction reports.* <https://doi.org/10.1007/s40429-022-00438-3>. **A review paper thoroughly discussing existing clinical evidence in the past 30 years on cannabinoids' medical use.**
14. Lafaye G, Karila L, Blecha L, Benyamina A. Cannabis, cannabinoids, and health. *Dialogues Clin Neurosci.* 2017;19:309–16.
15. Kroon E, Kuhns L, Hoch E, Cousijn J. Heavy cannabis use, dependence and the brain: a clinical perspective. *Addiction.* 2020;115:559–72.
16. Figueiredo PR, Tolomeo S, Steele JD, Baldacchino A. Neurocognitive consequences of chronic cannabis use: a systematic review and meta-analysis. *Neurosci Biobehav Rev.* 2020;108:358–69.

17. ● Han B, Compton WM, Einstein EB, Volkow ND. Associations of suicidality trends with cannabis use as a function of sex and depression status. *JAMA Netw Open*. 2021;4:e2113025. **This study used a large-scale dataset (National Survey of Drug Use and Health Data) with 281,650 adults, investigating the potential association between cannabis use and risk of suicidality. Findings show an increased risk of past-year suicidal ideation, particularly in women with cannabis use disorder.**
18. Gobbi G, Atkin T, Zytynski T, Wang S, Askari S, Boruff J, et al. Association of cannabis use in adolescence and risk of depression, anxiety, and suicidality in young adulthood: a systematic review and meta-analysis. *JAMA Psychiatry*. 2019;76:426.
19. Jett J, Stone E, Warren G, Cummings KM. Cannabis use, lung cancer, and related issues. *J Thorac Oncol*. 2018;13:480–7.
20. Campeny E, López-Pelayo H, Nutt D, Blithikioti C, Oliveras C, Nuño L, et al. The blind men and the elephant: systematic review of systematic reviews of cannabis use related health harms. *Eur Neuropsychopharmacol*. 2020;33:1–35.
21. Lovell ME, Akhurst J, Padgett C, Garry MI, Matthews A. Cognitive outcomes associated with long-term, regular, recreational cannabis use in adults: a meta-analysis. *Exp Clin Psychopharmacol*. 2020;28:471–94.
22. Dahlgren MK, Sagar KA, Smith RT, Lambros AM, Kuppe MK, Gruber SA. Recreational cannabis use impairs driving performance in the absence of acute intoxication. *Drug Alcohol Depend*. 2020;208:107771.
23. Budney AJ, Sofis MJ, Borodovsky JT. An update on cannabis use disorder with comment on the impact of policy related to therapeutic and recreational cannabis use. *Eur Arch Psychiatry Clin Neurosci*. 2019;269:73–86.
24. ● Leung J, Chan G, Hides L, Hall WD. What is the prevalence and risk of cannabis use disorders among people who use cannabis? A systematic review and meta-analysis. *Addict Behav*. 2020;109:106479. **A systematic review and meta-analysis of epidemiological cross-sectional and longitudinal studies published between 2009 and – 2019, investigating the risk of developing cannabis use disorder in cannabis user cohorts.**
25. Sciences NA, Engineering M. The Health effects of cannabis and cannabinoids: the current state of evidence and recommendations for research. Washington, DC: The National Academies Press; 2017. <https://doi.org/10.17226/24625>.
26. Freeman TP, Hindocha C, Baio G, Shaban N, Thomas EM, Astbury D, et al. Cannabidiol for the treatment of cannabis use disorder: a phase 2a, double-blind, placebo-controlled, randomised, adaptive Bayesian trial. *Lancet Psychiatry*. 2020;7:865–74.
27. Sholler DJ, Schoene L, Spindle TR. Therapeutic efficacy of cannabidiol (CBD): a review of the evidence from clinical trials and human laboratory studies. *Curr Addict Rep*. 2020;7:405–12.
28. Holm S, Sandberg S, Kolind T, Hesse M. The importance of cannabis culture in young adult cannabis use. *J Subst Use*. 2014;19:251–6.
29. Hall W, Hoch E, Lorenzetti V. Cannabis use and mental health: risks and benefits. *Eur Arch Psychiatry Clin Neurosci*. 2019;269:1–3.
30. Purnell L. The Purnell model for cultural competence. *J Transcult Nurs*. 2002;13:193–6.
31. Purnell L, Foster J. Cultural aspects of alcohol use (Part 1). *Drugs Alcohol Today*. 2003;3:3–8.
32. Crocq M-A. History of cannabis and the endocannabinoid system. *Dialogues Clin Neurosci*. 2020;22:223–8.
33. Narouze SN, editor. *Cannabinoids and pain*. Springer International Publishing; 2021. <https://doi.org/10.1007/978-3-030-69186-8>.
34. Russo E. History of cannabis and its preparations in saga, science, and sobriquet. *Chem Biodivers*. 2007;4:1614–48.
35. On the Preparations of the Indian Hemp. or Gunjah (Cannabis Indica), Their Effects on the Animal System in Health, and Their Utility in the Treatment of Tetanus and Other Convulsive Diseases. *Br Foreign Med Rev*. 1840;10:225–8.
36. Grinspoon L. *Marihuana reconsidered*. Harvard University Press; 1971.
37. Musto DF. The Marihuana Tax Act of 1937. *Arch Gen Psychiatry*. 1972;26:101.
38. Lande A. The Single Convention on Narcotic Drugs, 1961. *Int Organ*. 1962;16:776–97.
39. Devane WA, Hanuš L, Breuer A, Pertwee RG, Stevenson LA, Griffin G, et al. Isolation and structure of a brain constituent that binds to the cannabinoid receptor. *Science*. 1992;258:1946–9.
40. Ortiz NR, Preuss CV. *Controlled Substance Act*. StatPearls. Treasure Island (FL): StatPearls Publishing; 2022. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK574544/>, [cited 2023 Mar 14]
41. Room R, editor. *Cannabis policy: moving beyond stalemate*. 1st ed. Oxford [England]; New York: Oxford University Press; 2010.
42. de Quadros RR. “Drugs paradise”: Dutch stereotypes and substance regulation in European collaborations on drug policies in the 1970s. *Contemp Drug Probl*. 2019;46:219–40.
43. Booth M. *Cannabis: a history*. 1st U.S. ed. New York: Thomas Dunne Books/St. Martin’s Press; 2004.
44. Carrier N, Klantschnig G. Quasilegality: khat, cannabis and Africa’s drug laws. *Third World Q*. 2018;39:350–65.
45. Baker R. The case for medical marijuana: vote yes on Proposition 215. *BETA Bull Exp Treat AIDS Publ San Franc AIDS Found*. 1996;5(54):58.
46. Yu B, Chen X, Chen X. Marijuana legalization and historical trends in marijuana use among US residents aged 12–25: results from the 1979–2016 National Survey on drug use and health. *BMC Public Health*. 2020;20:156.
47. Room R. Legalising a market for cannabis. *Addiction*. 2014;109:345–51.
48. Rehm J, Manthey J. Cannabis and public health: a global experiment without control. *World Psychiatry*. 2020;19:192.
49. ● Rivera-Aguirre A, Castillo-Carniglia A, Laqueur HS, Rudolph KE, Martins SS, Ramírez J. Does recreational cannabis legalization change cannabis use patterns? Evidence from secondary school students in Uruguay. *Addiction*. 2022;117:2866–77. **A large-scale study among secondary students in Uruguay and Chile showed no increase in the frequency of cannabis use after cannabis legalisation in these countries.**
50. NIDA. 2022, August 22. Marijuana and hallucinogen use among young adults reached all time-high in 2021. Retrieved from <https://nida.nih.gov/news-events/news-releases/2022/08/marijuana-and-hallucinogen-use-among-young-adults-reached-all-time-high-in-2021> on 2023, March 15.
51. Farhoudian A, Radfar SR, Mohaddes Ardabili H, Rafei P, Ebrahimi M, Khojasteh Zonoozi A, et al. A Global Survey on Changes in the Supply, Price, and Use of Illicit Drugs and Alcohol, and Related Complications During the 2020 COVID-19 Pandemic. *Front Psychiatry*. 2021;12:646206. <https://doi.org/10.3389/fpsy.2021.646206>.
52. Chong WW, Acar ZI, West ML, Wong F. A scoping review on the medical and recreational use of cannabis during the COVID-19 pandemic. *Cannabis Cannabinoid Res*. 2022;7(5):591–602.
53. ElSohly MA, Mehmmed Z, Foster S, Gon C, Chandra S, Church JC. Changes in cannabis potency over the last 2 decades (1995–2014): analysis of current data in the United States. *Biol Psychiatry*. 2016;79:613–9.
54. Freeman TP, Groshkova T, Cunningham A, Sedefov R, Griffiths P, Lynskey MT. Increasing potency and price of cannabis in Europe, 2006–16. *Addiction*. 2019;114:1015–23.

55. ●● Petrilli K, Ofori S, Hines L, Taylor G, Adams S, Freeman TP. Association of cannabis potency with mental ill health and addiction: a systematic review. *Lancet Psychiatry*. Elsevier. 2022;9:736–50. **A recent systematic review comparing the association of high-potency cannabis (products with a higher concentration of THC) and low-potency cannabis (products with a lower concentration of THC) with psychiatric disorders.**
56. Bogt T, Schmid H, Nic Gabhainn S, Fotiou A, Vollebergh W. Economic and cultural correlates of cannabis use among mid-adolescents in 31 countries. *Addiction*. 2006;101:241–51.
57. Pedersen W. Cannabis use: subcultural opposition or social marginality?: a population-based longitudinal study. *Acta Sociol*. 2009;52:135–48.
58. Sandberg S. Cannabis culture: a stable subculture in a changing world. *Criminol Crim Justice*. 2013;13:63–79.
59. Golub A, Johnson BD, Dunlap E. Subcultural evolution and illicit drug use. *Addict Res Theory*. 2005;13:217–29.
60. Ekendahl M, Karlsson P. Comparisons in the making: youth accounts of cannabis use in Swedish addiction treatment. *Drugs Educ Prev Policy*. 2022;29:364–72.
61. Torre-Luque A, Ozeylem F, Essau CA. Prevalence of addictive behaviours among adolescents from 73 low-and middle-income countries. *Addict Behav Rep*. 2021;14:100387.
62. Cerdá M, Moffitt TE, Meier MH, Harrington H, Houts R, Ramrakha S, et al. Persistent cannabis dependence and alcohol dependence represent risks for midlife economic and social problems: a longitudinal cohort Study. *Clin Psychol Sci*. 2016;4:1028–46.
63. Boden JM, Dhakal B, Foulds JA, Horwood LJ. Life-course trajectories of cannabis use: a latent class analysis of a New Zealand birth cohort. *Addiction*. 2020;115:279–90.
64. Grucza RA, Agrawal A, Krauss MJ, Cavazos-Rehg PA, Bierut LJ. Recent trends in the prevalence of marijuana use and associated disorders in the United States. *JAMA Psychiatry*. 2016;73:300.
65. Shi Y, Lenzi M, An R. Cannabis liberalization and adolescent cannabis use: a cross-national study in 38 countries. *Plos One*. 2015;10:0143562.
66. Hall W, Stjepanović D, Caulkins J, Lynskey M, Leung J, Campbell G, et al. Public health implications of legalising the production and sale of cannabis for medicinal and recreational use. *The Lancet*. 2019;394:1580–90.
67. Cerdá M, Mauro C, Hamilton A, Levy NS, Santaella-Tenorio J, Hasin D, et al. Association between recreational marijuana legalization in the United States and changes in marijuana use and cannabis use disorder from 2008 to 2016. *JAMA Psychiat*. 2020;77:165–71.
68. Zellers SM, Ross JM, Saunders GRB, Ellingson JM, Anderson JE, Corley RP, et al. Impacts of recreational cannabis legalization on cannabis use: a longitudinal discordant twin study. *Addiction*. 2023;118:110–8.
69. ●● McBain RK, Wong EC, Breslau J, Shearer AL, Cefalu MS, Roth E, et al. State medical marijuana laws, cannabis use and cannabis use disorder among adults with elevated psychological distress. *Drug Alcohol Depend*. 2020;215:108191. <https://doi.org/10.1016/j.drugalcdep.2020.108191>. **Data from 314,187 adolescents living in 73 low- and middle-income countries who participated in the Global School-based Student Health Survey (GSHS) suggest the significant role of economic wealth, religion, and geographical factors on the prevalence of substance use in adolescents s living in these countries.**
70. Harper S, Strumpf EC, Kaufman JS. Do medical marijuana laws increase marijuana use? Replication study and extension. *Ann Epidemiol*. 2012;22:207–12.
71. ●● Gabri AC, Galanti MR, Orsini N, Magnusson C. Changes in cannabis policy and prevalence of recreational cannabis use among adolescents and young adults in Europe-An interrupted time-series analysis. *PloS One*. 2022;17:0261885. **A recent study using large-scale datasets exploring the changes in cannabis legislation influences on recreational cannabis use in 11 European countries.**
72. Han BH, Funk-White M, Ko R, Al-Rousan T, Palamar JJ. Decreasing perceived risk associated with regular cannabis use among older adults in the United States from 2015 to 2019. *J Am Geriatr Soc*. 2021;69:2591–7.
73. Wen H, Hockenberry JM, Druss BG. The effect of medical marijuana laws on marijuana-related attitude and perception among US adolescents and young adults. *Prev Sci*. 2019;20:215–23.
74. Salloum NC, Krauss MJ, Agrawal A, Bierut LJ, Grucza RA. A reciprocal effects analysis of cannabis use and perceptions of risk. *Addict Abingdon Engl*. 2018;113:1077–85.
75. Reid M. A qualitative review of cannabis stigmas at the twilight of prohibition. *J Cannabis Res*. 2020;2:46.
76. Ugwu UT, Dumbili EW. Inhaling thick smoke: cannabis subculture, community forming and socio-structural challenges in Nigeria. *Drugs Educ Prev Policy*. 2022;29:345–54.
77. Adinoff B, Reiman A. Implementing social justice in the transition from illicit to legal cannabis. *Am J Drug Alcohol Abuse*. 2019;45:673–88.
78. Wheeldon J, Heidt J. Cannabis criminology: inequality, coercion, and illusions of reform, *Drugs: Education. Prev Policy*. 2022;29:426–38.
79. Montgomery L, Dixon S, Mantey DS. Racial and ethnic differences in cannabis use and cannabis use disorder: implications for researchers. *Curr Addict Rep*. 2022;9:14–22.
80. Mariani AC, Williams AR. Perceived risk of harm from monthly cannabis use among US adolescents: National Survey on Drug Use and Health, 2017. *Prev Med Rep*. 2021;23:101436.
81. Shmulewitz D, Brown Q, Rahim-Juwel R, Martins SS, Wall MM, Mauro PM, et al. US trends in past-year marijuana use and perceived risk of regular use, 2002–2013, by race/ethnicity. *Drug Alcohol Depend*. 2017;171:e190. <https://doi.org/10.1016/j.drugalcdep.2016.08.520>.
82. Wu L-T, Swartz MS, Brady KT, Hoyle RH. Perceived cannabis use norms and cannabis use among adolescents in the United States. *J Psychiatr Res*. 2015;64:79–87.
83. ●● Lee MH, Kim-Godwin YS, Hur H. Race/ethnicity differences in risk and protective factors for marijuana use among US adolescents. *BMC Public Health*. 2021;21(1):1–0. <https://doi.org/10.1186/s12889-02>. **This study used a large-scale dataset of 68,263 adolescents (National Survey of Drug Use and Health Data) to examine the risk and protective factors of race and ethnicity on cannabis use. They found that among 7 ethnic subgroups, Native American adolescents had the highest past-month, past-year, and lifetime cannabis use. They discuss the influence of parenting styles and peer and community involvement in different ethnic groups as potential risk and protective factors of cannabis use.**
84. Steinberg L, Blatt-Eisengart I, Cauffman E. Patterns of competence and adjustment among adolescents from authoritative, authoritarian, indulgent, and neglectful homes: a replication in a sample of serious juvenile offenders. *J Res Adolesc*. 2006;16:47–58.
85. Merianos AL, King KA, Vidourek RA, Becker KJ, Yockey RA. Authoritative parenting behaviors and marijuana use based on age among a national sample of Hispanic adolescents. *J Prim Prev*. 2020;41:51–69.
86. Calafat A, García F, Juan M, Becoña E, Fernández-Hermida JR. Which parenting style is more protective against adolescent substance use? Evidence within the European context. *Drug Alcohol Depend*. 2014;138:185–92.
87. García F, Gracia E. The indulgent parenting style and developmental outcomes in South European and Latin American

- countries. In: Selin H, editor. *Sci Cult Hist Non-West Sci*. Dordrecht: Springer; 2014. p. 7. https://doi.org/10.1007/978-94-007-7503-9_31.
88. Keyes KM, Wall M, Feng T, Cerdá M, Hasin DS. Race/ethnicity and marijuana use in the United States: diminishing differences in the prevalence of use, 2006–2015. *Drug Alcohol Depend*. 2017;179:379–86.
 89. Shih RA, Tucker JS, Pedersen ER, Seelam R, Dunbar MS, Kofner A, et al. Density of medical and recreational cannabis outlets: racial/ethnic differences in the associations with young adult intentions to use cannabis, e-cigarettes, and cannabis mixed with tobacco/nicotine. *J Cannabis Res*. 2021;3:28.
 90. Dogan JN, Thrasher S, Thorpe SY, Hargons C, Stevens-Watkins D. Cultural race-related stress and cannabis use among incarcerated African American men. *Psychol Addict Behav J Soc Psychol Addict Behav*. 2021;35:320–5.
 91. Zapolski TCB, Yu T, Brody GH, Banks DE, Barton AW. Why now? Examining antecedents for substance use initiation among African American adolescents. *Dev Psychopathol*. 2020;32:719–34.
 92. Hemsing N, Greaves L. Gender norms, roles and relations and cannabis-use patterns: a scoping review. *Int J Environ Res Public Health*. 2020;17:947.
 93. McHugh RK, Votaw VR, Sugarman DE, Greenfield SF. Sex and gender differences in substance use disorders. *Clin Psychol Rev*. 2018;66:12–23.
 - 94.●● Cuttler C, Mischley LK, Sexton M. Sex differences in cannabis use and effects: a cross-sectional survey of cannabis users. *Cannabis Cannabinoid Res*. 2016;1:166–75. **This online survey investigated sex differences in cannabis use patterns and experiences in a large sample. (n=2374). Short-term and withdrawal effects of cannabis use were also compared between men and women.**
 95. Ste-Marie PA, Shir Y, Rampakakis E, Sampalis JS, Karellis A, Cohen M, et al. Survey of herbal cannabis (marijuana) use in rheumatology clinic attenders with a rheumatologist confirmed diagnosis. *Pain*. 2016;157:2792–7.
 96. Aggarwal SK, Carter GT, Sullivan MD, ZumBrunnen C, et al. Characteristics of patients with chronic pain accessing treatment with medical cannabis in Washington State. *J Opioid Manag*. 2018;5:257.
 97. Kalaba M, Ware MA. Cannabinoid profiles in medical cannabis users: effects of age, gender, symptoms, and duration of use. *Cannabis Cannabinoid Res*. 2022;7:840–51.
 98. Mahabir VK, Merchant JJ, Smith C, Garibaldi A. Medical cannabis use in the United States: a retrospective database study. *J Cannabis Res*. 2020;2:32.
 99. Bottorff JL, Bissell LJJ, Balneaves LG, Oliffe JL, Kang HBK, Capler NR, et al. Health effects of using cannabis for therapeutic purposes: a gender analysis of users' perspectives. *Subst Use Misuse*. 2011;46:769–80.
 100. Hathaway AD, Comeau NC, Erickson PG. Cannabis normalization and stigma: contemporary practices of moral regulation. *Criminol Crim Justice*. 2011;11:451–69.
 101. Cooper ZD, Craft RM. Sex-dependent effects of cannabis and cannabinoids: a translational perspective. *Neuropsychopharmacology*. 2018;43:34–51.
 102. Haines RJ, Johnson JL, Carter CI, Arora K. "I couldn't say, I'm not a girl"—adolescents talk about gender and marijuana use. *Soc Sci Med*. 2009;68(11):2029–36. <https://doi.org/10.1016/j.socscimed.2009.03.003>.
 103. Dahl SL, Sandberg S. Female cannabis users and new masculinities: the gendering of cannabis use. *Sociology*. 2015;49:696–711.
 - 104.●● Skliamis K, Korf DJ. How cannabis users obtain and purchase cannabis: a comparison of cannabis users from European countries with different cannabis policies. *Subst Use Misuse*. 2022;57:1043–51. **A recent survey conducted in seven European countries depicted different cannabis purchase patterns across countries. They showed that buying cannabis online is emerging in these countries.**
 105. Bennett T, Holloway K. How do students source and supply drugs? Characteristics of the university illegal drug trade. *Subst Use Misuse*. 2019;54:1530–40.
 106. Hughto JMW, Quinn EK, Dunbar MS, Rose AJ, Shireman TI, Jasuja GK. Prevalence and co-occurrence of alcohol, nicotine, and other substance use disorder diagnoses among US transgender and cisgender adults. *JAMA Netw Open*. 2021;4. <https://doi.org/10.1001/jamanetworkopen.2020.36512>.
 107. Day JK, Fish JN, Perez-Brumer A, Hatzenbuehler ML, Russell ST. Transgender youth substance use disparities: results from a population-based sample. *J Adolesc Health*. 2017;61(6):729–35.
 108. Fontanari A, Pase PF, Churchill S, Soll B, Schwarz K, Schneider MA, et al. Dealing with gender-related and general stress: substance use among Brazilian transgender youth. *Addict Behav Rep*. 2019;9:100166. <https://doi.org/10.1016/j.abrep.2019.100166>.
 - 109.●● Dyar C. A review of disparities in cannabis use and cannabis use disorder affecting sexual and gender minority populations and evidence for contributing factors. *Curr Addict Rep*. 2022; <https://doi.org/10.1007/s40429-022-00452-5>. **A recently published review paper highlights sexual and gender disparities as risk factors for cannabis use.**
 110. Schlag AK, O'Sullivan SE, Zafar RR, Nutt DJ. Current controversies in medical cannabis: recent developments in human clinical applications and potential therapeutics. *Neuropharmacology*. 2021;191:108586. <https://doi.org/10.1016/j.neuropharm.2021.108586>.
 111. Schlag AK, Baldwin DS, Barnes M, Bazire S, Coathup R, Curran HV, et al. Medical cannabis in the UK: from principle to practice. *J Psychopharmacol (Oxf)*. 2020;34:931–7.
 112. Sznitman SR, Bretteville-Jensen AL. Public opinion and medical cannabis policies: examining the role of underlying beliefs and national medical cannabis policies. *Harm Reduct J*. 2015;12:46.
 113. Potenza MN, Bunt G, Khalsa JH. Addiction medicine physicians and medicinal cannabinoids. *JAMA Psychiatry*. 2023. <https://doi.org/10.1001/jamapsychiatry.2023.0731>.
 - 114.● Clark M, Gritsenko V, Bonnici JS. Psychology student attitudes and beliefs toward cannabis for mental health purposes: a cross national comparison. *Int J Ment Health Addict*. 2021;19:1866–74. **This study compares the attitudes and beliefs toward medical cannabis among psychology students at universities in Malta and Russia. Results show significant differences between these cohorts, possibly in light of different legal atmospheres for medical cannabis in Malta and Russia.**
 115. Gritsenko V, Konstantinov V, Reznik A, Isralowitz R. Russian Federation medical student knowledge, attitudes and beliefs toward medical cannabis. *Complement Ther Med*. 2020;48:102274.
 116. Findley PA, Edelstein OE, Pruginin I, Reznik A, Milano N, Isralowitz R. Attitudes and beliefs about medical cannabis among social work students: cross-national comparison. *Complement Ther Med*. 2021;58:102716.
 117. Englund A, Freeman TP, Murray RM, McGuire P. Can we make cannabis safer? *Lancet Psychiatry*. 2017;4:643–8.
 - 118.●● Lorenzetti V, Hindocha C, Petrilli K, Griffiths P, Brown J, Castillo-Carniglia Á, et al. The International Cannabis Toolkit (iCannToolkit): a multidisciplinary expert consensus on minimum standards for measuring cannabis use. *Addiction*. 2022;117:1510–7. **A recent Delphi consensus-based framework suggests a standardised dose of THC (5 mg = 1 standard THC unit) globally in diverse research and clinic settings.**

119. Kuhns L, Kroon E. The need to calibrate standardized cannabis measurements across cultures. *Addiction*. 2022;117:1518–9.
- 120.●● Prashad S, Milligan AL, Cousijn J, Filbey FM. Cross-cultural effects of cannabis use disorder: evidence to support a cultural neuroscience approach. *Curr Addict Rep*. 2017;4:100–9. **This paper proposes a conceptual model for interactions between culture, neural mechanisms, diagnoses and treatments, and genetics in cannabis use disorder, highlighting the need to incorporate cultural considerations into cannabis research.**
121. Sherman BJ, McRae-Clark AL. Treatment of cannabis use disorder: current science and future outlook. *Pharmacother J Hum Pharmacol Drug Ther*. 2016;36:511–35.
122. Lee JO, Lee WJ, Kritikos AF, Jin H, Leventhal AM, Pedersen ER, et al. Regular cannabis use during the first year of the pandemic: studying trajectories rather than prevalence. *Am J Prev Med*. 2023;64(6):888–92.
- 123.● Jardine E, Lindner AM. The Dark Web and cannabis use in the United States: evidence from a big data research design. *Int J Drug Policy*. 2020;76:102627. **A longitudinal study showing the relationship between the interest in the dark web and increased cannabis use among adults in the USA. No such association was found in younger adults.**
124. Jenkins MC, Kelly L, Binger K, Moreno MA. Cyber-ethnography of cannabis marketing on social media. *Subst Abuse Treat Prev Policy*. 2021;16:35.
- 125.● Rutherford BN, Sun T, Johnson B, Co S, Lim TL, Lim CCW, et al. Getting high for likes: exploring cannabis-related content on TikTok. *Drug Alcohol Rev*. 2022;41:1119–25. **This recent study used a sentiment and thematic data analysis on cannabis-related content presented in viral videos on TikTok. They found that these highly viewed videos portrayed cannabis use positively, potentially influencing cannabis use among adolescents who use TikTok.**

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