



cannabis use.

The health and social effects of nonmedical cannabis use

Technical brief



World Health
Organization

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This publication is an update of the document published in 2016 entitled “The health and social effects of nonmedical cannabis use”.

ISBN 978-92-4-012327-4 (electronic version)

ISBN 978-92-4-012328-1 (print version)

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Cataloguing-in-Publication (CIP) data. CIP data are available at <https://iris.who.int/>.

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Acknowledgements

This technical brief is based on, and can be considered as an update to, the WHO publication *The health and social effects of nonmedical use of cannabis* (1). The development of the technical brief was managed by the Alcohol, Drugs and Addictive Behaviours (ADA) team in the Department of Noncommunicable Diseases (NCD) and Mental Health of the World Health Organization (WHO), Geneva, Switzerland, under the overall guidance of Devora Kestel.

The WHO staff coordinating the production of this document were Anja Busse, Dzmitry Krupchanka, Vladimir Poznyak and Dag Rekve.

WHO wishes to acknowledge particular contributions of the following persons: Wayne Hall, National Centre for Youth Substance Use Research, University of Queensland, Australia, for preparing the draft and performing the scientific editing of the technical brief; Eva Hoch, Charlotte Fresenius University, Institut für Therapieforschung, and Clinic of Ludwig-Maximilian University, Munich, Germany, for preparing background papers to inform the development of the document, preparing the draft and performing further the scientific editing of the technical brief; Marilyn Huestis, Institute of Emerging Health Professions, Thomas Jefferson University, United States of America (USA), for preparing a background paper to inform the development of the technical brief; Susan Weiss, National Institute on Drug Abuse (NIDA), USA, and Janni Leung, National Centre for Youth Substance Use Research, University of Queensland, Australia, for assistance with an update of the document sections; David Jernigan, School of Public Health, Boston University, USA, for preparing a background paper to inform the development of the document; Jason Connor and Daniel Stjepanović of the National Centre for Youth Substance Use Research, University of Queensland, for preparing the background paper and updating sections of the brief; Abhishek Ghosh of the Postgraduate Institute of Medical Education & Research, Chandigarh, India, for updating the references used in the draft technical brief; and Sarah Yeates of the National Centre for Youth Substance Use Research, University of Queensland, Australia, for formatting and proofreading a draft of the report.

Jason White (School of Pharmacy and Medical Sciences, University of South Australia) and Anju Dhawan (National Drug Dependence Treatment Centre, All India Institute of Medical Sciences, New Delhi) conducted a technical review of an earlier draft of the document.

The report benefited from inputs from the WHO colleagues who participated in the WHO meeting on public health responses to public health risks associated with cannabis use and cannabis use disorders (Geneva, 18–20 December 2019): Natacha Carragher, Alexandra Fleischmann, Jiang Long (ADA with Mental Health and Substance Use [MSD]); Gilles Forte of the former WHO Department of Essential Medicines and Health Products (EMP); Ana Carina Jorge dos Santos Ferreira Borges Bigot of the WHO Regional Office for Europe; Maristela Goldnadel Monteiro of the WHO Regional Office for the Americas; Khalid Saeed of the WHO Regional Office for the Eastern Mediterranean and Martin Vandendyck of the WHO Regional Office for the Western Pacific. The report furthermore benefited from technical inputs from WHO headquarters colleagues Antons Mozalevskis and Annette Verster. The following colleagues from the WHO regional offices who provided technical input at different stages of the document development were: Florence Baingana

and Chido Ratidzai Rwafa-Madzvamutse (WHO African Region), Renato Oliveira e Souza and Mario Zapata (WHO Region of the Americas/Pan American Health Organization), Maria Neufeld (WHO European Region) and Andrea Bruni (WHO South-East Asia Region).

Marlene Babl (Charlotte Fresenius University, Munich), Ayşe Bilir (Institut für Therapieforschung, Munich) and Abhishek Ghosh (Postgraduate Institute of Medical Education & Research, Chandigarh, India) provided support for background literature reviews. Maria Renström assisted with editing and structuring the report. Samantha Colledge-Frisby (National Drug Research Institute, Curtin University, Australia) ensured reference management and provided technical inputs.

David Bramley edited the report. Administrative support throughout the project was provided by Divina Maramba, Paule Pillard, Azzeddine Tarif and Hana Amor-Creste.

WHO gratefully acknowledges the financial and organizational support provided to this project by the Ministry of Health and Social Affairs, Norway, the United Nations Office on Drugs and Crime (UNODC) and the Ministry of Health, Luxembourg.

This publication contains the collective views and contributions of an international group of experts and does not necessarily represent the decisions or the stated policy of WHO.

Abbreviations and acronyms

CBD	Cannabidiol
CI	Confidence interval
ICD-11	International statistical classification of diseases and related health problems, 11th revision
OR	Odds ratio
THC	Δ^9 -tetrahydrocannabinol
UN	United Nations
UNODC	United Nations Office on Drugs and Crime
USA	United States of America
WHO	World Health Organization

Terminology

- **Cannabis** is the collective term for a range of psychoactive preparations of the cannabis plant *Cannabis sativa* and related species and hybrids. In this report “cannabis” is used instead of “marijuana” or other names indigenous to local cultures.
- Cannabis plants contain **cannabinoids**, a class of diverse chemical compounds that act on endogenous cannabinoid receptors that modulate neurotransmitter release in the brain. The principal psychoactive cannabinoid is δ -9-tetrahydrocannabinol (THC).
- Cannabis is **typically smoked** in the form of the flowering heads or leaves of the cannabis plant; often mixed with tobacco. Cannabis oils are prepared from these same sources and vary considerably in their THC potency. Cannabis has predominantly central nervous system depressant effects and produces a characteristic euphoria. This may be one of the presenting features of cannabis intoxication, along with impairment in cognitive and psychomotor functioning.
- **Cannabinoids:** Cannabinoids are derived from three sources: (a) **phytocannabinoids** are cannabinoid compounds produced by plants *Cannabis sativa* or *Cannabis indica*; (b) **endocannabinoids** are neurotransmitters produced in the brain or in peripheral tissues and act on cannabinoid receptors; and (c) **synthetic cannabinoids**, synthesized in the laboratory, are structurally analogous to phytocannabinoids or endocannabinoids and act through similar biological mechanisms.
 - **Cannabidiol (CBD)** is a component of cannabis plants that does not produce an intoxicating effect.
 - **Tetrahydrocannabinol** or δ -9 **tetrahydrocannabinol (THC)** is the major psychoactive constituent of cannabis that is primarily responsible for the psychoactive effects.
- **Cannabis use:** consumption of cannabis, whether orally or by any other means, regardless of its controlled status, indication or reason for use.
 - **Nonmedical cannabis use** refers to self-administered use that is not for medical purposes and not used under the supervision of a prescribing physician in accordance with specific indications and treatment regimens.
 - **Medical cannabis use** refers to use of cannabis under the medical supervision of a treating physician in accordance with the specific indications and treatment regimens in jurisdictions where it is permitted to be used as a medication.

- **Disorders due to use of cannabis:** disorders due to use of cannabis are characterized by the pattern and consequences of cannabis use. There follows a list of specific diagnostic categories that apply to cannabis according to the *International Classification of Diseases and Related Health Problems, 11th Revision (ICD-11)*:
 - **Episode of harmful use of cannabis:** an episode of the use of cannabis that has caused damage to a person’s physical or mental health or has resulted in behaviour leading to harm to the health of others. Harm to health of the individual occurs due to one or more of the following: (a) behaviour related to intoxication; (b) direct or secondary toxic effects on body organs and systems; or (c) a harmful route of administration. Harm to health of others includes any form of physical harm, including trauma, or mental disorder that is directly attributable to behaviour due to cannabis intoxication on the part of the person to whom the diagnosis of single episode of harmful use applies.
 - **Harmful pattern of use of cannabis:** a pattern of cannabis use that has caused damage to a person’s physical or mental health or has resulted in behaviour leading to harm to the health of others. The pattern of cannabis use is evident over a period of at least 12 months if substance use is episodic or at least one month if use is continuous (i.e. daily or almost daily). Harm to health of the individual occurs due to one or more of the following: (a) behaviour related to intoxication; (b) direct or secondary toxic effects on body organs and systems; or (c) a harmful route of administration. Harm to health of others includes any form of physical harm, including trauma, or mental disorder that is directly attributable to behaviour related to cannabis intoxication on the part of the person to whom the diagnosis of “harmful pattern of use of cannabis” applies.
 - **Cannabis dependence:** a disorder of regulation of cannabis use arising from repeated or continuous use of cannabis. The characteristic feature is a strong internal drive to use cannabis, which is manifested by impaired ability to control use, increasing priority given to cannabis use over other activities and persistence of use despite harm or negative consequences. These experiences are often accompanied by a subjective sensation of urge or craving to use cannabis. Physiological features of dependence may also be present, including tolerance to the effects of cannabis, withdrawal symptoms following cessation or reduction in use of cannabis, or repeated use of cannabis or pharmacologically similar substances to prevent or alleviate withdrawal symptoms. The features of dependence are usually evident over a period of at least 12 months but the diagnosis may be made if cannabis use is continuous (daily or almost daily) for at least 3 months.
 - **Cannabis intoxication:** a clinically significant transient condition that develops during or shortly after the consumption of cannabis that is characterized by disturbances in consciousness, cognition, perception, affect, behaviour or coordination. These disturbances are caused by the known pharmacological effects of cannabis and their intensity is closely related to the amount of cannabis consumed. They are time-limited and abate as cannabis is cleared from the body.

Presenting features may include inappropriate euphoria, impaired attention, impaired judgement, perceptual alterations (such as the sensation of floating, altered perception of time), changes in sociability, increased appetite, anxiety, intensification of ordinary experiences, impaired short-term memory, and sluggishness. Physical signs include conjunctival injection (red or bloodshot eyes) and tachycardia.

- **Cannabis withdrawal:** a clinically significant cluster of symptoms, behaviours and/or physiological features, varying in degree of severity and duration, that occurs upon cessation or reduction of use of cannabis in individuals who have developed cannabis dependence or have used cannabis for a prolonged period or in large amounts. Presenting features may include irritability, anger or aggressive behaviour, shakiness, insomnia, restlessness, anxiety, depressed or dysphoric mood, decreased appetite and weight loss, headache, sweating or chills, abdominal cramps and muscle aches.
- **Cannabis-induced delirium:** an acute state of disturbed attention and awareness with specific features of delirium that develops during or soon after substance intoxication or withdrawal or during the use of cannabis. The amount and duration of cannabis use must be capable of producing delirium. The symptoms are not better explained by a primary mental disorder, by use of or withdrawal from a different substance, or by another health condition that is not classified under mental, behavioural and neurodevelopmental disorders.
- **Cannabis-induced psychotic disorders:** these are characterized by psychotic symptoms (e.g. delusions, hallucinations, disorganized thinking, grossly disorganized behaviour) that develop during or soon after intoxication with or withdrawal from cannabis. The intensity or duration of the symptoms is substantially in excess of psychotic-like disturbances of perception, cognition, or behaviour that are characteristic of cannabis intoxication or cannabis withdrawal. The amount and duration of cannabis use must be capable of producing psychotic symptoms. The symptoms are not better explained by a primary mental disorder (e.g. schizophrenia, a mood disorder with psychotic symptoms), as might be the case if the psychotic symptoms preceded the onset of the cannabis use, if the symptoms persist for a substantial period of time after cessation of the cannabis use or withdrawal, or if there is other evidence of a pre-existing primary mental disorder with psychotic symptoms (e.g. a history of prior episodes not associated with cannabis use).
- **Cannabis use disorders (CUD):** “Cannabis dependence” and “harmful pattern of cannabis use” are the two ICD-11 diagnostic categories that comprise the entity of “substance use disorder”.

A different situation – different challenges – new research

In 2016, the World Health Organization published *The health and social effects of nonmedical cannabis use* (1). Since then, there have been significant changes in the cannabis preparations that are consumed for nonmedical purposes, changes in cannabis policies in some jurisdictions, and new research on the health and social effects of nonmedical use of cannabis.

In 2019, the WHO Expert Committee on Drug Dependence conducted a critical review of the abuse liability, dependence liability and therapeutic usefulness of cannabis (2, 3). Through this assessment, WHO made a series of recommendations to the United Nations (UN) Commission on Narcotic Drugs on the scope of international control of cannabis and cannabis-derived products. These recommendations reflected recent evidence on the therapeutic potential of cannabis preparations for certain medical conditions, as well as demonstrated harms that can arise from cannabis use. They included considerations on the availability of cannabis and cannabis-derived products for medical purposes where scientifically proven and clinically indicated, while protecting public health against harms that may arise from the nonmedical use of these products.

In 2020 the UN Commission on Narcotic Drugs took a number of decisions on the international control of cannabis accepting WHO's recommendation to remove cannabis and cannabis resin from the most restrictive schedule of the 1961 Single Convention on Narcotic Drugs (4, 5). These remain in Schedule I of the 1961 Convention and so remain subject to international control, while some international procedural barriers to research and development of cannabis-based medical products under national regulatory frameworks have been removed (4, 5).

This technical brief has been prepared as an update to the 2016 report on the health and social effects of nonmedical cannabis use (1) in the light of new evidence and research that has emerged, and in response to requests received by WHO from Member States, civil society and international experts.

Purpose: up-to-date information

The purpose of this brief is to provide concise up-to-date information on the global epidemiology of nonmedical use of cannabis, the short-term adverse health effects of cannabis use, and the long-term adverse effects of regular cannabis use on mental and physical health and social outcomes.

Scope – effects of nonmedical cannabis use

This brief presents an update of the evidence on the negative health and social effects of nonmedical cannabis use since 2016, and especially its impacts on adolescents and young adults. The subjective positive effects experienced by some people using cannabis and the therapeutic benefits from medical preparations of cannabis are outside the scope of this brief, as are prevention and treatment policies which are discussed elsewhere (6, 7). This document is not normative in nature and does not intend to make recommendations.

Methods

This technical brief builds on WHO publication *The health and social effects of nonmedical cannabis use* (1) and presents a narrative compilation of evidence from recent reviews of the literature with contributions from a broad range of experts and researchers from academia, research institutions, international organizations and national health agencies in different parts of the world.

WHO commissioned a set of background papers with scoping reviews in key thematic areas (including the epidemiology of cannabis use, short-term adverse effects of cannabis use, long-term effects of cannabis use, adverse effects of regular cannabis use, and adverse social effects of cannabis use). In parallel, WHO's Expert Committee on Drug Dependence drafted its critical review on cannabis and cannabis resin and contributed to the mapping of evidence across all areas. Results from background materials were presented and discussed at a WHO expert meeting in Geneva on 18–20 December 2019, pointing to the structure and content of the needed update. The draft was circulated after the meeting to collect additional feedback and contributions by technical experts from all six WHO regions, as well as organizations and other WHO departments. Suggestions from reviewers and additional literature sources were added on the basis of scoping literature reviews in 2022 and 2024 and the draft was circulated for a final round of comments in 2025. Conflicts of interest from all individual contributors were declared, assessed and managed in line with WHO procedures.

In this brief, evidence is presented as a narrative description of the current state of research across key areas. It does not provide numerical summaries across identified studies or grade the certainty of evidence. In line with the technical brief's scope (the health and social effects of nonmedical cannabis use), the document does not cover medical cannabis use, public health prevention of cannabis-related harms or treatment of cannabis use disorders. While the focus of the brief is nonmedical cannabis use, it was not always possible to differentiate the context of use in the contributing studies; moreover, some adverse effects of cannabis use can occur regardless of the purpose and legal context. Consequently, in some parts of the brief, the broader term "cannabis use" is utilized. It is important to note, however, that the concept of risk refers to the likelihood of an exposure (cannabis use in this case) causing harms. This does not mean that all persons exposed to the risk factor will experience negative consequences.

Background

The brief complements and updates the 2016 report in view of evolving cannabis policies and new research findings on nonmedical cannabis use. It does so for the following reasons:

- **Continued high prevalence:** Cannabis remains the most widely used psychoactive substance under international control. In 2024, 250 million people (or 4.8% among people aged 15–64 years) were estimated to have used cannabis (8). The scale of the world drug problem continues to increase amid expansions in cannabis use and markets.
- **International regulations:** Based on WHO's recommendation, the United Nations Commission on Narcotic Drugs decided to remove cannabis and cannabis resin from Schedule IV of the 1961 Convention but to maintain it in Schedule I of the same Convention (4, 5).

- **Changes in national drug policies** on medical and/or nonmedical cannabis use in several jurisdictions have increased international policy dialogues on the public health dimensions of cannabis use and related health and social consequences (9). At the same time, the demand for treatment for cannabis use disorders has been increasing in many parts of the world (1). There is a need to clarify the differences in prevalence of use and harms of nonmedical and medical use of cannabis in the light of the regulatory changes. In 2025, WHO guidelines on balanced national controlled medicines policies to ensure medical access and safety were published to advise national policy-makers how to make controlled medicines safely available where they have recognized therapeutic value while minimizing harms related to nonmedical use (10).
- **Significant new research:** There has been substantial new research on the adverse effects of nonmedical cannabis use on health, which WHO defines as a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity. There are also several studies on the long-term social effects of cannabis use during adolescence but there is still a need for more health-economic studies to answer questions on the overall economic impact on society.

As in the earlier report, the **short-term health effects** of cannabis use refer to any psychological or physiological effects that occur shortly after using cannabis. The **long-term health effects** of cannabis use refer to those effects that arise from regular cannabis use – especially daily use – that is continued for months, years and decades.

What did we know in 2016?

Summary of findings of the 2016 WHO report on the health and social effects of nonmedical cannabis use

The short-term adverse effects of cannabis use

- Cannabis use may acutely produce intoxication that is marked by disturbances in the level of consciousness, cognition, perception, affect or behaviour.
- A minority of people using cannabis may have panic attacks, experience hallucinations and be sufficiently distressed by these experiences to seek medical care. Acute cannabis intoxication increases the risk of traffic injuries.
- Case study and case series suggest that cannabis smoking can trigger coronary events in younger cannabis smokers who are otherwise at relatively low risk.

The adverse long-term effects of regular cannabis use on mental health

- Regular cannabis use can produce a cannabis dependence syndrome.
- The risks of developing cannabis dependence are around 1 in 10 among persons who ever use cannabis.
- A withdrawal syndrome is common in persons who seek treatment for cannabis dependence.
- Cannabis dependence and harmful use were common reasons for seeking specialist addiction treatment in many high-income countries and in some low- and middle-income ones.
- Daily cannabis use in adolescence and young adulthood is associated with early school-leaving, cognitive impairment, the use of other illicit drugs, depressive symptoms, and suicidal ideation and behaviour. There is debate about whether these associations are causal.
- Regular, heavy cannabis use during adolescence is associated with more severe and persistent adverse outcomes than the use of cannabis during adulthood.
- Regular cannabis use is likely to be a “component cause” that interacts with other factors to precipitate schizophrenia or a psychotic disorder.

The adverse long-term effects of regular cannabis use on physical health

- Long-term cannabis smoking is associated with chronic bronchitis and injury to bronchial cells, but it is unclear if it produces chronic obstructive pulmonary disease.
- Long-term heavy cannabis smoking can potentially trigger myocardial infarctions and strokes in young adults.
- It is unclear whether cannabis smoking increases the risks of respiratory and other cancers over and above those of tobacco smoking which is common among persons who regularly smoke cannabis.
- There is suggestive evidence that testicular cancer is linked to cannabis smoking and that this requires further investigation.

What is new?

Changing national cannabis policies

In the past decade, there has been an increase in the number of jurisdictions that have legalized the nonmedical use of cannabis by adults (9, 11). These policy changes were initially made in North America in the 2010s (11). Since then, some jurisdictions in Europe, Central and South America, Africa and Asia have begun to legalize nonmedical use by adults in different ways (9).

The legalization of nonmedical use has increased the diversity and potency of cannabis products that are available for legal use by adults (12). These products now include cannabis extracts, cannabis oils for vaping, and cannabis edibles and beverages (9, 12, 13).

Epidemiology of cannabis use

Globally cannabis remains the most widely used psychoactive drug under international control and its use has increased globally since 2016 (3, 8, 14). The prevalence of cannabis use appears to be more common in high-income countries than in low- and middle-income countries, although it appears to be increasing in the latter (8).

A major public health concern is that many young people initiate cannabis use in their mid-teens and that a substantial proportion of young people continue to use cannabis regularly during young adulthood, especially in countries that have legalized adult cannabis use (9, 15–17).

The average THC content of cannabis products has also increased in illicit cannabis markets (18). At the same time, even more potent cannabis products are now being sold to adults in legal cannabis markets and at lower prices than was the case in illicit markets (9, 13, 16).

Short-term adverse effects of cannabis use

Cannabis products that contain high doses of THC can produce unpleasant feelings (e.g. irritability, anxiety), distorted perceptions (e.g. paranoid thoughts, short-lived hallucinations, delusions or depersonalization) and dysfunctional behaviour (3, 19). Overdosing on cannabis or using cannabis unintentionally can cause short-term psychiatric, gastrointestinal and cardiovascular problems in children, teens and adults (20, 21). While these symptoms usually subside, medical assistance may be required in more severe cases.

The prevalence of the acute adverse effects of cannabis resulting in emergency department attendances has increased in jurisdictions that have legalized adult cannabis use (13, 22–24). These increases have been most marked in jurisdictions that allow the commercialized supply of cannabis (13, 23). Presentations to emergency departments by children who have ingested edible cannabis products in the belief that they are candies have increased in jurisdictions where nonmedical use is legal (25). At the same time, the perceived risks of cannabis use have decreased among adolescents in these jurisdictions (22). The prevalence of biomarkers of recent cannabis use has increased among

accident injuries (26) and fatalities in jurisdictions that have legalized nonmedical cannabis use (13). There is still debate about whether these increases indicate that drivers who had used cannabis were responsible for road traffic deaths and injuries (9, 27).

Long-term adverse effects of regular cannabis use on mental health

Cannabis dependence

There is an indication of an increase in the prevalence of cannabis dependence since 2016 along with the increased global prevalence of cannabis use (8, 28). Cannabis use disorders remain a common reason for seeking specialist drug treatment in many high-income countries and in some low- and middle-income countries (8, 19, 28). Fewer persons have sought treatment for cannabis problems since legalization in North American jurisdictions because fewer adults are referred to treatment by the courts (29, 30).

A systematic review of six longitudinal studies in Australia, France, Germany, Netherlands, New Zealand and the United States estimated the risks of developing cannabis dependence as 12% in young people who have ever used cannabis and 33% among young people who used cannabis at least weekly (31). Younger adults and males are identified as the most at-risk groups for cannabis use disorders among those who use cannabis for both medical and nonmedical reasons (32).

These risks may have increased in jurisdictions that have legalized nonmedical cannabis use (33, 34). This may be in part because the prevalence of daily cannabis use has increased (15) and in part because there has been more use of higher potency cannabis products (9). Persons who seek specialist treatment for cannabis dependence often require assistance to manage withdrawal symptoms (35, 36).

Adverse effects on adolescent development

There is consistent evidence from longitudinal studies that regular, heavy cannabis use in adolescence and young adulthood is associated with a variety of adverse mental and psychosocial outcomes (19, 37). These include poorer school performance and early school-leaving (38), cognitive impairment (39), and an increased risk of nonmedical use of other internationally controlled drugs (37, 40).

The associations of special concern are those between regular cannabis use in adolescence and cognitive impairment that may contribute to poor school performance. This is because poor educational outcomes in young people can adversely affect their life chances, occupational choices and labour market outcomes (37, 41).

It is difficult to prove causality in these associations (3, 37, 40), because we cannot exclude the hypothesis that these associations reflect the effects of shared genetic and environmental risk factors and other moderators (37, 42).

Psychosis and schizophrenia

The evidence has strengthened that cannabis use can be a “component cause” that interacts with other factors to precipitate schizophrenia or a psychotic disorder (43, 44). There is a dose–response relationship between the frequency and potency of cannabis use in adolescence and the risk of developing psychotic symptoms or schizophrenia (43). Psychotic symptoms have an earlier onset

in persons who regularly use cannabis as young adults (44). Young males might be particularly susceptible to the effects of cannabis on schizophrenia (45).

Persons with a psychotic disorder who continue to use cannabis experience exacerbations of psychotic symptoms, more frequent relapses and a poorer course of their illness (46, 47). In laboratory studies, transient schizophrenia-like positive, negative and cognitive symptoms can be produced by administering THC to healthy individuals (48). Genetically informative studies suggest that the association between regular cannabis use and psychosis is not fully explained by shared genetic risks factors (49, 50).

Depressive disorders

There are higher rates of regular cannabis use and cannabis use disorders among persons who have depressive disorders (1, 51, 52). Meta-analyses of prospective studies report small associations between cannabis use and depression (odds ratio [OR]=1.37; 95% confidence intervals [CI]=1.16–1.62 (53) and OR=1.29; 95% CI=1.13–1.46 (54)) but have not found a clear dose response relationship between the frequency of cannabis use and the risk of depression.

Anxiety disorders

Meta-analyses of the few epidemiological studies assessing whether cannabis use increases the risk of anxiety disorders have come to different conclusions. A recent systematic review of longitudinal studies of general population samples that assessed cannabis use and anxiety disorders included only studies in which participants with indications or a history of anxiety symptoms at baseline were excluded (55). They found that cannabis use was not associated with an incident anxiety disorder in seven studies (risk ratio [RR]=1.10; 95% CI=0.99–1.22).

Lowe et al. (56) reported a systematic review of six prospective studies of associations between adolescent cannabis use and anxiety disorders or symptoms. They included prospective studies of population samples of individuals in early (13–16 years old) or late (17–19 years old) adolescence who did not have a physical or mental health disorder at baseline (56). They found an association between adolescent cannabis use and the development of a subsequent anxiety disorder (OR=2.14; 95% CI=1.37–3.36). A sensitivity analysis restricted to five studies that controlled for comorbid substance use produced similar results (OR=2.38; 95% CI=1.34–4.20).

These associations can potentially be explained by shared risk factors for anxiety and cannabis use disorders. They may also be due to reverse causation if anxious persons use cannabis to self-medicate and develop a cannabis use disorder (57). It is also unclear whether regular cannabis use adversely affects the course of anxiety disorders or compliance with treatment.

Bipolar disorders

Persons with bipolar disorders also have higher rates of cannabis use disorders than the general population (58, 59). Systematic reviews of longitudinal studies find that people who used cannabis had a higher risk of later developing bipolar disorders than those who did not use it (58). In persons with bipolar disorders, the frequency of cannabis use at the time of diagnosis predicts the frequency of later manic episode symptoms (60). Cannabis use is also associated with a younger age of onset of mania, more frequent depressive or manic episodes, more severe bipolar symptoms, more rapid cycling or mixed episodes, and less improvement with treatment (60).

It is unclear whether these associations are best explained by shared risk factors for anxiety and cannabis use disorders or by reverse causation (e.g. if persons who develop bipolar illnesses use cannabis to self-medicate their symptoms). It is plausible that cannabis use can adversely affect the course of bipolar disorders and can reduce compliance with treatment.

Suicidal ideation and behaviour

There are very few studies examining the association between cannabis use and suicidal behaviour (61, 62). A meta-analysis of longitudinal studies of adolescent cannabis use reported a modest association with later suicidal ideation (OR=1.50; 95% CI=1.11–2.03) and a stronger association with suicide attempts (OR=3.46; 95% CI=1.53–7.84) (53). However, these estimates were based on only three studies for each outcome. More studies are required to assess these potential risks of cannabis use.

The adverse effects of regular cannabis use on physical health

Pregnancy and childbirth

A meta-analysis of 51 studies (63) with a total of 21 146 938 participants found moderate-certainty evidence that cannabis use in pregnancy was associated with increases in low birth weight (20 studies; OR=1.75; 95% CI=1.41–2.18), preterm birth (20 studies; OR=1.52; 95% CI=1.26–1.83), and small for gestational age (12 studies; OR=1.57; 95% CI=1.36–1.81). There was also low-certainty evidence that cannabis use in pregnancy was associated with greater perinatal mortality (6 studies; OR=1.29; 95% CI=1.07–1.55) (63). The association between cannabis use in pregnancy and all these outcomes persisted after adjusting for the use of tobacco products. There is some evidence that these problems have increased in jurisdictions that have legalized the nonmedical use of cannabis (64, 65).

Nausea and vomiting

Functional nausea or vomiting, also described as “cannabinoid hyperemesis syndrome” has been identified among people who smoke cannabis very heavily. This condition is characterized by uncontrolled cyclic vomiting that it is relieved by taking very hot showers (66). The primary evidence for the syndrome comes from case series in which hyperemesis is reported by persons with no prior history of this condition but who consumed high amounts of cannabis by smoking. These symptoms typically remit within several days of abstinence from cannabis use and may be rapidly reinstated if the person resumes cannabis smoking at the same frequency that preceded its onset (67). Some 5–6% of people who had used cannabis in the past 12 months ever experienced hyperemesis syndrome (68). The prevalence of emergency department presentations for this syndrome has increased in jurisdictions that have legalized nonmedical cannabis use for adults (66, 68, 69).

Respiratory symptoms

People who smoke only cannabis are more likely to report cough, sputum and wheezing than people who do not smoke cannabis although they are no more likely to report shortness of breath (70–72). A review published in 2022 found that marijuana use can cause bronchitis; however, a moderate body of evidence showed distal airway or parenchymal lung disease did not result from this use (70).

Chronic obstructive pulmonary disease

Chronic obstructive pulmonary disease is a common lung disease causing restricted airflow and breathing problems. It is very common in people who smoke tobacco who report chronic

bronchitis, chest tightness, and increased cough and production of sputum most days of the year. Epidemiological and clinical research on persons who smoke only cannabis has not consistently found an increased risk of chronic obstructive pulmonary disease (42).

Other respiratory diseases

A small number of cross-sectional studies suggest that cannabis smoking is associated with bronchial asthma but there is a paucity of longitudinal studies that have controlled for other risk factors for bronchial asthma (42). A population-based longitudinal study that followed 2602 young adults for 13 years found that cannabis smoking was a risk factor for bronchial asthma and the use of asthma medication (73). People who were currently using cannabis were more likely to fill a prescription for asthma medication (OR=1.71; 95% CI=1.06–2.77) after adjusting for other factors that predict asthma symptoms (73).

Aspergillosis (fungal infection) and other forms of pneumonia have been reported in immunocompromised people who smoke cannabis (74). Cannabis smoking impairs the function of alveolar macrophages which are key immune cells in the lung's defences against infection (75). There is contradictory evidence on the association between cannabis smoking and pneumonia in two cohorts of HIV-infected men (76, 77). Cannabis has been identified as a possible risk factor in some tuberculosis outbreaks but the evidence for an association between cannabis smoking and tuberculosis infection is still weak and requires further research (78).

Cardiovascular diseases

THC acutely stimulates the cardiovascular system, increases heart rate and produces changes in blood pressure. Over the past 20 years case reports have linked cannabis smoking to acute myocardial infarction, cardiac arrhythmias, cardiomyopathies, stroke, arteritis and sudden cardiac death (79–81).

Several systematic reviews have assessed evidence on the association between cannabis use and various types of cardiovascular diseases. Drummer et al. (82) found increased mortality or associations with increased risk in 11 of 12 studies. A review conducted by Jouanjus et al. (83) of 81 case reports, 29 observational studies, three clinical trials and two experimental studies of cannabis use and cardiovascular disease, showed that there were stronger associations between cannabis use and ischaemic strokes than with other cardiovascular diseases.

Systematic reviews of cohort studies of associations between cannabis use and cardiovascular diseases have come to divergent conclusions. One review found an association between cannabis use and an increased likelihood of myocardial infarction within 24 hours in two studies and stroke in six studies, as well as suggestive evidence of an increased risk of angina pectoris and acute coronary syndrome among people using cannabis, which was stronger in people with a history of a cardiovascular events (84). A meta-analysis found suggestive but not statistically significant increases in the risks of myocardial infarction and stroke (85). In contrast, van Amsterdam & van den Brink (86) and Yang et al. (87) found that cannabis smoking was significantly associated with myocardial infarction after adjusting for concurrent tobacco use. Frequent cannabis smoking was also associated with a significant risk of myocardial infarction (aOR=1.88; 95% CI=1.15–3.08) in persons who had never smoked tobacco (88). Large, well-designed cohort studies are required to clarify these risks.

Stroke

There were 100 case reports of strokes in people who smoked cannabis by 2016 (89, 90), either while cannabis was being smoked or shortly afterwards. A systematic review of the prevalence and outcomes of stroke in people using cannabis found higher prevalence of stroke (1.2% for ischaemic stroke and 0.3% for haemorrhagic stroke) in people who used cannabis than in people who did not use it (0.8% and 0.2% respectively) (OR=1.17; 95% CI=1.10–1.25) (91). There was insufficient evidence of associations between stroke risks and the duration and timing of cannabis use (91). In 2022 the American Heart Association concluded that available evidence suggests that there is an increased risk of stroke among people using cannabis (92).

Cancer

Epidemiological studies find mixed evidence on associations between cannabis use and various types of cancer (93–95). The association between cannabis smoking and cancer has not been as well studied as that between tobacco smoking and cancer. The interpretation of epidemiological studies of the issue is also complicated because many people who smoke cannabis also smoke or have regularly smoked tobacco.

A systematic review and meta-analysis of epidemiological studies found very weak evidence of an association between cannabis smoking and lung cancer risk (96). The review included 19 case-control and five cohort studies plus one cross-sectional study conducted between 1973 and 2019 that assessed associations between cannabis smoking and lung, head and neck, urogenital and other cancers. The authors concluded that there was insufficient evidence to assess whether there was an association between cannabis use and lung cancer.

Several studies have examined the risk of head and neck squamous cell carcinoma in people using cannabis (97–100). The studies concluded that the risk of head and neck squamous cell carcinoma in persons who had ever used cannabis was similar to the risk in persons who had not used cannabis (OR=1.26; 95% CI=0.88–1.80) (96). The association between heavier cannabis use and the risk of oral cancer were mixed in four studies (96). Pooled data from the two studies with moderate risk of bias found no association between lifetime cannabis use and oral cancer (OR=1.22; 95% CI=0.95–1.56) (96).

Several case control studies have examined associations between testicular germ cell tumour and cannabis use (101–103). In a pooled analysis of three studies (77, 78, 81) an increased risk of developing testicular germ cell tumour was associated with 10 or more years of cannabis use (OR=1.36; 95% CI=1.03–1.81) (96). Ghasemiesfe et al. (96) concluded that there was low-quality evidence that regular cannabis use was associated with testicular germ cell tumours but there was insufficient evidence regarding the risks of other cancers in people using cannabis.

Adverse social effects of nonmedical cannabis use

Learning problems

Associations have been shown between cannabis use in adolescence and learning problems (104) and poor educational outcomes (105). These associations may be partly due to the association between cannabis use during adolescence and lower income and poor engagement with paid work in adulthood (106). It is unclear whether these associations are explained by cognitive impairment, a reduced motivation to complete education and socialization with peers who devalue education (37).

Risk of violent behaviour

Recent epidemiological evidence has suggested that regular cannabis use can increase the risk of violence in persons with psychoses. A meta-analysis of 12 studies of cannabis and violence in persons with psychoses found an increased risk of violence among persons with psychoses and nonmedical cannabis use (OR=5.8; 95% CI=3.27–10.28) (107). The authors cautioned that these studies did not control for a large number of potential confounders, so it was not possible to exclude the possibility that persons with psychoses who were prone to violence were more likely to use cannabis regularly (107).

Summary of updated evidence (as of 2025) on the health and social effects of nonmedical cannabis use

The short-term adverse effects of cannabis use

- A minority of people who use cannabis may experience panic attacks, hallucinations and sufficient distress to seek medical care.
- Cannabis intoxication modestly increases the risk of traffic injuries if persons drive while intoxicated.

The adverse long-term effects of regular cannabis use on mental health

- The evidence has strengthened that regular cannabis use can produce a cannabis use disorder in which withdrawal symptoms are common.
- The risks of these disorders may have increased with increased access to cannabis products with higher levels of THC.
- Cannabis use disorders remain a common reason for seeking specialist addiction treatment in many high-income countries and in some low- and middle-income countries.
- Epidemiological evidence has strengthened that daily cannabis use in adolescence and young adulthood is associated with cognitive impairment and early school-leaving.
- Regular, heavy cannabis use during adolescence is associated with more severe and persistent adverse outcomes than the use of cannabis during adulthood.
- Regular cannabis use appears to be a “component cause” that interacts with other factors to precipitate psychotic disorders, and continued use worsens the prognosis in persons who develop these disorders.
- Daily use in adolescence is associated with the use of other illicit drugs, and also with depression and suicidal ideation, but it is uncertain whether these associations are causal.

The adverse long-term effects of regular cannabis use on physical health

- Long-term cannabis smoking is associated with chronic bronchitis and injury to bronchial cells but it does not appear to produce chronic obstructive pulmonary disease.
- Long-term cannabis smoking is associated with functional nausea and vomiting that remits with the cessation of cannabis use.
- Evidence is strengthening that long-term, daily cannabis smoking can trigger myocardial infarctions and strokes in young adults.
- It remains unclear whether cannabis smoking increases the risks of respiratory and other cancers over and above tobacco smoking which is common among persons who regularly smoke cannabis.
- Suggestive evidence that testicular cancer is linked to cannabis smoking requires further investigation.

Conclusion

As presented in this brief update to WHO's 2016 report on *The health and social effects of nonmedical cannabis use* (1), the nonmedical use of cannabis may have a broad impact on health and social development. This includes short term adverse effects such as panic attacks, hallucinations or increased risk of traffic injuries when driving while intoxicated. Regular cannabis use is linked to long-term negative effects on mental health, such as development of cannabis use disorder, cognitive impairment and early school-leaving, and poorer mental health outcomes, including an increased risk of psychotic disorders and a worse prognosis among those affected. Finally, there are adverse long-term effects of regular cannabis use on physical health – including chronic bronchitis, a cannabis associated functional nausea and vomiting, and growing evidence of increased risks of myocardial infarction and stroke among people using cannabis heavily – while uncertainties remain regarding cancer risks beyond those attributable to tobacco, with suggestive but inconclusive evidence linking cannabis use to testicular cancer.

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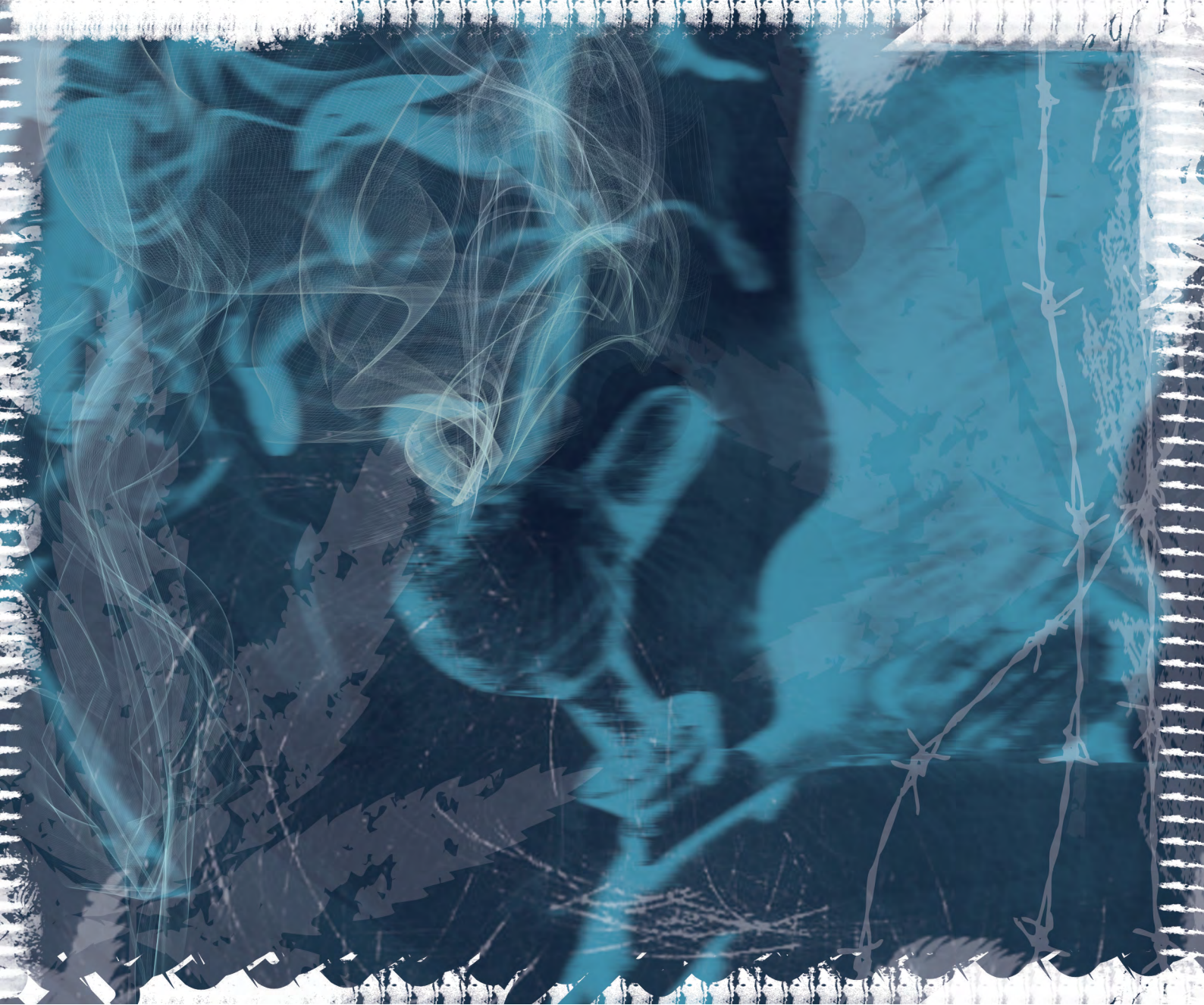
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