The impact of cannabis on public health can be varied, involving domains such as biology, psychology, cognitive science, family, social development, and cultural structures, both as a cause of negative outcomes as well as having therapeutic potential. This section summarizes the extant scientific knowledge on the association between cannabis use and health outcomes other than traffic safety.[1]

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Respiratory Diseases (Other Than Cancer)

Similarities between the process of smoking cannabis and tobacco raised concerns over the acute impact of cannabis smoking on the development of diseases that have already been associated with tobacco use, such as airway inflammation, chronic bronchitis, or emphysema (Tashkin & Roth, 2019).

However, differences in the effects that inhaling tobacco and cannabis may have on health have been noted. For instance, while tobacco smoking produces acute bronchial constriction, cannabis smoking causes acute bronchial dilation, depending on the dose of THC (NASEM, 2017; WHO, 2016).

Overall, the association between respiratory symptoms and regular smoking of cannabis remains unclear, largely due to methodological research limitations (Tashkin & Roth, 2019; WHO, 2016; Martinasek et al., 2016; Hall & Lynskey, 2020; NASEM, 2017; Preteroti et al., 2023).

Electronic Cigarette, or Vaping Product Use–Associated Lung Injury (EVALI)

It was suggested that when compared with smoking cannabis, vaping cannabis may present fewer damaging effects on health. In 2019, however, researchers noted a surge in cases observed among e-cigarette or vaping users who presented symptoms such as dyspnea, cough, fever, constitutional symptoms, gastrointestinal upsetting, and hemoptysis. Health experts termed this symptomatology Electronic cigarette, or Vaping product use-Associated Lung Injury, or EVALI for short (Soto et al., 2023).

[1] The impact of cannabis use on traffic safety outcomes are discussed in a separate Fact Sheet.

Research on this issue has been challenged by difficulties with the identification of the sources of THC (with informal sources associated with an elevated risk of EVALI) and because different cannabis vaporization devices and products carry different levels of health risk (MacCallum et al., 2023).

Although a clear understanding of EVALI is lacking, it is understood that it is linked with the liquid used in the vaporization process (the e-liquid), which typically contains ingredients such as psychoactive agents (e.g., nicotine, THC), solvents, and flavoring compounds—all ingredients with potential health risks (e.g., toxic/chemical induced lung injury) either alone or in combination. The addition of Vitamin E acetate (a thickening agent for THC) to the e-liquid is a major contributor to the EVALI risk (Overbeek et al., 2020).

Secondhand Smoke

There is concern that, as happens with tobacco, second-hand cannabis smoke may also have a negative impact on individuals' respiratory health (Goodwin et al., 2023; McKee et al., 2018). Concern is particularly high for children, where accidental exposures to cannabis are increasing (Riggs & Thant, 2022). Unfortunately, research on the impact of second-hand cannabis smoke on individuals' health is lacking.

Cancer

Cannabinoids can have both anticancer as well as pro-tumorigenic effects. (The former is addressed in the section on Therapeutic Use later in this fact sheet.)

Experimental research has found some evidence that, like cigarette smoking, cannabis smoking could be associated with cancers of the lung and the upper aerodigestive tract (head and neck) (de Groot et al., 2018). Experimental research has also suggested an association between cannabis use and the incidence of bladder cancer (NASEM, 2017). Some studies suggested there is also an association between cannabis smoking and the incidence of glioma (a type of brain tumor), and that marijuana use among HIV-infected white men is associated with risk for developing Kaposi sarcoma (a form of skin cancer). However, the evidence for these associations is weak, as these studies present important methodological limitations, such as difficulties in getting a proper population for making comparisons (WHO, 2016), failing to clearly account for participants' exposure to cannabis, and/or failing to control for tobacco use and other confounding factors (Hall & MacPhee, 2002; de Groot et al., 2018; Ghasemiesfe et al., 2019; NASEM, 2017; Chandy et al., 2024). As a result, most epidemiological studies have failed to clearly demonstrate a causality or even an association between cannabis use and these forms of cancer (WHO, 2016; Ghasemiesfe et al., 2019; de Groot et al., 2018; Thandra et al., 2021; NASEM, 2017; Mehrnoush et al., 2022; Thomson et al., 2023).

The stronger (but nevertheless weak) evidence for an association between cannabis use and a form of cancer involves testicular germ cell tumor (TGCT), particularly among individuals with more than 10 years of marijuana use (Gurney et al., 2015). Unlike research on other forms of cancer associated with cannabis, research on the association between cannabis use and TGCT is not subject to confounding by tobacco smoking (Ghasemiesfe et al., 2019).

Children and the Accidental Ingestion of Cannabis

TThe increasing availability, diversity, and potency of cannabis products has elevated the drug's potential for accidental injuries and death. Indeed, children's accidental exposure to cannabis has increased (Riggs & Thant, 2022). Although when ingested by young children, cannabis can result in respiratory failure and coma (NASEM, 2017), hospitalizations of children after cannabis ingestion are typically brief and not fatal (Riggs & Thant, 2022).

Cardiovascular Diseases

Tachycardia (Elevated Heart Rate)

Laboratory-based studies have indicated that cannabis use (THC) can produce rapid changes in cardiovascular function, as well as changes in vascular contractility particularly among heavy daily cannabis users, but the effects are generally mild and not life-threatening (Pabon et al., 2022).

Although laboratory analyses have found evidence suggesting that cannabis may have a negative impact on the cardiovascular system, prospective clinical data has not confirmed this concern (Ghosh and Naderi, 2019).

Myocardial Infarction

Early research suggested that harmful cardiovascular effects occurred only in people with pre-existing heart disease (NASEM, 2017), but more recent research focusing on case studies showed that acute exposure to cannabis, even by young healthy people, may lead to myocardial infarction, stroke, and other severe cardiovascular events (Weresa et al., 2022; Hall & Lynskey, 2020).

Despite these case studies, reports based on large national databases as well as cohort-based studies show conflicting results largely due to methodological limitations, reiterating the need for clarifying research (Theerasuwipakorn et al., 2023).

Secondhand Smoke and Cardiovascular Disease

Laboratory studies have suggested that like secondhand tobacco use, secondhand cannabis smoke may have an impact on vascular endothelial function (WHO, 2016). However, despite this biological plausibility, epidemiologic evidence remains unclear (Middlekauff et al., 2022).

Stroke

Also unclear is the association between cannabis use and the incidence of stroke, with research differing on determinant factors, with some research indicating that stroke tends to occur among chronic cannabis users or among cannabis users who also smoked tobacco. On the other hand, some research even suggests that cannabinoids may trigger a neuroprotective effect against stroke, a suggestion that has been debated and needs evaluation (WHO, 2016; Ochoa, 2021; Pérez-Neri et al., 2023; NASEM, 2017).

Mental Health

The association between cannabis use and mental health outcomes is difficult to assess, for it is usually mediated by associations with other substance use disorders (Blanco et al., 2016), as well as factors such as genetic risk and/or childhood abuse (WHO, 2016). Because of these difficulties, the direction of these associations is often unclear, with opposite causal directions being possible (i.e., having a major depressive disorder increasing the risk of cannabis initiation, and vice versa) (Borodovsky & Budney, 2018; NASEM, 2017).

Although research on the direction of these associations is often equivocal, cannabis use has been more often associated with an increase, rather than a decrease, in negative outcomes (Borodovsky & Budney, 2018). Early onset and frequent use of cannabis has been associated with a variety of mental health problems, including depression, psychosis, mood disorders, anxiety disorders, post-traumatic stress disorder (PTSD), schizophrenia, and personality disorders (NASEM, 2017; Hasin & Walsh, 2020).

Suicide Risks

There is moderate evidence of an association between cannabis use and an increased incidence of suicide ideation, attempts, and completion; with this association being stronger among heavier users (NASEM, 2017; Denissoff et al., 2022; Shamabadi et al., 2023). However, the existing evidence is not yet rigorous enough to allow firm conclusions regarding causality (Denissoff et al., 2022).

Cognitive Performance

There is moderate evidence of an association between acute cannabis use and the impairment in the cognitive domains of learning, memory, and attention (NASEM, 2017). The most consistent cognitive impairment observed during acute cannabis intoxication was a decrease in performance on verbal recall tasks (Zhornitsky et al., 2021).

Regarding the chronic effects of cannabis on verbal episodic memory, research has examined the possibility that abstinence could lead to a complete recovery of verbal recall performance, but the evidence is mixed (McCartney et al., 2021; Zhornitsky et al., 2021; Figueiredo et al., 2020; Krzyzanowski & Purdon, 2020; Lovell et al., 2020; Platt et al., 2019; Scott et al., 2018; Dellazizzo et al., 2022)

Injuries (Other Than Caused by Motor Vehicle Crashes)

Overall, injuries due to cannabis use are rare, but can occur when cannabis is used alone or with other substances, with the latter concern particularly high as a factor in motor vehicle crashes (which are examined in a separate fact sheet) (Rao et al., 2018).

There has been an increase in accidental poisoning caused by cannabis ingestion, particularly among children, which was likely caused by an increase in the availability, access, and use of cannabis (Walker et al., 2023; NASEM, 2017; Allaf et al., 2023).

Allergies

It has been postulated that allergic reactions to cannabis use can result in symptoms such as rhinitis, conjunctivitis, asthma, or cutaneous reactions (Skypala et al., 2022). However, research on this topic is still in its infancy (Toscano et al., 2023).

Cannabis Hyperemesis Syndrome (Severe Abdominal Pain and Cyclical Vomiting)

First reported in 2004, cannabis hyperemesis syndrome (CHS) is a form of disorder characterized by stretches of episodic nausea and vomiting associated with cannabis intake (Perisetti et al., 2020). Only a small number of deaths have been attributed to this syndrome (Hall & Lynskey, 2020). Research on this issue is also lacking.

Prenatal, Perinatal, and Postnatal Exposure to Cannabis

Although there is no evidence of an association between cannabis use during pregnancy and pregnancy complications for the mother, there is evidence that maternal cannabis smoking is associated with a dose-dependent decrease in neo-natal outcomes, including fetal growth, and respiratory and neurologic infections (NASEM, 2017); (Marchand et al., 2022).

The association between maternal cannabis smoking and later outcomes in the offspring is less clear (NASEM, 2017). Recent research has suggested that prenatal exposure to cannabis may interfere with normal development and maturation of the brain, which could cause children who have been exposed to cannabis in utero to show impaired attention, learning, and memory, as well as impulsivity and behavioral problems (Riggs & Thant, 2022; Brown et al., 2021). However, the association between these negative outcomes and maternal use of cannabis has not been clearly demonstrated yet (Shorey-Kendrick et al., 2023).

Oral Health (Periodontitis)

Research has reported an association between cannabis use and periodontal disease, which was higher among frequent cannabis smokers and was dose dependent. This association can occur independently of the use of tobacco, although a synergic effect may be observed among individuals who use both drugs (Chisini et al., 2019; Mayol et al., 2021; Scott et al., 2022).

Kidney functions

Research has started to examine whether cannabis use could affect acute as well as chronic kidney disease, but no significant association between cannabis use and acute kidney diseases has been demonstrated yet (Potukuchi et al., 2023; Rein et al., 2023).

Cannabis and Male Sexual Behavior

The literature related to the effects of cannabis on male sexual behavior is scarce. Several studies either did not find any effects of cannabis or reported contradictory results (Mondino et al., 2019; Rodríguez-Manzo & Canseco-Alba, 2023), with the direction of the effect cannabis may have on male sexual activity being unclear and dose-dependent. Low, acute doses of cannabis can enhance human sexual functioning in some men, while large doses can produce negative effects (for example, lack of interest in sexual activity, erectile dysfunction, and inhibited orgasm) thereby affecting sexual motivation in other subjects (Mondino et al., 2019; Rodríguez-Manzo & Canseco-Alba, 2023).

Cannabis and COVID-19 Outcomes

A recent review of the scarce literature on the impact the use of cannabis may have had on COVID-19 outcomes reported that although the use of cannabis did not impact mild COVID-19 symptoms, individuals who used cannabis experienced more COVID-19-related hospitalizations. However, the validity of these conclusions is questionable, for they were based on a very limited number of studies, which makes causality difficult to assess (Bonnet et al., 2023).

Therapeutic Use of Cannabis

A number of medical conditions and associated symptoms have been approved by state legislatures as qualifying conditions for medicinal cannabis use, in particular, for relief of the symptoms of cancer, glaucoma, human immunodeficiency virus/acquired immunodeficiency syndrome, and multiple sclerosis (Bridgeman & Abazia, 2017). The Food and Drug Administration (FDA) has approved one plant-based marijuana and two medications made from synthetic chemicals that mimic the actions and effects of THC.

Pain Relief

The most frequently reported use of medical marijuana is for pain relief (Maddison et al., 2022); however, the evidence for the effectiveness of cannabis to relieve pain is unclear. Some research shows cannabinoids having no effect on acute pain or cancer pain while increasing the risks of non-serious adverse events (Barakji et al., 2023; Bialas et al., 2022), and other studies support the potential of cannabinoids to induce analgesia (Soliman et al., 2021), which may be associated with certain dosage forms and routes of administration (Klein & Clark, 2022).

Despite the lack of definitive scientific evidence, cannabinoids are already regularly used for the treatment of pain in diseases and conditions for which no other therapy options are effective or are not well tolerated (Hidding et al., 2023). However, even in these cases, it has been pointed out that the therapeutic use of cannabis should still be conducted with caution, as THC may cause significant negative side effects (Eeswara et al., 2023).

Nausea and Vomiting

There is substantial evidence that oral cannabinoids can be used in the treatment of chemotherapy-induced nausea and vomiting (NASEM, 2017).

Pregnant women are increasingly treating nausea symptoms with whole cannabis (cannabis in its original or biodiverse form) or CBD alone (Volkow et al., 2019). However, the specific impact of fetal CBD exposure on these negative outcomes is unclear and as indicated, cannabis exposure may be associated with adverse embryonic development and postnatal outcomes (Brown et al., 2021; Swenson et al., 2023; Sandini et al., 2023).

Clinical Antitumor Effects of Cannabinoids

Some evidence to supports the possibility that cannabinoids can be an effective treatment for cancers, although there is insufficient data to support this claim (Hanganu et al., 2022; Guggisberg et al., 2022; NASEM, 2017). Although the clinical approval of cannabinoids is largely restricted to palliative uses in various diseases, research has

recently suggested that cannabinoids may have an anti-tumor effect (Velasco et al., 2016; Aziz et al., 2023; Silva-Reis et al., 2023; Buchtova et al., 2023; Erukainure et al., 2023; Akinloye et al., 2023). Current research is searching for cannabis-based compounds that effectively induce cancer cell death (e.g. (Blal et al., 2023; Dada et al., 2023; Freire et al., 2023), as well as for mechanisms for the effective delivery of cannabinoid-based medicines against cancer (Kaur et al., 2023; Freire et al., 2023; Buchtova et al., 2023).

Despite cannabinoids having the potential for anti-cancer treatments, research has also reported that under certain conditions, cannabinoid treatment may stimulate cancer cell proliferation (Velasco et al., 2016), and that cannabidiol and cannabis extracts may counteract the anticancer effects of widely used standard-of-care drugs (Buchtova et al., 2023; Ramer et al., 2022). Thus, there is a need for studies on the association between cannabis and cancer-related outcomes to balance any anticancer properties of cannabis against pro-tumorigenic effects (Hanganu et al., 2022; Guggisberg et al., 2022).

Glaucoma

Cannabis has also been suggested for the treatment of glaucoma due to the potential for cannabis to alleviate intraocular pressure and have neuroprotective effects (Järvinen et al., 2002). However, the beneficial effects of cannabis to treat glaucoma tend to be short-timed and can be offset by ophthalmic side effects (NASEM, 2017; Wang & Danesh-Meyer, 2021;Passani et al., 2020).

Sleep Disorders

It has been posited that the use of CBD has the potential to benefit individuals experiencing sleep disorders, increasing sleep quality (Gendy et al., 2023; Maddison et al., 2022), particularly for those using edible and CBD-dominant products (Bidwell et al., 2023). The evidence, however, is weak and contradictory, largely due to methodological problems (NASEM, 2017; Maddison et al., 2022; Amaral et al., 2023; Luchowska et al., 2023).

Cannabis as a Tool to Slow Down Cognitive Aspects of the Aging Process

Research conducted in animal models indicates that using low doses of THC has shown some promising results to slow psychological aging, but these early findings are highly inconclusive (Zamberletti & Rubino, 2022).

The potential benefits of using CBD for improving the behavioral and psychological symptoms of dementia have generated increasing interest among researchers (NASEM, 2017). The available evidence, however, is inconclusive (Leszko, 2023; Trojan et al., 2023).

Cannabis as a Harm Reduction Strategy for People who Use Other Drugs

It has been suggested that cannabis could be used to reduce harm from some prescription drugs and/or substances, including alcohol, tobacco, and opioids (Lo et al., 2023; Charoenporn et al., 2023).

CBD has been suggested as a mechanism to reduce opioid consumption following a traumatic injury (Klein & Clark, 2022), and there is some evidence to support the use of CBD to treat opioid use disorder (Reddon et al., 2023), in particular for reducing drug-induced craving and anxiety (Lo et al., 2023; Schneider-Smith et al., 2020). However, the evidence is weak, and the research on this possibility is lacking, largely due to legal and methodological limitations (Klein & Clark, 2022; Lo et al., 2023). The evidence for using CBD in treating cocaine use disorders, and/or polydrug use disorders is even less clear than what has been shown for opioid use disorders (Lo et al., 2023).

Cannabis and COVID-19

Research on the COVID-19 pandemic showed that the SARS-CoV-2 virus can cause excessive immune response and trigger an inflammatory cascade in the body. Because cannabinoids have been found to regulate on these processes, researchers have been interested in whether cannabis could play a role in the treatment of COVID-19 (Preteroti et al., 2023). Research on this topic was scarce, and fraught by methodological problems (Janecki et al., 2022).

Cannabis and the Easing of Respiratory Symptoms

Cannabis smoking causes acute bronchial dilation, depending on the dose of THC. Such effect suggests the possibility that for those in need of bronchial dilation, there may be short-term respiratory benefits associated with cannabis use (NASEM, 2017; WHO, 2016).

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