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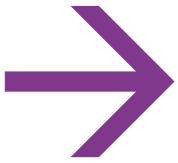
Swedish Research Council for
Health, Working Life and Welfare

CANNABIS:
HARMLESS RECREATION OR HARMFUL DRUG?

Cannabis is one of the most widely used drugs in the world → Its effects on health and society are a much debated topic → Cannabis use is associated with a heightened risk of respiratory disease, road accidents and lower infant birth weight → Regular use can lead to addiction and impaired cognitive function → Cannabis use increases the risk of social problems → Some of the substances in the plant can have benefits for sufferers of MS and epilepsy → The pain relief properties of cannabis remain unclear at this time



SUMMARY

Cannabis is one of the most widely used drugs in the world. Levels of use are lower in Sweden than in many other countries, but a slight increase has been seen in recent years. Cannabis use is associated with a heightened risk of respiratory disease, road accidents and lower infant birth weight. Above all, cannabis affects various mental functions. Regular use can lead to addiction and impaired cognitive function (thinking, coordination). The risk of short-term, acute psychosis has long been known, but there is also a higher risk of schizophrenia and other chronic psychoses. In addition, cannabis use increases the risk of social problems such as poor school performance, employment issues and a need for financial support.

Some of the substances in the cannabis plant can have benefits for sufferers of multiple sclerosis and epilepsy and may be prescribed as medication. The pain relief properties of cannabis remain unclear at this time.

Under the UN Single Convention on Narcotic Drugs, trafficking and dealing in cannabis is illegal, but the form that the legislation takes and the way it is applied varies greatly from country to country. Studies in areas that have legalised cannabis report a number of negative health effects. It is therefore essential to monitor current developments in certain countries.

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Title: Cannabis: Harmless recreation or harmful drug?

Authors: Anna-Karin Danielsson, Associate Professor of Public Health Science, Department of Public Health Sciences, Karolinska Institutet

Pelle Olsson, writer

Peter Allebeck, Professor of Social Medicin, Department of Public Health Sciences, Karolinska Instituet and Senior Physician, Center for Epidemiology and Community Medicine, Stockholm County Council

Peer review: Anders C Håkansson, Consultant Physician, Clinical addiction research unit, Department of Clinical Sciences, Lund University

Cover photo: Matthew Brodeur

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1. Introduction

Cannabis and its effects on health and society are a much debated topic both in Sweden and internationally. The debate is often defined by polarised rhetoric, where cannabis is either promoted as an entirely safe and possibly even healing substance, or as a drug that causes a significant disease burden and premature death. One issue that regularly attracts major media attention is whether cannabis increases the risk of psychotic illness, and there is also media focus on the extent to which cannabis leads to other drug use and addiction. Another debated question is whether cannabis has medicinal properties that alleviate conditions such as epilepsy, multiple sclerosis (MS) and chronic pain.

In recent years, Uruguay, Canada and several US states have legalised cannabis, although in most cases sales are strictly regulated. Changes have also been seen in Europe, with countries such as Portugal and Norway decriminalising personal use of cannabis. In Sweden, liberalisation mainly tends to be an issue raised by the youth wings of political parties. At this point in time, however, the parliamentary parties are united in their support of the current legislation.

In this report, we examine what current research says about cannabis and health, cannabis and social problems, and cannabis for medicinal use. We discuss the legal status of cannabis in different countries and conclude by considering what further knowledge is required.

2. Definitions

Cannabis is used as a generic term for marijuana, hash, hash oil and so on. These derive from the hemp plant Cannabis sativa. The plant contains a large number of chemical substances known as cannabinoids, several of which are psychoactive, which means that they affect brain function, behaviour and consciousness. Historically, cannabis has been used as an intoxicant and for medicinal purposes.

Different strains of cannabis vary in their proportions of the various cannabinoids, which impacts on the way they affect the body and the mind. The high comes from the cannabinoid delta-9 tetrahydrocannabinol (THC). The level of THC is often used as a measure of cannabis strength. Today's cannabis can contain much more THC than it used to (1). There are other kinds of cannabinoid that suppress some of the effects of THC, such as cannabidiol (CBD) (2).

'Spice' is the name of the synthetic cannabinoids that are manufactured in a laboratory. These tend to give a much stronger high than cannabis, are therefore easy to overdose on (3, 4) and have caused death by acute intoxication (5). According to the Swedish Council for Information on Alcohol and Other Drugs (CAN), the use of spice has declined among Swedish schoolchildren in recent years (6).

3. Prevalence

Cannabis is one of the most widely used drugs in the world (7). According to the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), at least 87 million Europeans – a quarter of the adult population – have tried cannabis at least once in their life, with 24 million taking it in the past year (8). An estimated 7 percent of Sweden's 16–34 year olds have used cannabis in the last 12 months, compared with 15 percent in Denmark, 14 percent in Finland and 9 percent in Norway (8).

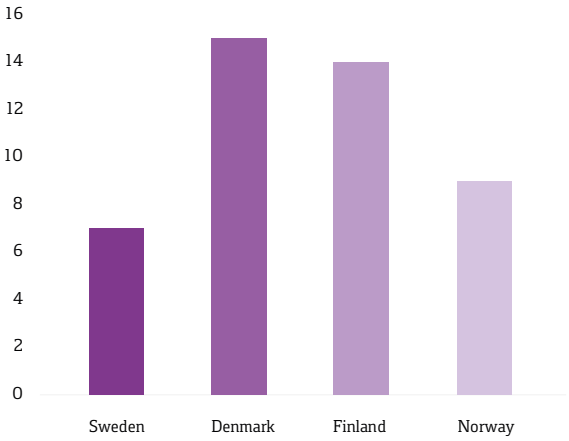

Figure 1 *Proportion of people aged 16–34 who have used cannabis in the last 12 months.*
Source: European Drug Report 2018, The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA)

The Public Health Agency of Sweden estimates that 12 percent of Swedes in the age group 16–84 have smoked cannabis at some point, with an annual prevalence of 3 percent (9). The drug is used most widely among young people aged between 16 and 29, with almost 9 percent stating that they have taken cannabis in the past year. The level of cannabis use is comparatively low in Sweden, although a slight increase in annual use appears to have occurred over time, at a rate of around 1 percent in the years 2013–2017 (10).

Data on the national trend among young people comes from the Swedish Council for Information on Alcohol and Other Drugs (CAN). In a 2018 survey, 8 percent of boys and 6 percent of girls in the final year of secondary school stated that they had taken drugs at least once. This compares with a figure of 17 percent for boys and 14 percent for girls in the second year of upper secondary school. In 91–96 percent of cases (depending on age) the drug taken was cannabis (6). There has been a slight increase in frequent use of cannabis (taking it at least 20 times in their life) among young people at both late secondary and upper secondary level. Those who have taken cannabis have increased their use from an average of 4 times in 1989 to 13 times in 2016 (11). There has also been a discernible change in attitude among young people concerning the mental and physical risks of smoking cannabis. Today, around half of

young people state that they believe that frequent cannabis smoking is associated with major risks.

4. Effects

4.1 Health effects

Recent years have seen the publication of several comprehensive literature reviews focusing on the health effects of cannabis use (12, 13). A general problem when assessing the effects of cannabis use is that covariant factors such as tobacco smoking, alcohol and use of other drugs must also be taken into account. Well-designed scientific studies also factor in aspects such as childhood conditions, socioeconomics, personality and education, and try to carefully isolate the specific effects of cannabis use. There is a further need for multiple studies that point in the same direction, and studies that compile results from several different surveys, known as meta-analyses, are thus extremely valuable. In the literature reviews referred to here (12, 13), meta-analyses and individual studies have been examined carefully by expert groups, who have then summarised the results. For a complete list of references, please see forte.se/en/publication/rb-cannabis.

Respiratory tract

Since cannabis is often smoked, an obvious starting point is to consider cannabis use as a risk factor for chronic respiratory infections, such as chronic bronchitis and chronic obstructive pulmonary disease (COPD). A greater prevalence of chronic bronchitis has been found in cannabis smokers, but not the more serious form, COPD.

Cardiovascular system

The effects of cannabis lead to an elevated heart rate and lower blood pressure, or blood pressure may even rise. The cardiovascular effects come quickly after consumption, and can cause anxiety. In young and healthy people, these acute effects will not necessarily lead to any harm. However, cannabis use by people who have previously suffered a heart attack has been shown to carry a greater risk of chest pain (angina pectoris). Some studies have suggested that regular cannabis use over the long term can increase the risk of heart problems, but the data remains inconclusive. Clinical studies on small populations have shown that the risk of suffering a stroke at a young age is greater among cannabis users. Follow-up of a major study population showed, however, that this effect disappeared once covariant factors, particularly tobacco smoking, were taken into account (14).

Cancer

In this area too, it is difficult to analyse causality since tobacco smoking often occurs alongside cannabis use. A number of studies have been conducted, but the results are not entirely conclusive. In our follow-up of military servicemen, we found a doubled risk of lung cancer among those who reported extensive use of cannabis in their youth, even after controlling for tobacco smoking (15). Studies into the risk of testicular cancer are interesting, as this form of cancer is not linked to smoking. Multiple studies show an increased risk of testicular cancer among extensive users of cannabis, and our study of military servicemen also showed a 2.5 times higher risk among people who took cannabis extensively in their youth (16).

Accidents and injuries

Impaired attention, motor skills and coordination naturally make cannabis use a significant risk on the roads. A number of studies into cannabis levels in the blood in conjunction with road deaths and injuries have shown that the risk of injury is approximately doubled if the driver is under the influence of cannabis.

Pregnancy

Again, many studies have found it difficult to separate the effect of cannabis from the effect of smoking, alcohol and social conditions. It has, however, clearly been shown that women who take cannabis during pregnancy produce babies with a lower birth weight. Several studies have shown an elevated risk of premature birth and the need for intensive care, although the underlying data is slightly weaker on this. Studies following the children of mothers who took cannabis during pregnancy have not found any increased risk of stunted growth, intellectual disability or later mental problems that could be traced back to the cannabis use.

Mental effects

It is only natural that the effects on mental faculties and mental health are afforded most attention in the debate about the health impacts of cannabis. Cannabis is a psychoactive drug and its main ingredient, THC, specifically affects the cannabinoid receptors located in the brain and other organs.

When THC is inhaled by smoking, the level of THC in the brain rises rapidly and these receptors react by releasing dopamine. This increased release of dopamine in the regions where cannabinoid receptors are located affects a number of functions: motor skills, cognition, reaction speed and coordination. The high and the mental effects that occur can vary greatly, in terms of the way the affected brain functions and processes the way it sees the world. It is thus reasonable to assume that cannabis may have both acute and long-term effects on the function of the brain (17).

It is useful to divide the mental effects into acute and long-term. By acute, we mean effects that occur hours and days, perhaps weeks, after use. Long-term effects are those that last for months and years, even after cannabis use has ceased.

Acute effects

Intoxication – cannabis high: Intoxication – literally 'poisoning' – refers to the immediate effects that occur in the body when certain substances are ingested. The most

common effect, and the one usually being sought, is a cannabis high, but the nature of this can vary greatly. Depersonalisation (not recognising yourself), hallucinations and confusion were documented by Doctor Jacques-Joseph Moreau back in 19th-century France. He produced the first systematic descriptions by studying the effects of cannabis use on a group of intellectuals and artists who regularly held special cannabis sessions (as part of the Club des Haschishins): "… The mental changes that hashish causes, from simple manic elation to insane rage, from the weakest impulse... to the most irresistible compulsion, the wildest delirium..." (18).

Anxiety: While in certain cases the cannabis high can be considered pleasant and calming, it is not uncommon to have powerful reactions such as anxiety and panic attacks. Both the physical effects on the cardiovascular system and the mental effects (e.g. depersonalisation – a strong sense of unreality and not recognising yourself) can quite often lead to severe anxiety and panic attacks (19). Some researchers suggest that these panic attacks may lie behind violent actions and even suicide.

Psychosis: Cannabis has long been known as a cause of acute psychosis. Here, acute means a psychosis that occurs close to the time of cannabis use, and that might last days or even weeks after use. The nature of the psychosis may vary: it may have 'passive symptoms' – being withdrawn and showing general detachment, or 'active' symptoms – feelings of elation, delusions, visual hallucinations and occasionally violence. Acute psychoses will typically subside after a few weeks. There is, however, a possibility of 'flashbacks', psychotic experiences, weeks after the psychosis has subsided and without taking any cannabis. One explanation could be that THC remains stored in fat cells and may be released slowly (19, 20).

Long-term effects

Cognition: The term cognition includes learning, memory, combinatory ability and verbal skills. Multiple studies have indicated that people who take a great deal of cannabis have impaired cognitive abilities, although it has proved difficult to pinpoint the cause. MR-PET scans of the brain have shown certain changes in cannabis users in the regions that deal with memory and attention.

An initial long-term follow-up in New Zealand showed that young people who had taken large amounts of cannabis had a lower IQ than those who had not. The correlation was clearest in people who began using cannabis early in life (21). Critics of the study posited that socioeconomic factors could explain the findings (22). However, further analyses of this group of young people showed that this was not the case. A US study of a slightly older group showed generally impaired cognitive function among cannabis users, but a long-term follow-up only found impaired memory function remaining (23).

Chronic psychosis: One of the more widely debated issues regarding the effects of cannabis use is whether an elevated risk of chronic psychosis exists, even after the use of cannabis has stopped. The term chronic psychosis includes schizophrenia, of which there are different kinds, and other forms of psychosis, such as 'functional psychosis' or 'schizophreniform disorder'. All these forms of chronic psychosis are extremely disabling, with long periods of delusions, mood swings and problems with social interaction. Improvements can be achieved through medication and rehabilitation, but in the majority of cases the illness lasts for much of a person's life.

Little is known about the causes of schizophrenia and other psychoses. There is probably a genetic component, which may then lead to psychosis if other risk factors occur in life, particularly during childhood. The condition often develops over a long period, making it difficult to distinguish between chicken and egg – whether cannabis use precedes psychotic illness, or whether people who suffer psychosis or exhibit precursors to psychosis tend to begin taking cannabis.

One of the first indications that cannabis really could increase the risk of schizophrenia came from our research group in 1987, when we showed that young people who reported high cannabis consumption in their youth had more than twice the risk of developing schizophrenia, compared with those who had never used cannabis (24). It was long thought that the findings could be explained by covariant factors, or by the young people having symptoms of mental illness before they began taking cannabis.

Over the following decades, several long-term follow-up studies produced similar results. A review by Moore et al. in 2007 (25) summed up the state of knowledge based on seven long-term studies from various countries. According to the summary, the risk of suffering chronic psychosis is twice as high among heavy users of cannabis, compared with those who have never taken the drug. Of course, cannabis is not the only cause of chronic psychosis, but several of these studies stated that over 10 percent of all cases of chronic psychosis could be prevented by never taking cannabis. Some researchers question the correlation, asserting that it only applies to certain groups and that it can be explained by covariant factors (26). However, Murray et al. have produced multiple studies showing that stronger cannabis preparations and synthetic cannabinoids pose a higher risk of psychosis, meaning that the dose-response curve is more distinct than ever and that young cannabis users run the greatest risk (27). In a comparison of selected cities in Europe, they recently showed that cities with a higher prevalence of cannabis use and wider use of a more potent cannabis type (e.g. Amsterdam, London and Paris) also have more incidences of psychosis (1).

Depression: The same problem of establishing causality applies for depression, but again there are several long-term studies ruling out the explanation that people with

depression turn to cannabis. Moore et al analysed the risk of depression and found the correlation to be less clear-cut than for cannabis and psychosis (4, 25). In our studies of military servicemen, we found no increased risk of depression, but we did find an elevated risk of schizoaffective disorder, by which we mean depression combined with certain schizophrenia-like symptoms (28). In another of our studies, we found a certain increase in the risk of depression among male and female cannabis users, but this was largely explained by alcohol use and other drug use (29). However, we did find that female cannabis users were at greater risk of reporting psychological distress (30).

Addiction: A certain proportion of those who use cannabis on a regular basis develop an addiction. Studies have shown that 16 percent of people who began taking cannabis in their youth and 33–50 percent of those who have a daily cannabis habit develop an addiction (31). In this instance, addiction means that the person cannot control their consumption, needs more and more and has withdrawal symptoms if the supply of the drug ceases. Reports from Sweden and other countries indicate that people are increasingly seeking treatment for cannabis addiction (32).

4.2 Social effects

Several studies have linked cannabis use with social problems and socioeconomic status, not least through learning problems (33) and poor exam results (34). There also appears to be a correlation between cannabis use in late teenage years and low income and poor engagement with working life in early adulthood, i.e. ages 25–27 (35).

Our studies showed that extensive cannabis use in late teenage years increases the risk both of unemployment and reliance on social security benefits in adulthood (36) and of being pensioned off early, in other words a definite exclusion from the labour market in adulthood (37). These elevated risks remain, although to a lesser extent, after adjusting for factors such as social background, mental health, alcohol use, tobacco smoking and other drug use. These findings are supported by other research showing that cannabis smokers run a greater risk of needing social security benefits and also tend to remain dependent on financial assistance (38). In addition, there are reported correlations between cannabis use and insecure employment, as well as poor performance at work and unemployment (39–41).

It is, however, unclear whether the cannabis use itself reduces motivation for education, which in turn damages prospects in the labour market, or whether the observed correlations are instead the result of other factors that increase the risk of both cannabis use and negative social impacts. Studies have shown that (social) environmental factors affect the risk of early first cannabis use and interrupted education (42), but they have also reported on the significance of genes in the relationship between cannabis use and low socioeconomic status (43). Growing up in a difficult socioeconomic situation has been linked to cannabis use (44). At the same time, there are studies showing the opposite – that cannabis use is more common among young people with a higher socioeconomic background (45, 46), although more frequent use and problematic use appear to be more common among those with a lower socioeconomic background (46).

4.3 Cannabis and violence

Cannabis has increasingly become associated with violent murders and terrorist acts where, according to newspaper reports, the perpetrators have been known cannabis consumers (e.g. 47–49). Suspicions that the drug can prompt aggressive behaviour are nothing new. Back in the late 19th century, it was noted in India that a large proportion of the 'criminally insane' patients at the asylums – the mental hospitals of the time – were habitual smokers of 'ganja' (50).

A Dutch study showed a greater risk of violence and criminal actions among young people monitored during their teenage years, and associated increased consumption with a greater propensity for violence (51). Similar results were reported in a study of school-age young people in Norway (52). A Canadian study followed over a thousand patients after their discharge from psychiatric emergency care. Those who continued to smoke cannabis ran a much higher risk of violent behaviour – more so than those who continued to drink alcohol (53).

There have also been other studies, but these are hard to interpret due to the difficulties of documenting cannabis intake in relation to violent acts and any covariant factors (e.g. personality and alcohol consumption). We therefore do not have any definitive answer to the question of whether cannabis can contribute to violent acts.

5. Medicinal use

Many countries, particularly Canada, Israel and many states in the USA, have seen political acceptance of cannabis for 'medicinal use'. The type of preparation in question relates to the whole plant, not extracted substances. Intake is usually by smoking, which makes the dosing difficult to regulate.

No regulatory authority in the world has approved unprepared cannabis as a medicine, and it has not been established as a treatment by any country's public health agency.

There are, however, medications containing cannabinoids that have been extracted from the cannabis plant or synthesised. These products have undergone meticulous testing to investigate both their benefits and side-effects. The constituent substances also have to be precisely defined and the method of use has to be safe, which is not the case for 'ordinary' cannabis use. The substances used in medication are THC, which is the substance that gives the cannabis high, and cannabidiol (CBD), which does not produce a high.

The medications used in Sweden are Sativex and Marinol, the latter of which can be prescribed under licence. Sativex comprises equal parts THC and CBD, and is used in spray form to relieve painful cramps associated with multiple sclerosis (MS). The active ingredient in Marinol is dronabinol, which is synthetic THC. Marinol is used largely to improve appetite and combat weight loss in AIDS sufferers, and to reduce the nausea caused by chemotherapy. Another licensed medication is Epidiolex, which only contains CBD and is prescribed for children with certain forms of severe epilepsy. The use of these medicines is limited, but has risen in recent years. Swedish figures for 2018 show that 395 patients received Sativex, 11 were given Marinol and a few more were prescribed Epidiolex (54).

Although there is some scientific support for the use of cannabinoids for certain conditions, such as MS and epilepsy, there is still uncertainty about the optimum dose and the specific patient groups for which they are particularly suitable (55). There is also a lack of long-term follow-up studies of the effects. It remains unclear just how good cannabinoids are at combating pain, with various studies underway to analyse the effects and side-effects in more detail. The most recent major review of the research, conducted in 2018, showed that 29 percent of patients who received cannabinoids (synthetic or natural) obtained 30 percent pain relief, while almost as high a proportion, 26 percent, obtained the same pain relief from a placebo (56).

6. Legal aspects

Cannabis is classified as a narcotic substance under the UN Single Convention on Narcotic Drugs. This means that the drug may only be used for scientific and medical purposes (as approved medication) and that its possession, cultivation and sale is prohibited. Most countries in the world have ratified the convention, which means that it must be incorporated into their national legislation. However, the form that the legislation takes, and particularly the way it is applied, varies greatly from country to country. In the Netherlands, it has long been legal to sell cannabis in 'coffee shops', but cultivation is prohibited, as is possession of large quantities. In Denmark, trading cannabis used to be permitted in Christiania, but over the past 15 years the policy has changed, with an active focus on eradicating the drugs trade. Cannabis is banned under federal law in the USA, but a number of states have legalised it by various regulatory means. Sweden and many other countries have restrictive legislation that makes both possession and personal consumption of cannabis illegal. However, possession of a small amount for personal use carries a light punishment, usually a fine, while trade in large amounts of cannabis may be prosecuted as a serious drugs crime, usually resulting in imprisonment.

The debate about 'legalisation' of cannabis therefore needs to be more nuanced, since the question is really how the law regulates different parts of the cannabis chain, from cultivation and production to personal use, and what sentences apply when the law is broken. All societies have some form of regulation, such as control of cultivation, age limits and specific points of sale.

A term often used in the debate is 'decriminalisation'. This usually means not focusing the legislation on personal possession and use, but keeping cannabis trafficking and dealing illegal. Arguments in favour of decriminalisation include reducing the criminalisation and stigmatisation of young people who 'only' buy the drug for personal use, and the scope to free up police resources. The argument against legalisation, in the form of free production and sale, is that it would put cannabis on a commercial footing that would significantly increase its availability, and thus consumption. Many companies in the tobacco and alcohol industry are poised to enter the cannabis market, set up stores and begin marketing campaigns.

An extensive 'natural experiment' is under way in the USA, where a few states, notably Colorado, have gone a long way down the route of open sales and marketing. This has raised considerable concerns, particularly regarding children and young people, with several reports of a rise in injuries and poisonings (57, 58). Analysis of health service data from Colorado has also shown an increase in incidents such as road accidents and overdoses since the legalisation, in comparison with other states (59). It is currently too early to draw conclusions from ongoing policy changes around the world, but it is essential to monitor developments, in terms of both criminality and health effects.

7. Knowledge needs

Our summary presents strong evidence that cannabis use is linked to an increased risk of respiratory disease (e.g. chronic bronchitis), road accidents, lower birthweight in babies born to mothers who used cannabis during pregnancy, and psychotic disorders. There is scientific backing for the use of cannabis to alleviate epilepsy, and to relieve spasticity and neuropathic pain in MS sufferers. There are also scientific indications that cannabis use is associated with addiction and social problems, in the form of poor school results, employment issues and a need for social security benefits. Weaker evidence is available concerning cannabis use and cancer, cardiovascular disease, anxiety, depression, cognition (IQ) and violence.

Many questions remain unanswered when it comes to the potential effects of cannabis use. There are various reasons for this, often relating to the way the studies are designed and what information the researchers are able to access. There tends to be a lack of information about a key factor, such as tobacco, alcohol or other drug use, or the study population is far too small and not representative of the general population, or the follow-up time is not long enough to establish what is a cause and what is a possible

effect. Population-based studies rarely ask questions about drug use. When they do, the studies generally lack information about the age at which drug use began, how much is consumed, how often, and whether a person is a former user. Taken as a whole, these shortcomings often lead to ambiguous results.

The following is needed to bring clarity to these issues:

- Studies into the health effects of cannabis use in risk populations or unexplored groups, such as older, pregnant and breastfeeding women, frequent cannabis users and users with multiple health problems.
- Studies of short and long-term health outcomes for diseases never or rarely studied, such as various cancers, cannabis-related overdoses and other health problems (not least mental illness).
- Studies of the pharmacological properties of cannabis: how the effects relate to the way it is taken – through inhalation, tablets or some other means – and how the effects vary according to dose and strength.
- Studies that follow people over a long period, with recurring and detailed questions about cannabis use and other drug use, but also about alcohol, tobacco, social situation, lifestyle and ill-health.

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