

# Further sources

## **The European school survey project on alcohol and other drugs**

<http://www.espad.org>

<http://www.espad.org/sites/espad.org/files/TD0116475ENN.pdf>

## **National institute on drug abuse**

<https://www.drugabuse.gov>

<https://www.drugabuse.gov/drugs-abuse/commonly-abused-drugs-charts>

## **Erowid**

[erowid.org](http://erowid.org)

# Routs of administration

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<b>Route</b>	<b>Absorption</b>	<b>Rapidity of effect</b>
Eat/drink	absorption	slow (10 to 20 minutes)
Subcutaneous	skin tissue (injection)	slow
Intramuscular	muscle tissue (injection)	slow to medium
Chewing	oral mucosa	medium (several minutes)
Rectal	rectal mucosa	medium
Vaginal	vaginal mucosa	medium
Snuffing	nasal mucosa	rapid (< one minute)
Smoking	pulmonary alveoli	very rapid (< 10 seconds)
Intravenous	blood stream (injection)	very rapid

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ADDICTION

CAFFEINE,  
NICOTINE,  
CANNABIS,  
ALCOHOL

# CAFFEINE

- Alkaloid found in many plants (in coffee, tea, guarana), very similar to other alkaloids found also in tea (theobromine, theophylline)
- Legal in all countries, but some have legal regulation e.g. in amount of caffeine per 100ml of drink or age limit for availability of energy drinks
- Probably the most widely used psychoactive substance in the world

# biological properties

- Adenosine antagonist
- Adenosine is inhibitor in CNS - promotes sleep and suppresses arousal
- Caffeine binds to adenosine receptors. Secondary to decrease of adenosine in brain, increase of dopamine follows
- Absorbed via stomach to blood stream and reaching brain within 5-30 minutes. Stimulating effect peaks in 15-45 minutes. Effect can last up to 2-4 hours.
- Metabolised is via liver and excreted via urine. Half-life about 5 hours, but less in smokers and more in pregnant women (up to 18 hours; it can get to milk and to babies who metabolised it up to 30 hours).

# dosage

- Threshold usage - 10 mg
- Lethal usage 3-20 grams (LD50 in rats 192 mg)
- espresso has 60-100mg of caffeine, cup of filtered coffee 100-120 mg, cup of tea 40-80 mg, glass of coke 50 mg, high quality chocolate on average 35 mg, can of energy drink 80-300 mg
- Daily recommended intake 200 mg (maximum 400mg) for healthy adults; 2.5 mg per 1kg of body weight for adolescents. Best results in high energy sports found in about 3 mg per kg of body weight
- Although rare, overdose resulting to death have been reported

# effects

- Physical effects: increases heartbeat, respiration, basal metabolic rate, production of stomach acid, production of urine; it relaxes smooth muscles e.g. bronchial muscle.
- Subjective effects: increased reactions, concentration, focus; decreased fatigue and sense of effort in physical activity
- Beneficial health effects: Mild protective factor of dementia and Alzheimer's disease; protective factor from depression; removing effects of common cold and respiratory illnesses; helps to promote healthy life style by removing sense of effort in physical activities; helps in low-pressure problems
- Confirmed positive effects in concentration, vigilance and increased safety in military, shift works etc. (e.g. regular caffeine consumption halves the risk of a car accident)
- Best results in endurance sports and high-intensity sports (e.g. football, rowing), unclear results in short-term power sports (lifting, sprint) – pills are recommended over coffee

# effects

- Negatively effects quality and quantity of sleep
- Heavy use or use by sensitive people increases anxiety, ulcer problems, heart problems and high pressure problems, osteoporosis. It may cause constipation
- Avoid or at least decrease consumption in pregnancy and during breastfeeding period
- Some doubts about positive effects in e.g. increased concentration – the effect may be related just to removal of caffeine withdrawal symptoms and because of taking a break for coffee



# addiction

- Some experts reject addiction to caffeine as substance addiction
- Overdose produces restlessness, dizziness, nausea, headache, tense muscles, sleep disturbances, and irregular heartbeats, extreme overdose may include also anxiety attack, including delirium
- Regular people develop emotional and mental dependency to their 'everyday cup', heavy user may develop withdrawal symptoms like headaches, lethargy, nervousness, inability to focus
- No cross-sensitization with other substances and no comorbidity with other substances except nicotine. Concerns in case of use with alcohol – it may mask awareness of alcohol intoxication.
- Overdose reported in few countries - energy drinks and children

# emerging problem in youth?

- Steep increase of caffeine drinks consumption in current adolescents – majority of them on daily basis (coke, ice tea, energy drinks)
- Soft drinks include high amount of sugar – their consumption reinforce poor dietary habits and contribute to obesity
- High caffeine consumption may prime brain reward circuits to other drugs e.g. nicotine
- Children learn to use caffeine drinks to improve moods and thus may be more likely to repeat such coping with other substances
- Caffeine often combined with alcohol makes binge drinking worse
- Energy drinks are calibrated to healthy adult – adolescents' physiology has bigger problems with metabolising it – more problems with anxiety, hyperactivity, insomnia that strongly impact developmental processes (e.g. learning, school results)
- Energy drinks are preferred by children with hyperactivity and various externalising behaviours – and caffeine has the worst impact on them

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# Do sleeping habits mediate the association between time spent on digital devices and school problems in adolescence?

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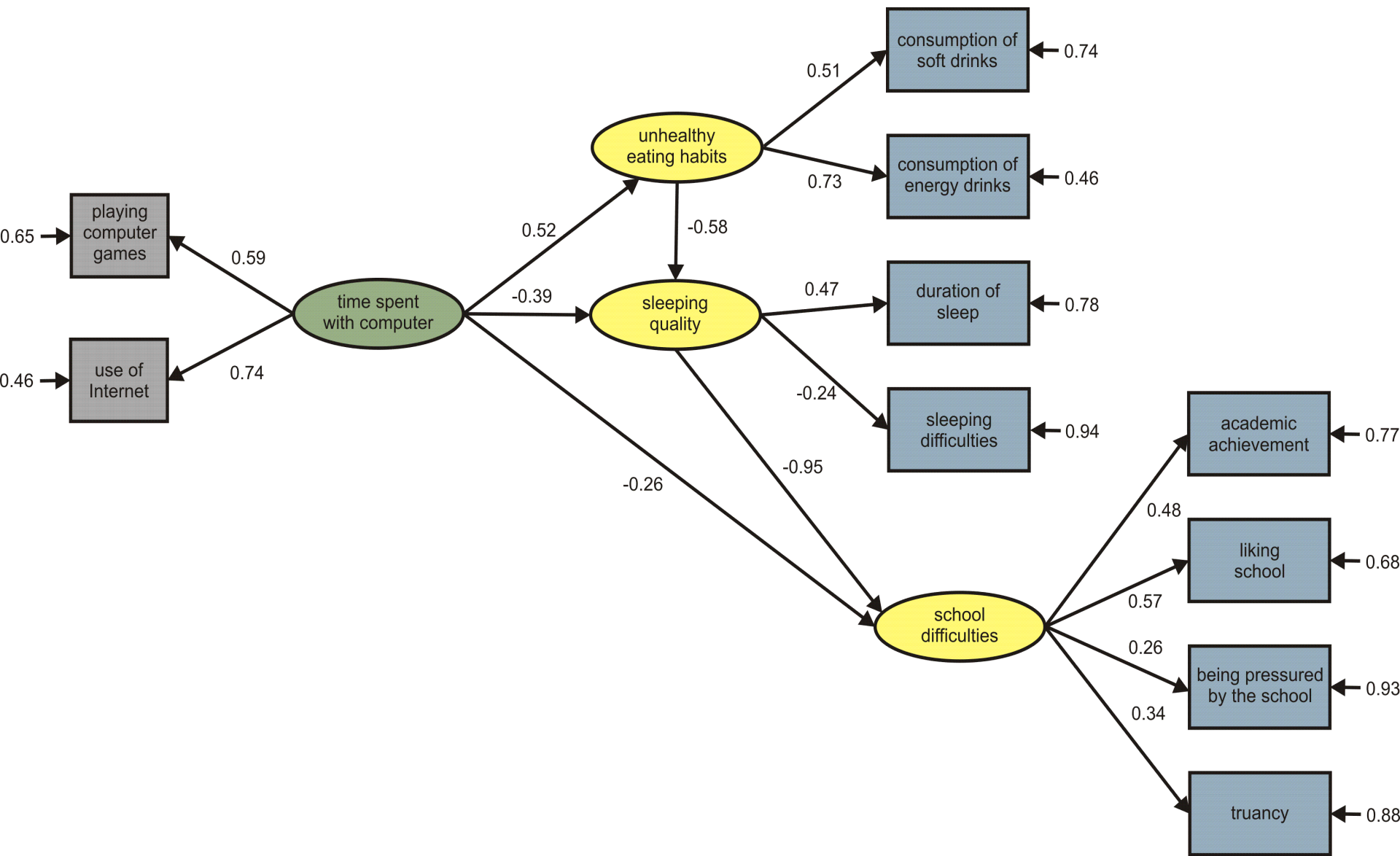
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**Background:** This study examined the associations of Internet and computer screen time with school difficulties and the role of sleep quality and soft and energy drinks consumption. **Methods:** We used data from the cross-sectional Health Behaviour in School-aged Children study collected in 2014 among Slovak adolescents (aged 11–15).



The association of time spent with a computer with school difficulties mediated by caffeine-rich drinks consumption and sleeping quality: a structural equation model. Goodness of Fit: Chi2=56.28; df=30; Chi2/df=1.87; p=0.0025, RMSEA=0.011

# TOBACCO



# NICOTINE

- Alkaloid and the main psychoactive component of tobacco
- Stimulant – agonist of nicotinic acetylcholine receptors. Acetylcholine plays a role in various parts of brain - connected to arousal, attention, memory and motivation. Nicotine increases amount of adrenaline (increases blood pressure, respiration, heart rate), dopamine (pleasure and motivation), glutamate, and noradrenaline. Decreases GABA (inhibitor neurotransmitter) – “nicotine volumes up the system”
- <https://www.youtube.com/watch?v=yd46Hs7pTow>
- About 4000 various chemicals are released when tobacco is burned
- Effects are heavily influenced by the user – personal context, although it is more a stimulant than a sedative

# dosage

- Inhaled - effect starts in 10-20 sec and lasts about 10-30 minutes
- Oral – effect starts in 2-5 min and lasts 1-2 hours
- Depending on type of tobacco and the way of smoking, between 1 to 3 mg of nicotine one gets from a single cigarette. Nicotine gum usually has 2 to 4 mg. Nicotine patch usually has 7, 14, 21 mg (but released during within longer period – up to 24 hours).
- LD50 for mice about 3mg. Unclear for humans – reports from 60mg (unlikely) to 500mg. Resistance to nicotine is massively influenced by tolerance
- Overdose can happen in unexperienced smokers (e.g., in waterpipes) and via skin exposure in agriculture use (tobacco is used as insecticide). Media panic about drinking nicotine liquid used in e-cigarettes
- Deaths have been caused by ingesting water that had cigarettes steeped in it or drinking insecticide brew. Death is often prevented because high nicotine intake causes vomiting.





# effects

- Because it volumes-up several neurotransmitters, effects can be paradoxical
- It can act as both stimulant and relaxant - it increases heart rate and blood pressure but also reduces anxiety and relaxes muscles (but smokers usually have elevated anxiety compared to non-smokers)
- Improves cognitive functions, concentration, and (simple) task performance
- Increases liking of other activities
- Nicotine tends to reduce appetite (hence increased weight after terminated smoking can serves as a reason for relapse)

# addiction

- Nicotine is highly toxic and creates dependency quickly (compared to other substances) with high changes in tolerance
- Smoking is very strong reinforcer – 10 puffs per cigarette = 300 puffs per packet if one smokes one packet per day = behaviour that is repeated 300 times per day and brain that is hit by reinforcing substance 300 times per day
- Nicotine increases levels of dopamine in Nucleus accumbens that leads to more liking of activities we do while smoking - that leads to increased wanting of smoking in those situations.
- As smoking helps to deal with stress, tendency to smoke increases in stressful situations
- Effect on brain seems to be very long-lasting or even permanent
- In treatment – crucial are positive coping skills (coping with stress), social support (quitting is taken seriously by close social circle), avoiding smoking environments. Nicotine replacement helps

# epidemiology

- Prevalence of smokers 20-30% in developed countries with about 10-15% dependent smokers in general public. Up to 70% of smokers become addicted (the highest in all drugs). Number of smokers, even addicted and even children, on the rise in developing countries.
- 85% of smokers would like to stop, 30% made at least three serious life attempts. 80% of smokers relapse within 6 months after quitting attempt
- Men smoke more often – but almost no gender gap in developed countries
- Those of lower social-economical status are more likely to start and continue smoking (not valid for many developing countries)

# risk groups

- **Adolescents** – most smokers start here, earlier start correlates with lifetime use
- Lower social-economical status
- Mental illness – 70% with psychiatric diagnosis are smokers; over 90% of schizophrenics are smoking
- Prisoners – 85% relief from boredom, stress

# Public health concerns

- Smoking (not necessarily nicotine itself) is one the most important public health issues – causes number of diseases, smokers live 10 years less on average. 1 in 10 premature deaths (1 in 5 in developing countries)
- Associated in both active and passive smokers with:
  - Lung diseases, chronic bronchitis, asthma
  - Cancer of lung, mouth, kidney, oesophagus, pharynx, larynx, stomach, pancreas, cervix, ureter, and bladder
  - heart disease including stroke, vascular disease, heart attack
- Pregnant smokers: increased risk of stillborn, premature, or low-birth weight infants, sudden infant death syndrome. Pregnancy – 40% of infant deaths are attributed to mother smoking

# CANNABIS



[https://www.youtube.com/watch?v=PRLYV0\\_6zY8](https://www.youtube.com/watch?v=PRLYV0_6zY8) especially between 15:00 and 30:00

# Cannabis

- Flowers, stems, leaves, seeds of hemp plant (usually taken from the flower top). Also in concentrated resinous form (Hashish) or black oil (Hash oil)
- Smoked or eaten – smoked has quicker but smaller effect. Eaten is slower but with much stronger effect
- The main psychoactive substance is tetrahydrocannabinol (THC). It resembles endocannabinoids (e.g. anandamide – it decreases refractory period and neurons can fire immediately). THC last longer than endocannabinoids – prolonged effect
- They also influence opioid system in nucleus accumbens – causing slightly higher release of dopamine (causing euphoria and enjoyment). It also increases levels of noradrenaline that can lead to higher anxiety. Receptors are also in peripheral system and immune system – cannabis have anti-inflammatory and analgesic effect
- It has both relaxant/depressant and stimulating effects (e.g. some people feel sleepy while others feel aroused) - depending on person and context
- <https://www.youtube.com/watch?v=oeF6rFN9org>

# dosage

- Amount of active substances in cannabis is fluctuating heavily. Amount of THC steeply increased after 2000.
- In general in not very experienced person – one hit (mouth full of smoke) should be enough. With average potency, three hits are enough for experience person.
- It is recommended to smoke about a quarter of hit and wait for 5 minutes. Then repeat in necessary.
- Eating is not recommended for beginners – overdose may often happen with attack of panic
- No direct deaths reported (only caused by injuries while driving under influence e.g.)



# effects

- Smoking - onset 20-90 seconds, duration 2-4 hours
- Eating – onset 20-120 minutes, duration 12+ hours

- **Positive effects “high”**

mood lift, euphoria, boring tasks or entertainment can become more interesting or funny

increased giggling and laughing

relaxation, stress reduction

creative, philosophical, abstract, or deep thinking : ideas flow more easily

increased appreciation or awareness of music; deeper connection to music;

increased emotional impact of music

increased awareness of senses (taste, smell, touch, hearing, vision)

change in experience of muscle fatigue; pleasant body feel; increase in body/mind connection

medical use: pain relief (headaches, cramps), reduced nausea, increased appetite

# effects

- **neutral to negative**

general change in consciousness, time dilation and compression

slowness (slow driving, talking)

tiredness, sleepiness, lethargy

stimulation, inability to sleep (less common)

mouth dryness, sticky-mouth (varies with strain)

interruption of linear memory; difficulty following a train of thought

difficulty with short-term memory

panic attacks, anxiety, paranoia

coughing, asthma, upper respiratory problems

higher risk-taking (e.g. risky sexual behaviour in women, risky driving)

# long-term health effects

- Positive health effects – decreases eye pressure, effective in chronic pain treatment
- Can influence existing or predisposition to psychosis (schizophrenia) and depression
- Poor motivation (and thus e.g. lower school results)
- Respiratory illnesses (asthma,...), poor lung functioning, lung cancer
- Impaired reproduction capacity (in males)

# addiction

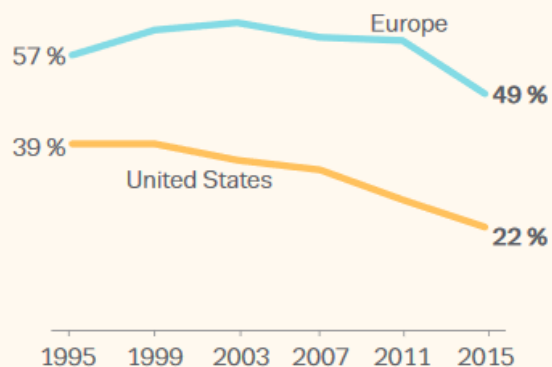
- All symptoms of cannabis addiction have been described
- Cannabis is only slightly addictive (some experts claiming it is not addictive at all) – it secondary affects dopamine reward circuits. Problem may increase with increasing amount of THC in plants
- Withdrawal is mild and not life threatening but may lasts up to several weeks. Symptoms include lethargy, loss of appetite, headaches, difficult sleeping, slowed thinking and talking
- Hangover exists - irritated eyes, memory impairment, slow thinking, fatigue
- Believe that endangered group are teenagers - cannabis may prepare their reward system for hijacking by another substance

# gateway hypothesis

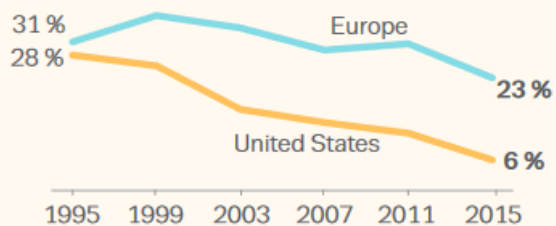
- Stepping stone / escalation / progression hypothesis - Does marijuana open doors for other drugs?
- Based on observation – illicit drug users used marijuana before. But correlation does not necessarily constitute causation. Longitudinal population studies show mixed results. Gateway hypothesis is often used within “moral model of addiction” and used to reason “war on certain drugs”
- Animal studies – exposure to one substance (changes in reward system) increases susceptibility to another substance. Regular exposure to THC increases preference to heroin or nicotine
- Social and cultural context – when marijuana is not common, other substances serve as a gateway.
- Other important factors play more important role – especially social-economical factors like unemployment are very strong
- From substance use perspective, the strongest predictor is use of alcohol and tobacco in early-mid adolescence (and even soft and energy drinks)
- Should be marijuana legal? When marijuana is pushed to black market, it is associated with other illicit substances. It is less addictive and with less negative effects than alcohol or tobacco. But we have more history and “social norms” with alcohol and tobacco. But marijuana has also great medical potential and this potential is underused because of illegal status.

## SUBSTANCE USE AMONG SCHOOL STUDENTS IN EUROPE AND THE UNITED STATES

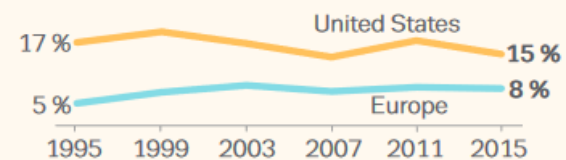
### Alcohol



### Cigarettes

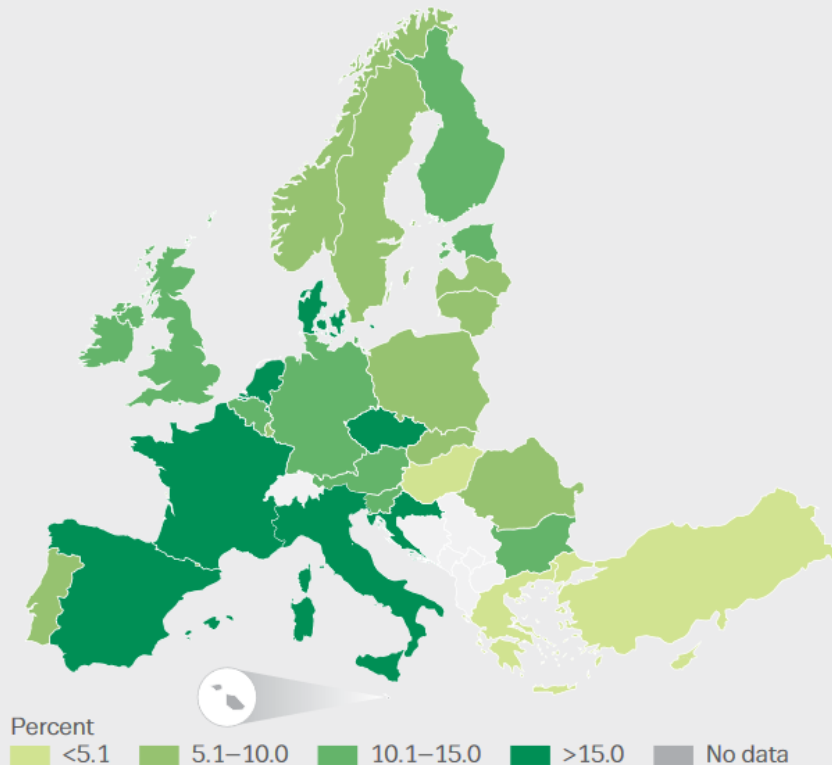


### Cannabis



NB: Trends in last month substance use among 15- to 16-year-old school students in Europe and the United States. European averages (unweighted) are based on data from 21 EU countries and Norway (source: [ESPAD](#)). US averages are based on samples of 10th grade students (source: [Monitoring the Future](#)).

Last year prevalence of cannabis use among young adults (15–34): most recent data (map) and selected trends



Last year prevalence rates among 15- to 34-year-olds range from 3.5 % in Hungary to 21.5 % in France.

Among young people using cannabis in the last year, the ratio of males to females is two to one.

The most recent survey results show most countries to be reporting either stability or only slight increases in last year cannabis use among young adults

Around 1 % of European adults are daily or almost daily cannabis users (in US estimated 4% of general population being dependent to Cannabis)

About 150000 of Europeans were in treatment in 2016 for cannabis use – increasing trend

# ALCOHOL







# alcohol

- Ethanol or ethyl alcohol
- Made by fermentation of starch, sugar, and other carbohydrates
- GABA agonist and Glutamate antagonist – it is a depressant. But also activates opioid receptors that release more of endorphins that leads to more release of dopamine and serotonin in nucleus accumbens
- Effect in various parts of brain: nucleus accumbens and amygdala – pleasant and euphoria; cerebral cortex – slows down thinking; prefrontal cortex – shuts off inhibition in thinking and behaviour; cerebellum – loss of coordination; hypothalamus – mood regulation, increases sexual arousal but decreases sexual performance; medulla – increases sleepiness, decreases breathing, lowers body temperature
- <https://www.youtube.com/watch?v=B-EmeQg40wE>

# dosage

- Coming up effect in 15 minutes after ingestion
- Plateau effect in 30-60 minutes
- Coming down effect in 45-60 minutes
- Hangover can last up to 36 hours
  
- Effects are influenced by blood alcohol content (BAC)
- Effects is influenced by gender, genetic predisposition, speed of intake, combination with food (full stomach slows alcohol absorption), type of drink,...
- Death may occur because of overdose itself (e.g. suppressed breath in BAC above 0.30%), by swallowing vomit in sleep, by accidents or even by bad withdrawal symptoms (delirium tremens). Deadly dosage about 0.50% BAC

<b>BAC</b>	<b>Predictable Effects</b>
.02% to .04%	Lightheaded – Relaxation, sensation of warmth, "high," minor impairment of judgment
.05% to .07%	Buzzed– Relaxation, euphoria, lower inhibitions, minor impairment of reasoning and memory, exaggerated emotions (good and bad)
.08% to .10%	Legally Impaired – Euphoria, fatigue, impairment in balance, speech, vision, reaction time and hearing, judgment and self-control are impaired
.11% to .15%	Drunk – "High" reduced and depressive effects (anxiety, depression or unease) more pronounced, gross motor impairment, judgment and perception severely impaired
.16% to .19%	Very Drunk – Strong state of depression, nausea, disorientation, dizzy, increased motor impairment, blurred vision, judgment further impaired
.20% to .24%	Dazed and Confused – Gross disorientation to time and place, increased nausea and vomiting, may need assistance to stand/walk, impervious to pain, blackout likely
.25% to .30%	Stupor – All mental, physical and sensory functions are severely impaired, accidents very likely, little comprehension, may pass out suddenly
.31% and up	Coma – Level of surgical amnesia, onset of coma, possibility of acute alcohol poisoning, death due to respiratory arrest is likely in 50 % of drinkers

# effects – short term

## **Positive**

- Relaxation & mood lift
- increased sociability & reduced social anxiety
- analgesia (kills pain)

## **Neutral**

- slurred speech
- drowsiness, sleepiness
- mild visual distortions
- changed (often increased) response to sexual stimuli & changed aesthetic appreciation: normally beautiful things can seem ugly and vice versa
- reduced impulse control

# effects – short term

## **Negative**

- dizziness and confusion
- emotional volatility (anger, violence, sadness)
- nausea, vomiting
- blackouts and memory loss
- decreased ability to maintain erection in males and inability to reach orgasm in females
- unwanted sexual encounters (date rape)
- coma and death at extreme doses
- frequent urination
- Poor sleep quality and quantity – disrupted sleep patterns

# Effects – health and harm

- Reduced risk of heart diseases (strokes, arrhythmia,...)
- Increased risks of cancer: oral, throat, liver, breast
- Liver cirrhosis
- Injuries from accidents and risky behaviour
- Fetal alcohol syndrome
- Suicides, suicide attempts, self-harm behaviour
- Poor nutrition (e.g. Wernicke-Korsakoff Syndrome – memory impairment due to low levels of vitamin B Thiamine)
- Criminality

# addiction

- Up to 5% of western population
- Tolerance is created because brain removes some GABA, dopamine, glutamate and serotonin receptors – more alcohol is needed to achieve the effect (but poisoning happens normally. With increasing degeneration of body, even faster poisoning may happen)
- Bad alcohol hangovers are considered to be worse than the day-after effects of nearly any other psychoactive
- Cue reactivity & withdrawal – brain is learned to react by fastening itself (increased heart rate, increased blood pressure) when it expects some alcohol. If the alcohol is not coming, one is feeling miserable. The alcohol is then needed just to feel normal
- Withdrawal – starts hours after last drink, persists for weeks. Delirium tremens – few days after last drink – visual and tactile hallucination, fever, strong anxiety, death rate 5%