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UNITED NATIONS OFFICE ON DRUGS AND CRIME
Vienna

WORLD DRUG REPORT 2025

UNITED NATIONS
New York, 2025

PREFACE

Every year, the *World Drug Report* aims to provide an accurate, scientific and impartial overview of drug trends and patterns around the world. This year's report paints a picture of a global market that is growing steadily and shifting rapidly, with serious consequences for people in every part of the world.

As at 2023, some 316 million people worldwide had used drugs in the past year, representing an increase over the past decade that outpaces population growth, which indicates a higher prevalence of drug use. We are witnessing growing demand fuelled by a combination of factors, as well as growing supply from a relentless and adaptive illicit trade, both of which inflame – and are inflamed by – global instability, in a vicious cycle.

The synthetic drug market has expanded rapidly in the recent past and shows no signs of slowing down. Seizures of amphetamine-type stimulants worldwide broke records in 2023 and represented close to half of all synthetic drug seizures. Synthetic opioids also remained a major challenge, and the swift and concerning emergence of nitazenes continued in some markets. Global cocaine production has hit an all-time high once again, accompanied by significant increases in cocaine seizures, cocaine users and – most tragically – cocaine-related deaths in many countries in recent years.

In some regions of the world, drug-related trends are being consolidated and confirmed. Western and Central Europe continue to report more cocaine seizures than North America, thus representing the new primary destination for the drug; synthetic opioids continue to present an acute threat in North America, although the number of related deaths has decreased; the non-medical use of tramadol continues to plague West and Central Africa; and methamphetamine has maintained its upward trend in South-East Asia.

In other parts of the world, events have disrupted recent patterns and left the future uncertain. "Captagon" originating in the Syrian Arab Republic has flooded the Near and Middle East in recent years, but the country's political transition may trigger shifts in both production and trafficking. Opium production has remained comparatively low following the 2022 drug ban in Afghanistan, but economic pressures faced by farmers threaten this trajectory, while the emergence of synthetic opioids as an alternative for opiate users is also a danger. These volatile situations will present challenges and opportunities in the coming period.

What is clear from the research is that drugs and the ever-changing illicit drug market have a very real impact on our lives and our societies. For the first time, this year's report dedicates a chapter to the many impacts of drugs, encompassing the impacts on individuals and the well-being of families and communities.

One major concern is drug use among young people, which can be particularly damaging, resulting in higher rates of healthy years of life lost. On average, young people around the world use drugs at least as much as adults. Another notable challenge is the persistent difference in how drugs affect different people, including men and women, and the gaps in treatment available to them.

Beyond drug use itself, the illicit drug market has far-reaching consequences. Drug trafficking continues to drive organized crime and generate criminal profits, and associated violence has risen rapidly in some instances, including in countries of origin, transit and destination.

The good news is that many of the losses and tragedies caused by drugs are not inevitable, but preventable. Much of the evidence in this edition of the *World Drug Report* speaks for itself. It speaks for investing in the prevention of drug use at an early age; for science-based, voluntary and equally accessible treatment and services; for criminal justice responses that focus on disrupting the illicit market while treating all people with dignity; and for measures that are tailored to context and responsive to the particular needs of people.

I hope that this edition of the *World Drug Report* can provide clarity on global and regional drug patterns and help advocate an approach that places science and people at the centre.

Ghada Waly, Executive Director
United Nations Office on Drugs and Crime

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EXPLANATORY NOTES

The designations employed and the presentation of the material in the *World Drug Report* do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Countries and areas are referred to by the names that were in official use at the time the relevant data were collected.

Since there is some scientific and legal ambiguity about the distinctions between "drug use", "drug misuse" and "drug abuse", the neutral term "drug use" is used in the *World Drug Report*. The term "misuse" is used only to denote the non-medical use of pharmaceutical drugs.

All uses of the word "drug" and the term "drug use" in the *World Drug Report* refer to substances controlled under the international drug control conventions, and their non-medical use.

The term "seizures" is used in the *World Drug Report* to refer to quantities of drugs seized, unless otherwise specified.

All analysis contained in the *World Drug Report* is based on the official data submitted by Member States to UNODC through the annual report questionnaire, unless indicated otherwise. Sex-disaggregated analysis has been included wherever possible.

The data on population used in the *World Drug Report* are taken from: *World Population Prospects*: *The 2024 Revision* (United Nations, Department of Economic and Social Affairs, Population Division).

References to dollars ($) are to United States dollars, unless otherwise stated.

References to tons are to metric tons, unless otherwise stated.

The following abbreviations have been used in the present module:

3,4-MDP-2-P	3,4-methylenedioxyphenyl-2-propanone
ADHD	attention deficit hyperactivity disorder
AUC	*Autodefensas Unidas de Colombia* (United Self-Defense Forces of Colombia)
APAA	*alpha*-phenylacetoacetamide
APAAN	*alpha*-phenylacetoacetonitrile
ATS	amphetamine-type stimulants
CESAN	Environment and Public Health Command
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COVID-19	coronavirus disease
CRU	Clan Lab Response Unit
CV	*Comando Vermelho*
DALYS	disability-adjusted life years
EMCDDA	European Monitoring Centre for Drugs and Drug Addiction
EU	European Union
EUDA	European Union Drugs Agency
Europol	European Union Agency for Law Enforcement Cooperation
FARC-EP	*Fuerzas Armadas Revolucionárias de Colombia – Ejército del Pueblo* (Revolutionary Armed Forces of Colombia – People's Army)
GDP	gross domestic producty
HCV	hepatitis C virus
HHC	hexahydrocannabinol
HIV/AIDS	human immunodeficiency virus/acquired immunodeficiency syndrome
IMDPAM	isopropylidene (2-(3,4-methylenedioxyphenyl)acetyl)malonate
INCB	International Narcotics Control Board
ISO	International Organization for Standardization
LFO	National Facility Dismantling
LTWP	Technical and Scientific Police Laboratory

EXPLANATORY NOTES

MAMDPA	methyl 3-oxo-2-(3,4-methylenedioxyphenyl) butanoate
MDMA	3,4-methylenedioxymethamphetamine
MDMA HCI	3,4-methylenedioxymethamphetamine hydrochloride
MNCPC	Mission for the Control of Chemical Precursors
NAAC	National Addictions Authority, Cyprus
NICC	National Institute for Criminalistics and Criminology
NPS	new psychoactive substances
PCC	*Primeiro Comando Capital*
PMK	piperonyl methyl ketone
PTSD	post-traumatic stress disorder
QALYs	quality adjusted life years
THC	tetrahydrocannabinol
THC-COOH	11-nor-9-carboxy- Δ9 tetrahydrocannabinol
UNODC	United Nations Office on Drugs and Crime
WHO	World Health Organization

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CONTENTS

THE IMPACT OF DRUG USE

THE IMPACT OF DRUG USE

Key takeaways

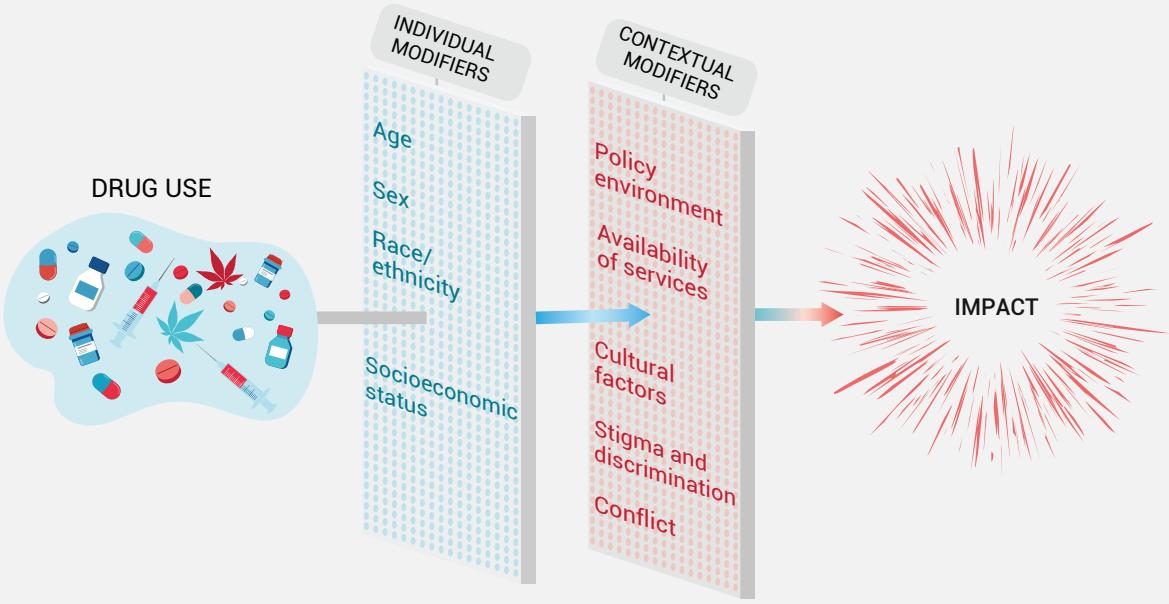
► **The impacts of drug use are many and varied.** Drug use has myriad impacts – on people, on social relations, on levels of criminality and violence, on the environment, on various aspects of the economy, and on the health status of people and communities. The many and varied impacts of drug use do not occur in isolation; they overlap, combine and interact. Several factors or characteristics, such as the drugs themselves, how they are consumed, their method of use, the age and sex of the user, contextual factors related to policy, cultural factors, stigma, and the availability of services, interact in different ways to exacerbate or modify the extent, depth and breadth of the impact, as well as determine the different pathways of impact of drug use.

► **The negative health impact of drug use is considerable, but mostly preventable.** Most of the harms caused by drug use, the impact of drug use and drug use disorders are preventable or can be mitigated by acting on different modifiers. Nevertheless, the negative health impact of drug use, as quantified by healthy years of life lost due to disability and premature death, or disability-adjusted life years (DALYs), is significant, because services that could reduce that impact are not available in sufficient number.

► **The availability of quality drug use prevention interventions, treatment and other services remains limited.** Wider availability and accessibility of scientific evidence-based, quality drug use prevention interventions, treatment and other services that address individual and contextual factors such as stigma and socioeconomic conditions among the affected population could not only mitigate the harm caused by and health impact of drug use but also modify the pathways of impact of drug use and drug use disorders on health. By contrast, an absence or dearth of quality, evidence-based services not only increases harm but also exacerbates the health impact of drug use.[1, 2]

► **Drug use treatment services remain inadequate worldwide, especially for women.** Globally, just 1 in 12 people with drug use disorders are estimated to have received any form of drug treatment in 2023. The proportion was even lower in some regions and among women.[3] Worldwide, only 1 in 18 women with drug use disorders, compared with 1 in 7 men, received treatment that year. Furthermore, just 18 of every 100 people who inject drugs accessed opioid agonist therapy, and an annual average of 35 needles and syringes per person who injects drugs were distributed.[4] In prisons, the availability of treatment and healthcare services is even more limited than in the community.[5, 6]

Impact of drug use is influenced by individual and contextual factors (modifiers)



Introduction

The impact of drug use is multifaceted and goes far beyond the health of people who use drugs. Drug use has many other repercussions for people who use drugs, their families and communities across multiple dimensions, because social relations, family resources, the community, socioeconomic status, public safety and the criminal justice system are also impacted by drug use. Moreover, the varied impacts of drug use affect people differently, as various mediators or factors interact, overlap and combine in different ways, defining many pathways of impact across the various dimensions.

The aim of this chapter is firstly to map the pathways of impact of drug use by identifying the factors that can exacerbate or mitigate the extent, depth and breadth of that impact. The chapter then zooms in on one element of this by closely examining the impact of drug use on health, providing examples based on the use of opioids, as the drugs with the most serious outcomes, and the use of cannabis, as the most commonly used drug globally. Examples related to other drugs are provided where relevant, but the chapter is focused solely on drug use and does not analyse the impact of drug production, trafficking or supply.

Understanding the impact of drug use across different dimensions is key to the formulation of policies and interventions aimed at addressing and mediating the factors that affect drug use and mitigating the adverse impact of drug use and drug use disorders. The relationship between an episode of drug use and its related harm or impact is

Explanation of key terms: impact, risk and harm

The impact of drug use encompasses the wider effects of drug use on individuals and society. It is linked to but different from the risk of drug use and broader than the harm that stems from it. In principle, the impact can be positive or negative; if negative, it is often referred to as harm. The negative impacts of drug use can include high healthcare costs and reduced quality of life – effects that are harmful to both society at large and those affected by drug use disorders. The impact of drug use can also include perceived physical, social or mental health benefits, however, particularly at the outset, when people may be seeking certain short-term experiences or to self-medicate, despite the risk of prolonged drug use having a harmful impact.

Any kind of drug use can carry with it a risk, which is defined as the likelihood or probability that using drugs will lead to negative outcomes. The risk of a negative health outcome from drug use exists even in the case of one-off use. Injecting drug use, for example, carries the risk of contracting HIV or experiencing a non-fatal or fatal overdose, and driving under the influence of drugs carries the risk of being involved in a road traffic accident.

The negative consequences of drug use are defined as harms. Harms can be direct or indirect, they can include physical health problems, such as contracting HIV or hepatitis C through contaminated injecting equipment, and mental health problems, such as anxiety and depression, or they can be social, such as relationship issues and legal problems caused by drug use.

Objective and subjective perspectives for measuring the impact of drug use and drug use disorders

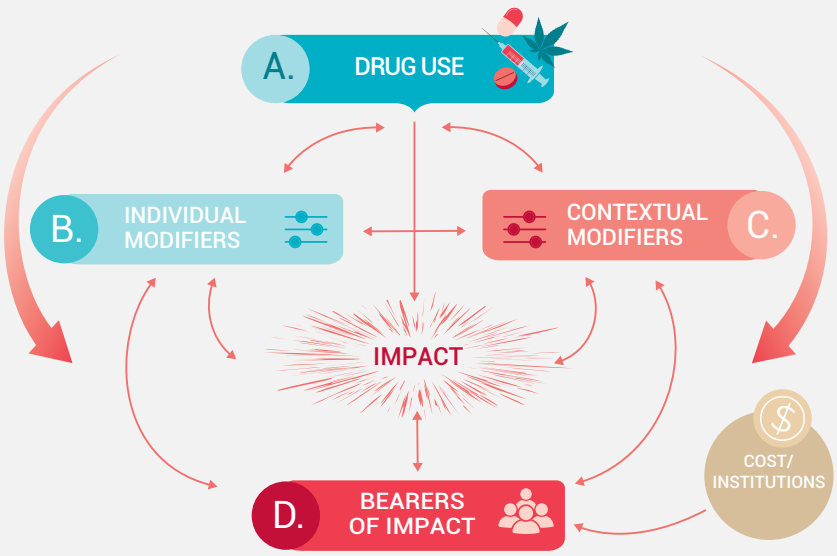
Different people perceive, analyse and measure the impact of drug use differently. For example, scientific research can give an objective perspective of the impact of drug use, while medical research can provide clear indications of its health consequences and the likelihood of developing disorders associated with it. Some consequences of drug use can be quantified and objectively measured, such as the number of people who have died as a result of drug use, the number of people who use drugs living with HIV and the economic costs associated with such use.

Some people may perceive higher or lower levels of harm than others or even perceive certain benefits to their drug use. The perspective of people who use drugs may also differ from that of their family and community. In Afghanistan, for example, people who used drugs on a regular basis perceived poor health, poverty and issues with employment as the three main harmful consequences of their drug use, whereas focus groups comprising family members of people who use drugs reported that drug use caused family violence, affected children negatively and was one of the main reasons for the collapse of family relationships.[a, b] Subjective perspectives can include assessment of the neighbourhood disruption caused by drug use and drug-related crime. Societal attitudes and norms, such as stigma and discrimination against people who use drugs and drug use disorders, are another set of subjective measures that can lead people to perceive the impact of drug use differently.

[a] UNODC, *Afghanistan Drug Insights Volume 5: High-Risk Drug Use in Afghanistan* (June 2025).

[b] UNODC, *Impacts of Drug Use on Users and Their Families in Afghanistan* (April 2014).

Drug use strikes different people differently as different mediators interact, develop and combine in different ways, defining many pathways of impact



Note: This is not intended as a strictly causal diagram; it represents the multiple pathways through which drug use is associated with various impacts. The term "modifier" is used to indicate that the factors affect the type and level (depth and breadth) of impacts. Terms such as moderator, mediator, confounder and collider are all terms used in statistics and causal pathway analysis all with specific meanings in that content. "Modifiers" has been chosen as a plain language generic term to describe the influence that various factors can have on the extent of impacts.

not unidimensional. There are multiple determinants of the impacts of drug use, which means that policy interventions such as the provision of sufficient services can also affect the pathways and mitigate the overall impact. Disentangling the pathways of impact can therefore help put in perspective, and thereby prioritize, the areas where most of the impact can be minimized or mitigated. It is important to note, however, that not all kinds of impact can be measured or quantified. Likewise, not all the different mediators or factors that can influence the impact are measurable, nor can the influence of a single mediator or factor be isolated from that of other factors.

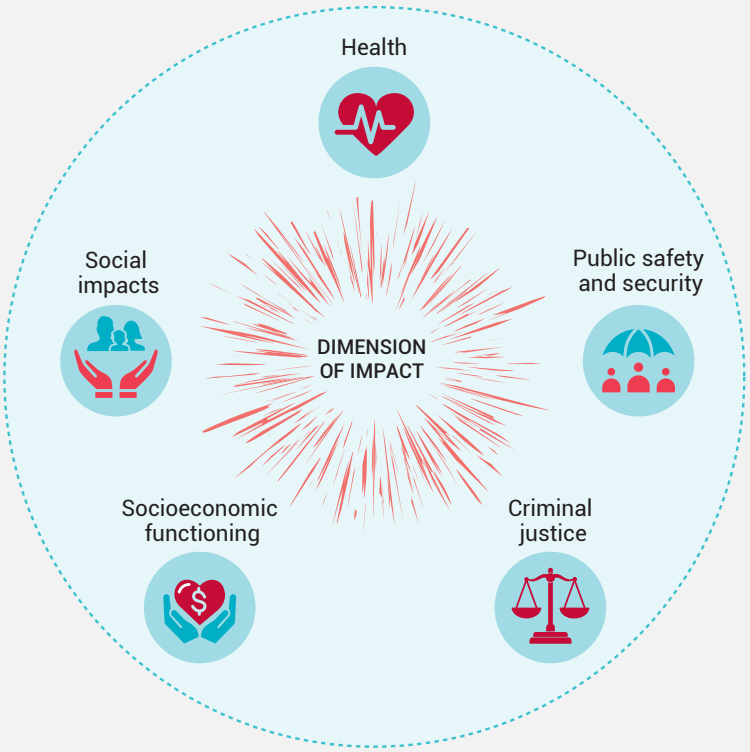
The present chapter proceeds in two parts. The first part considers the conceptual pathways of impact of drug use, that is, the factors that modify the impacts of drug use and exacerbate or interrupt the effects. Building on that concept, the second part delves into the health impacts of drug use more concretely. The terms "modifiers" and "mediators" are used throughout the present chapter as plain language generic terms to describe the influence that various factors can have on the extent of the impact of drug use.

Pathways of impact of drug use

Beyond drug use itself, the factors that can determine the impact of drug use include individual modifiers and contextual (external) modifiers. That impact is not only borne by those who use drugs but also by their family, not least their children, their community, their neighbourhood and society at large. Similarly, the impact of drug use is not only felt in terms of the health and well-being of people who use drugs and those around them but also in terms of its impact on society and on safety and security, all of which can lead to significant costs for society (see the text box below on estimating the cost of addressing drug use and of responses to drug use problems).

Moreover, the factors that can modify (exacerbate or mitigate) the impact of drug use can be related to the pattern of drug use and the context in which drug use occurs. The individual characteristics of the person using drugs, which are less likely to be modified per se, also define the intensity and types of impact. Factors related to those who bear the impact of drug use and drug use disorders may also modify the extent, depth and breadth of that impact (see infographic above).

Drug use has an impact on different dimensions



How drugs, patterns of use and individual factors can modify the intensity and nature of the impact of drug use beyond the health of the person who uses drugs

Drug use patterns and drug type

Just as drugs differ in terms of their potency and effects, the frequent, daily or near daily use of a drug, or the concurrent use of multiple drugs have different impacts on the effects experienced and outcomes compared with those resulting from the occasional or one-off use of a drug.

Individual modifiers

Many of the individual characteristics or factors that can modify the outcome and impact of drug use are not in the individual's control. They include genetics, sex and the stage of development at which initial exposure to drugs occurs, as well as personality traits that come from exposure to adverse childhood experiences and vulnerability to, or pre-existing, mental health disorders. Moreover, no one factor alone is sufficient to automatically lead to the initiation of or harmful patterns of use of drugs and, in many instances, these influences evolve over time.[7] That said, the age of initiation of drug use has a bearing on some elements of the impact of drug use. Drug use among adolescents, for example, can affect development and has the potential to disrupt their personal or academic lives, which in turn results in difficulties with educational achievement, occupational prestige and the transition to adulthood.

Sex and gendered roles also influence drug use and its consequences, as women suffer more severe social and economic consequences. They experience higher levels of stigma, shame and discriminatory responses than men but receive less social support for their drug use problems and face lower employment and income levels, among other issues. Race and ethnicity, including incarceration experiences, also influence the extent of impact of drug use.[8]

Contextual modifiers

Beyond the individual characteristics of the person using drugs, the contextual factors that can modify the impacts of drug use include the policy environment. For example, the criminalization of drug use and resulting incarceration of people who use drugs or have drug use disorders have high costs, both direct and indirect, for individuals, their families and the community, as well as placing a significant financial burden on State resources. Another example is the extent to which scientific evidence-based interventions that prevent drug use,[9] treatment services that address drug use disorders[10] and interventions that reduce the adverse health and social consequences of drug use[11] are available and accessible without prejudice.

The destruction of community and neighbourhood infrastructure that can occur in conflict situations is another contextual factor, as it often results in poor physical and mental health and community safety, which contribute to family- and individual-level stressors, as explored in the *World Drug Report 2022*.[12]

Furthermore, migrant communities experience the loss of social support networks and adverse socioeconomic conditions, traumatic experiences and social exclusion that can increase their risk of drug use; in addition, they often face barriers to accessing drug or health services in general.[13]

People who use drugs face different levels of stigma that can lead to them being denied essential health and social services. This denial, in turn, makes drug use more harmful. Cultural values, the social acceptability of drug use, descriptive norms and normative expectations also influence people's initiation of substance/drug use and related problem behaviours.[14, 15] Individuals' perceptions, especially young people, of the risk or harm of both occasional and regular drug use can predict how likely they are to begin and continue using drugs.[16, 17] The way drugs are portrayed in the media, the popular culture and social media can also impact public perceptions, especially of young people.

Bearers of the impact of drug use

Drug use and drug use disorders in a family member, can result in emotional distress and stress among other family members, not least children. Such effects can include the physical exhaustion and burnout of caregivers, especially if they are parents or grandparents.[18] The children of parents who use drugs or suffer from drug use disorders are also more likely to lack a safe nurturing environment. In addition, drug use in the family has a negative impact on the social and economic situation of family members because of the financial burden resulting from the loss of income, social stigma and shame stemming from drug use in the family.[19] Furthermore, intimate partner violence is reported to be common among men and women who live with people who use drugs, although a greater proportion of women than men are the victims of such violence.[20, 21]

Costs of drug use and of responses to drug use problems

The health and social impacts of drug use, as well as those related to safety and security, are associated with economic costs for people who use drugs, their families, society at large, the institutions involved in the response to the drug problem and even Governments. The tangible costs of drug use, such as the direct costs of healthcare provided to a person with a drug use disorder, or the indirect costs resulting from factors such as loss of productivity or the estimated value of a premature loss of life, can be measured. The intangible costs of drug use can include reduced quality of life or the suffering of an individual or family, which may not be economically measurable.

The costs resulting from drug use disorders can include:

- Individual-level social, economic and health costs for the person using drugs
- Loss of income for the person who uses drugs or their family, including in the form of out-of-pocket costs for the treatment of drug use disorders, or their unemployment
- Loss of productivity
- Cost of treatment and health and social care borne by the person who uses drugs, their family and society at large
- Cost of ensuring public safety and security
- Cost of criminal justice responses, including alternatives to incarceration, compulsory treatment, incarceration, rehabilitation and dealing with repeat offenders.

Estimating the cost of addressing drug use and of responses to drug use problems

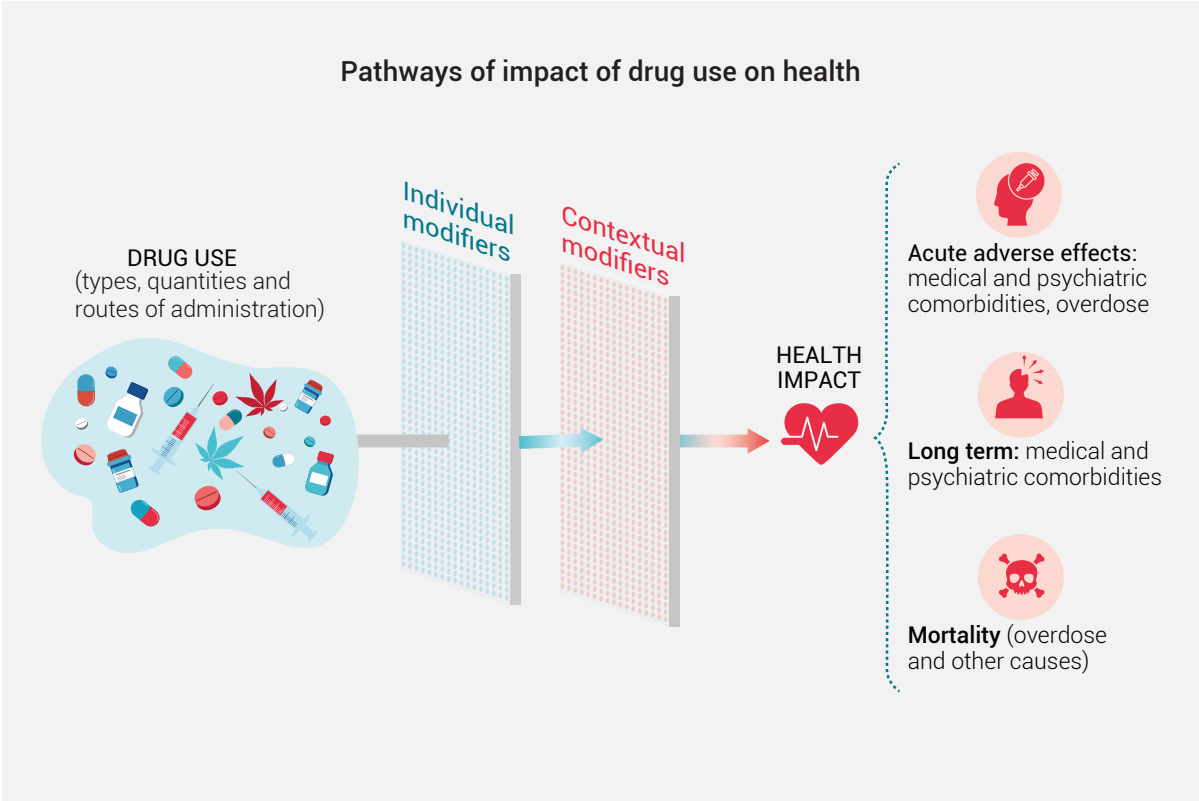
Previous attempts to estimate the cost of addressing the problem of drug use include estimates published in the *World Drug Report 2016*, in which, on the basis of 22 economic studies with different levels of coverage, it was estimated that the costs arising, both directly and indirectly, from the drug problem ranged between 0.07 and 1.7 per cent of GDP of the 14 countries studied.[a] The following table lists the results of three more recent studies as examples of the magnitude and composition of recent cost estimates.

Three illustrative examples of national estimates of costs incurred due to and to address the drug problem

	Total cost	Percentage of national GDP	Cost distribution
Cyprus 2016	60.58 million euros	0.33	• 76.3% direct costs of law enforcement efforts • 12.5% indirect costs of loss of income and productivity • 7.4% direct costs of (medical) treatment • 2.1% direct costs of coordination (NAAC) • 1.7% direct costs of prevention and research
Sweden 2020	3.7 billion euros	0.78	• 38.2% direct costs – among these, 47% for addressing drug-related offences, 31% for social care and welfare services, including the care of children and adults by social services, including in rehabilitation centres, 17% healthcare costs (including opioid agonist treatment, NSP, treatment of infectious diseases, overdose management and psychiatric comorbidities), 3% cost of employers related to drug use and 2% preventive work and research • 40.3% intangible costs – among these, 60% due to quality adjusted life years (QALYs) lost due to drug-related deaths and 40% due to reduced quality of life of family members and others around people who use drugs • 21.5% indirect costs – among these, 70% due to loss of productivity from premature death and 30% due to loss of productivity from unemployment and absence from work due to imprisonment
United States of America 2019 Tangible costs (measured directly)	$500 billion		• 23.6% direct costs of healthcare for substance use disorder treatment (including for alcohol) and other health conditions • 41.2% indirect costs of loss of productivity due to premature mortality or absenteeism due to substance use including alcohol • 19.5% indirect and direct costs of efforts against crime, including for law enforcement and criminal justice authorities • 11.3% direct tangible costs of traffic collisions • 3.0% costs of public assistance and social services • 0.9% costs due to fires (fire protection and property damage) • 0.4% costs of research and prevention
United States 2019 Intangible costs	$3.2 trillion		• 80% owing to pain and deaths due to substance use (including alcohol) • 12% owing to the loss of quality of life of those with substance use disorders (including alcohol) who did not receive treatment • 8.0% owing to pain and deaths due to traffic accidents or violent crimes related to substance use

Source: "Survey Findings and Conclusions: 'The Social Cost of Illicit Addictive Substances in Cyprus'" (Cyprus National Addictions Authority (NACC), 2019); Thomas Hofmarcher et al., "Societal costs of illegal drug use in Sweden," *International Journal of Drug Policy* 123 (January 2024), 104259; Analysis provided by Marwood Group, *Economic Cost of Substance Abuse Disorder in the United States, 2019* (Recovery Centers of America, April 2020).

[a] *World Drug Report 2016*, "The world drug problem and sustainable development" (United Nations publication, 2016), p. 85.



Pathways of impact of drug use on health

Using the conceptual pathway of drug use and its impact, this section delves into the different factors (the modifiers and mediators) that can exacerbate or mitigate the various elements of the impact of drug use on health in different ways. That impact can be direct or indirect, can be seen from different perspectives and can include acute and chronic effects on the health (biopsychosocial aspects)[22] of a person who uses drugs and, by extension, the health impact on the family and the broader community. Some impacts can be observed and directly measured, while others may not be visible per se or be directly measurable, despite having a significant effect on health.

The acute effects on the health of a person who uses drugs may include:

- Intoxication, accidental poisoning and overdose resulting in hospitalization
- Psychiatric symptoms such as anxiety, psychosis or paranoia, as well as acute cognitive impairment
- Accidents, injuries or road traffic accidents resulting from psychomotor impairment

The chronic or long-term effects on the health of a person who uses drugs may include:

- Medical (or somatic) morbidity, including infectious, pulmonary, metabolic, cardiovascular and oncological diseases
- Poor nutrition and hygiene resulting from a chaotic lifestyle and leading to increased health risks and various somatic diseases
- Psychiatric comorbidity as a result of, or exacerbated by, drug use
- Increased mortality caused by medical or psychiatric comorbidity or overdose

Drug use disorders are chronic relapsing conditions that can result from the continued use of drugs.[23,24] The severity and impact of such disorders are mediated by a confluence of individual factors, patterns of drug use and a range of contextual factors or modifiers such as the degree of family and community support, social disarray and inequalities, normative behaviours regarding drugs,

the availability and legal status of drugs, and the availability of and access to a range of services. These factors mediate the impact on the health of individuals with drug use disorders and their family, among other bearers of impact.[25]

The complexity of interactions between the various individual and contextual factors can help explain why not all people who are exposed to drugs develop drug use disorders, why some individuals use drugs just a few times before they stop using them and why others progress to longer-term harmful patterns of use, chronic behaviours and the associated negative outcomes and health impacts.[26]

IMPACT ON HEALTH

- **Acute adverse effects**: medical and psychiatric comorbidities, overdose
- **Long term**: medical and psychiatric comorbidities
- **Mortality** (overdose and other causes)

Health impact of drug use

Any episode of drug use has the potential to result in immediate health harms to the person using drugs.[27] Such harms can range from short-term consequences (e.g. acute intoxication, psychiatric symptoms and injury or accident) to long-term consequences, as regular drug use can result in harmful patterns of use, drug use disorders, a range of medical and psychiatric comorbidities and death. Depending on the drug consumed, the harm and impact on the individual and population can vary in severity. In 2021, according to the Global Burden of Disease Study, opioid use disorders, followed by amphetamine and cocaine use disorders accounted for the largest number of healthy years of life lost due to disability and premature death attributed to drug use. Cannabis can also account for a large share of health harms at the population level due to its high prevalence of use, increasingly harmful patterns of use and high THC content in some regions. Almost 40 per cent of countries have reported cannabis to be the drug most responsible for drug use disorders and the main drug for which people enter drug treatment.[28]

Healthy years of life lost globally due to disability and premature death attributed to drug use

One way of describing the aggregated health impact of drug use disorders is through estimates of healthy years of life lost due to disability and premature death, or disability-adjusted life years (DALYs) attributed to drug use. An estimated 28 million DALYs were attributed to drug use in 2021.[29] This is an estimate of the global burden of disease, in terms of absolute numbers, that has nearly doubled over the past two decades, while the rate per million population has increased by one quarter. Also in 2021, almost half a million deaths were attributed to drug use, and more than half of the healthy years of life lost (15.6 million DALYs) were directly attributed to drug use disorders, in particular opioid use disorders. In fact, most of the deaths due to drug use disorders globally were attributed to opioids, followed by amphetamines and cocaine.

As other studies have shown, however, a sizeable proportion of overdose deaths involve the use of multiple substances.[30] Notably, a not insignificant proportion of overdose deaths are reported to be intentional overdoses, which are seen more frequently among people in older age groups (above 44 years of age) who use multiple drugs, mainly opioids, sedatives and tranquillizers, and who have some degree of underlying comorbidities.[31, 32, 33]

Acute adverse effects of drugs on an individual

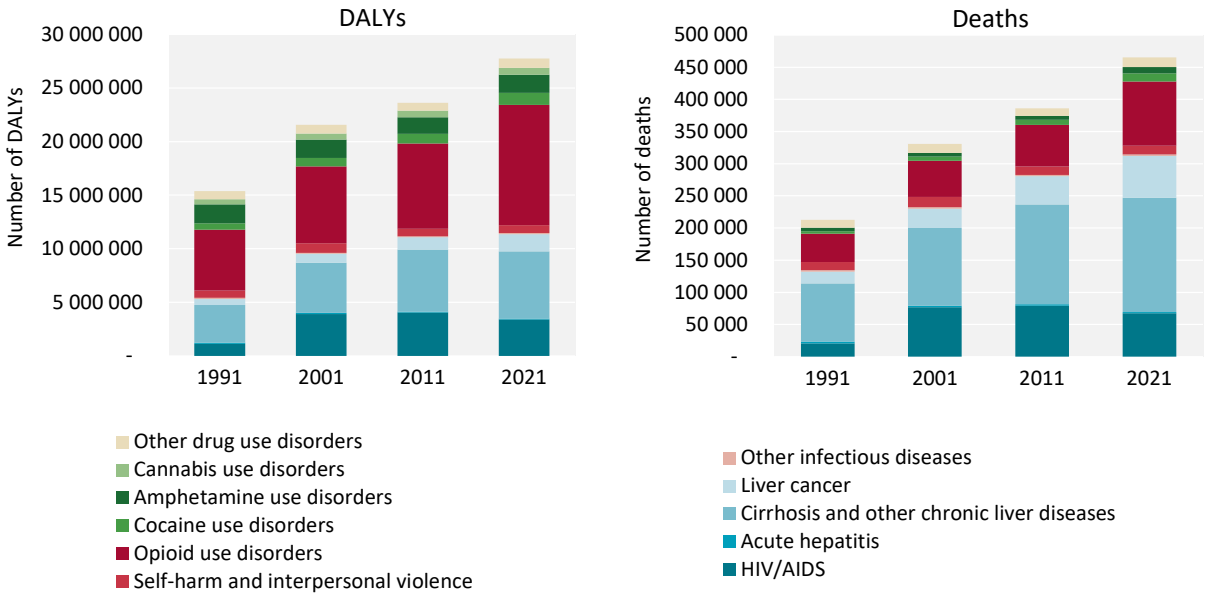
The acute adverse effects of drug use can occur after either a single instance or multiple instances of exposure to a drug within a short span of time. Such effects, which vary across drug types, can range from mild to severe or life threatening and may require medical intervention and hospitalization.[34]

The main toxic or adverse effect of opioid use, which can be severe in the case of potent synthetic opioids, is decreased respiratory rate and depth, which can cause brain damage or death due to respiratory depression.[35] The acute adverse effects of intoxication from stimulants may include agitation or aggression; tremors; nausea; vomiting; an increase in breathing rate, blood pressure (hypertension) and heart rate (tachydysrhythmia);[36] overheating and dehydration (more pronounced in the case of MDMA ingestion); kidney damage; and fatal and non-fatal overdose, especially in the case of methamphetamine.[37] In the case of cannabis, the acute adverse effects depend on different factors, primarily the drug's THC content, and can include neurobehavioural issues (anxiety, panic attacks and acute psychoses), gastrointestinal problems (nausea or vomiting),[38] the development of cardiovascular symptoms (tachycardia and hypertension),[39] and cognitive and psychomotor impairment resulting in motor vehicle accidents and fatalities.[40] These effects can be experienced even upon first-time use.

Medical comorbidity resulting from regular drug use

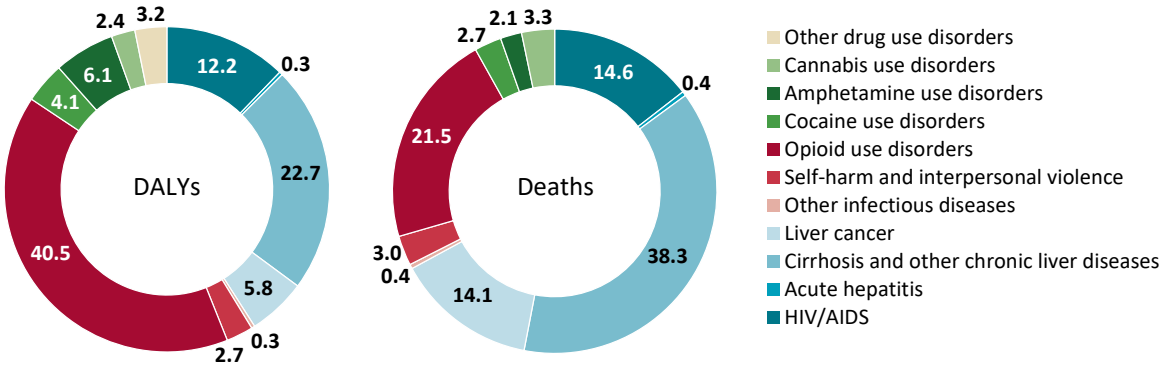
A series of long-term medical conditions can result from regular drug use, as illustrated by the significant share of morbidity that contributes to the number of DALYs. Of the 28 million DALYs related to drug use in 2021, 11.2 million were attributed to opioid use disorders, 6.3 million

FIG. 1 Healthy years of life lost due to disability and premature death, or disability-adjusted life years (DALYs), attributable to the use of drugs, 1991–2021



Source: Global Burden of Disease Study 2021 (GBD 2021) Results. (Seattle, United States: Institute for Health Metrics and Evaluation (IHME)), 2022.

FIG. 2 Proportion of healthy years of life lost due to disability and premature death, or disability-adjusted life years (DALYs), attributable to the use of drugs, 2021



Source: Global Burden of Disease Study 2021 (GBD 2021) Results. (Seattle, United States: Institute for Health Metrics and Evaluation (IHME)), 2022.

to cirrhosis and other chronic liver diseases, which were mainly the result of hepatitis C, and 3.4 million to HIV and AIDS. In addition, around 1.6 million DALYs were lost due to cancers, mainly liver cancers resulting from hepatitis C and attributed to drug use (mainly injecting drug use). More deaths were attributed to cirrhosis and other chronic liver diseases (177,279 deaths) than to opioid use disorders (99,535 deaths), while HIV and AIDS accounted for 67,473 deaths.[41]

As is the case with tobacco, smoking cannabis has been associated with lung and other cancers including among young people, although the strength of the evidence is not sufficient to be conclusive.[42, 43, 44] Different reviews, including the work of the International Agency for Research on Cancer, and meta-analysis have also reported an increased risk of different cancers, including head and neck, lung and gastrointestinal cancers, among people who regularly consume opium.[45, 46, 47, 48]

Various drugs can have a significant impact on the cardiovascular system. The use of stimulants (methamphetamine and cocaine), for example, has been associated with pulmonary hypertension, cardiomyopathy, arrythmias and myocardial infarction, among other cardiac diseases.[49, 50] Furthermore, the regular use of opioids can cause hypotension, endocarditis (in the case of injecting opioid use), arrythmias and strokes.[51]

Non-fatal overdose is another major health impact of drug use; nearly one quarter of people who inject drugs reported having experienced at least one non-fatal overdose in the past year.[52] Of those, younger groups and groups who have been injecting regularly for some time experienced more episodes of non-fatal overdose than older and less experienced groups.[53] Non-fatal overdose is a major cause of long-term physical and psychiatric comorbidity among people who use drugs, especially those who inject opioids, and may involve respiratory depression, which can lead to brain injury; liver and other organ damage; cardiovascular and neurological consequences; anxiety and depression; and an increased risk of subsequent fatal overdose.[54, 55, 56]

Psychiatric comorbidity attributed to drug use and drug use disorders

Psychiatric comorbidity is not an uncommon occurrence among people who use drugs and people with drug use disorders.[57] Although it is difficult to establish a causality, almost half of people with drug use disorders are reported to present with at least one psychiatric comorbidity, while high rates of comorbidity of substance use disorders are also reported among people with a mental health disorder.[58]

The association between mental health and substance use disorders also reflects bidirectional risks and vulnerabilities, to the extent that mental health disorders can increase vulnerability to drug use as a form of self-medication to alleviate a particular symptom of those disorders, such as dysphoria or emotional distress.[59] At the same time, drug use disorders may increase the risk of developing a mental disorder.[60, 61] For example, a study in India showed that 88 per cent of people who injected opioids and were in treatment had psychiatric comorbidities (panic disorder, social anxiety disorder and antisocial personality disorder being the most common), with the majority having more than one comorbidity.[62] In addition, a systematic review of the literature showed the prevalence of (current) depression among people with opioid use disorders to be 36 per cent, followed by anxiety disorder, ADHD and PTSD.[63]

Both the recreational and chronic use of methamphetamine has been associated with psychosis, with some users developing psychotic syndromes similar to schizophrenia.[64] Moreover, early initiation of cannabis use and the regular consumption of products with a high THC content among adolescents and young adults may be a risk factor for developing depression, anxiety disorder or psychoses. In addition, individuals with depression may use cannabis as a form of self-medication to alleviate symptoms and subsequently develop or exacerbate existing mental health disorders such as schizophrenia.[65, 66, 67] Similarly, the existence of mental health disorders such as mood disorders (e.g. major depression), anxiety disorders (e.g. generalized anxiety disorder), PTSD and conduct disorders such as antisocial personality disorder and neurodevelopment disorders (e.g. ADHD) have been strongly associated with the initiation of drug use and the development of drug use disorders.[68, 69]

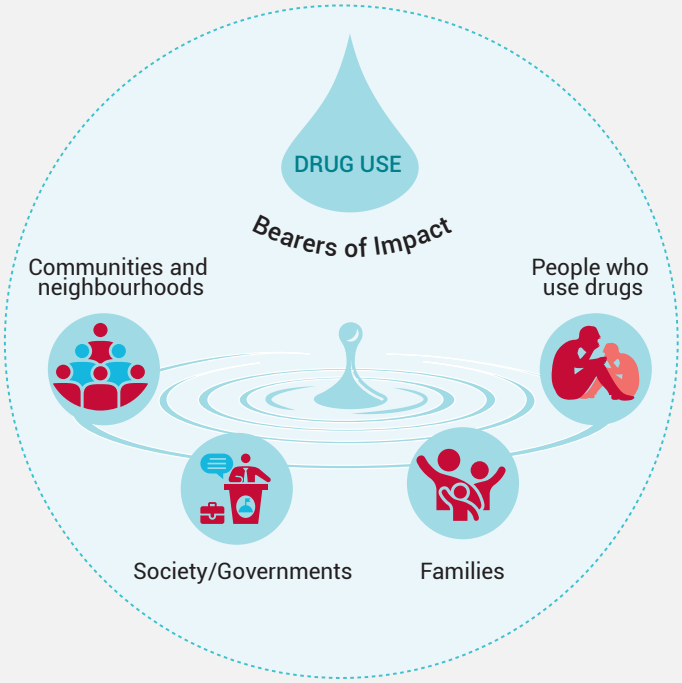
Impact of drug use on the health of families, children and the community

The burden of disease associated with drug use, as well as the short- and long-term care required for people suffering from various physical, social and health problems caused by another person's drug use, can also impact society at large.

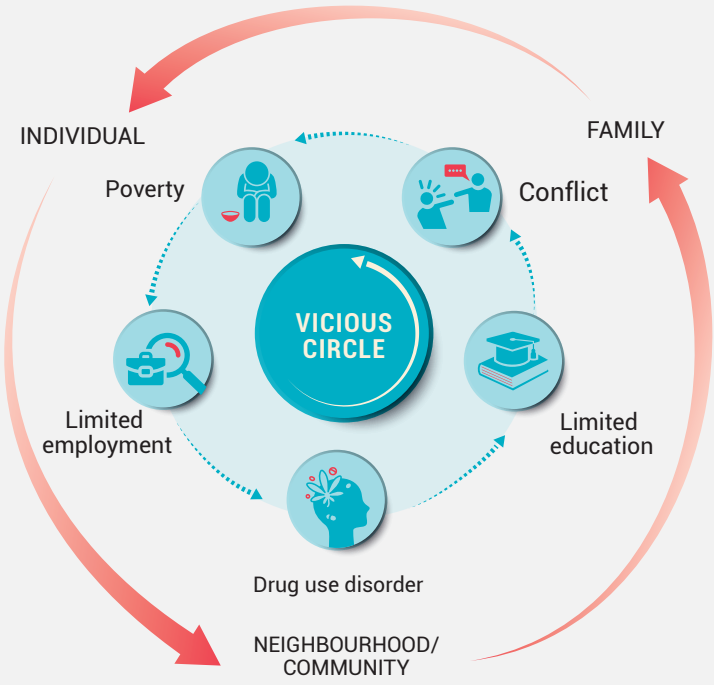
An individual's health is not only affected by their own characteristics and behaviour but also by their environment, including the social and economic environment – the social determinants of health.[70] Socioeconomic vulnerabilities may make a person susceptible to drug use disorders that further contribute to the socioeconomic inequalities of the person who uses drugs and their family (see infographic on the social determinants of health, etc. on the next page).[71] In a national drug use survey conducted in Pakistan in 2013, for example, people with high-risk drug use reported that its impact on their health, followed by its impact on their relationships with their parents and family, were their main concerns related to their drug use. Conversely, key informants considered drug use as both a "problem *of* the family" and "a problem *for* the family".[72]

Family, which is recognized as the fundamental group unit of society and as the natural environment for the growth and well-being of all its members,[73] is the primary source

The impact of drug use is felt beyond those who use drugs



Drug use disorders, social determinants of health and their impact on the individual, their family and their neighbourhood



of attachment, nurturing and socialization.[74] Various studies have also shown that members of families in which a family member has a drug use disorder are highly vulnerable to mental health conditions such as anxiety and depression. In a study of people who inject drugs and their family members in Viet Nam, for example, family members reported that their own depressive symptoms were significantly associated with the burden of caregiving.[75] The children of parents who use drugs or suffer from drug use disorders are also at a higher risk of lacking a safe nurturing environment, of having their developmental needs unmet and of experiencing impaired attachment and emotional distress.[76, 77, 78] As mentioned above, in Afghanistan, focus group participants reported that drug use caused family violence, affected children negatively and was one of the main reasons for the collapse of family relationships among people who used drugs.[79] Moreover, as demonstrated in a study from China, substance use by a caregiver has been associated with possible episodes of domestic abuse (such as financial exploitation or physical and emotional abuse) of elderly people.[80, 81]

Drug use and drug use disorders can also have an impact on pregnant women and neonates. Polysubstance use during pregnancy can further complicate outcomes both for the pregnant person and the neonate. The main reported complications of methamphetamine use in pregnancy are placental abruption, high rates of operative deliveries and preterm birth.[82] Newborns who have been exposed to opioids before birth are at risk of premature birth and a low birth weight and may also experience neonatal abstinence syndrome (see table 1). Cocaine exposure during pregnancy can result in potential long-term neurodevelopmental, behavioural and learning impairments in neonates, as well as the common issues associated with exposure to drugs during pregnancy such as low birth weight, low gestational age and other complications during birth.[83] There is also consistent evidence that regular cannabis use during pregnancy increases the risk of maternal anaemia and neonatal problems such as reduced birth weight and reduced neonatal length.[84]

A less obvious impact of drug use on the family is children being orphaned because of the fatal overdose of a parent. An increase in fatal drug overdoses in the United States has translated into more children living with their grandparents, who become their caregivers, or living in foster care and orphanages.[85, 86] Between 2011 and 2021 in the United States, more than one million lives were lost to drug overdose, and nearly 322,000 children (those under 18 years of age) were orphaned because of their parent's fatal overdose.[87] Studies have shown that bereavement can lead children who lose a parent to face short- and long-term challenges, including problems with their physical and mental health, schooling issues, disruptions in education, financial and housing instability and even substance use.[88, 89,90]

Road traffic accidents, injuries and fatalities caused by people under the influence of drugs are another public health concern, as not only is the driver who is under the influence of substances at risk, but the passengers and people on the road are too.[91] The effect of different drugs on driving behaviours can vary depending on their effects on the brain. Cannabis use, for example, can impair a person's judgement of time and distance and decrease coordination, whereas the use of stimulants (cocaine or methamphetamine) can result in aggressive and reckless behaviour while driving. Being intoxicated with multiple substances such as alcohol and cannabis can have more deleterious consequences than the use of a single substance.[92]

Impact of drug use and drug use disorders on violence experienced by people who use drugs and their families

People who use drugs and with drug use disorders are often affected by violence either as victims or perpetrators. Studies have shown that people with drug use disorders, including disorders related to stimulants, opioids, sedatives and cannabis, are between 4 and 10 times more likely to perpetrate violence than people in the general population or those not diagnosed with a drug use disorder.[93, 94, 95]

The association between drug use and violent outcomes is a complex one that may be mediated by a range of factors. Among people who use drugs, factors such as the effects of drugs leading to cognitive impairment, previous experiences of violence, comorbidity of mental health disorders, and social determinants such as sex, ethnicity and poverty, may expose them to a high risk of being a victim of violence. People who use drugs, in particular those in population groups with specific vulnerabilities, are often victims of violence perpetrated by a range of actors, including other people who use drugs, intimate partners and people involved in the drug trade.[96] Studies in Western countries have also documented the varying degrees of violence and abuse that people who use drugs experience, including the use of excessive force during their interactions with law enforcement authorities[97, 98, 99] and while accessing drug services, especially low-threshold services in the community.[100, 101, 102] Such untoward experiences can further undermine access to services and the health status of people who use drugs.

Intimate partner violence, including physical violence, sexual coercion, psychological abuse, financial abuse and

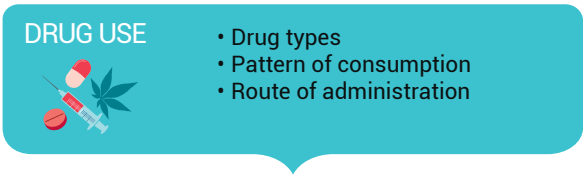
controlling behaviours, among people with drug use disorders, be they victims or perpetrators, can result in physical, sexual and psychological harm.[103] This contributes to long-lasting physical and mental health consequences.[104] Intoxication (as in the case of stimulants) and withdrawal from drugs (opioids or stimulants) increase the likelihood of intimate partner violence being perpetrated.[105]

Intimate partner violence among people who use drugs is reported to be common among both men and women, although a larger proportion of women using drugs are victims of such violence.[106, 107] Women who are exposed to intimate partner violence in the context of drug use, whether it is their own or their partner's, experience trauma and physical injuries that can result in chronic pain and, in turn, lead them to use or continue using drugs as a form of self-medication.

Understanding gender inequality helps explain why the health impact on women who use drugs exceeds the health impact on men who use drugs. Women who use drugs and experience intimate partner violence are reported to have a higher risk of developing drug use disorders and experience more severe symptoms of such disorders than those who do not experience intimate partner violence.[108] A qualitative study in Thailand, for example, showed that women who inject drugs were more likely to be abused by their husbands, partners or male counterparts, and the more severe the domestic violence the women experienced, the more drugs they consumed as a coping mechanism.[109]

Adverse childhood experiences due to a parent or caregiver's drug use

Adverse childhood experiences of abuse and neglect, including those resulting from a parent or caregiver's use of drugs or drug use disorders, can range from the physical, sexual or emotional abuse of a child to family dysfunction such as parental conflict, loss of family or family separation, the incarceration of a parent as a result of drug use, and mental health issues within the family. Such experiences can have an immense impact on the health and development of the child, leading to an intergenerational cycle of poor quality of life, mental health disorders, drug use and drug use disorders, and adverse childhood experiences in the next generation.[110, 111, 112, 113, 114, 115, 116, 117]



Drugs and patterns of use that can modify the intensity and nature of the impact of drug use

One set of factors in the pathways of impact of drug use on health is the type of drugs used and their pharmacological composition and effects. Combined with the pattern of consumption and the route of administration of the drug, this set of factors can determine different impacts on the health of a person who uses drugs and the people around them.

In recent decades, opioids have accounted for most of the DALYs attributed to drugs and direct deaths (through overdose) globally[118] (see table 1). Of all the types of opioid use, the use of fentanyls has been associated with the greatest harm in terms of non-fatal and fatal overdoses, particularly in North America. Fentanyls are not only more potent than heroin but, being lipophilic, can reach the brain and provide the desired "reward" more rapidly than heroin, which also leads to faster respiratory depression and its fatal or near fatal consequences.[119]

The harm associated with the use of certain drugs may be perceived in different ways by different people. In Afghanistan, for instance, heroin use and methamphetamine use among men have been associated with the most harms, whereas among women, opium use has posed the most significant harm, followed by methamphetamine and heroin.[120]

Similarly, the main drug of concern reported among people in treatment may vary according to trends in the substances used in a country. In countries in Europe, for example Germany[121] and Italy,[122] cannabis, opiates and cocaine have been reported as the primary substances for which people seek treatment. In South America, for example in Chile,[123] the primary substances for which people seek treatment are cocaine and amphetamines, and in South-East Asia, it is methamphetamine.[124]

The drugs of concern can also change depending on market dynamics. In the Russian Federation, there has been an observable change in patterns of use among people in treatment, with a higher proportion of people using synthetic drugs such as stimulants, cannabinoids and methadone and a decline in the proportion of those injecting opiates.[125] Similarly, in Myanmar, the proportion of young people using (through inhalation) amphetamine

TABLE 1 Summary of evidence of adverse outcomes among people with opioid use disorders

	Prevalence and risk of health outcomes among people with opioid use disorders (including those who inject)
Non-fatal outcomes	
Using a needle after someone else in the past year (receptive syringe sharing)	25.5% (16.7–34.3%) among people who inject drugs (PWID), including non-opioid users
HIV incidence	0.8–10.7 per 100 person years
HIV prevalence	17.8% (10.8–24.8%) among PWID (including non-opioid users)
HCV incidence	5.9–42.0 per 100 person year among PWID (including non-opioid users)
HCV prevalence (HCV antibody)	52.3% (42.4–62.1%) among PWID (including non-opioid users)
HCV prevalence (HCV–RNA)	39.2% (31.6–47.0%) among PWID (including non-opioid users)
Skin and soft tissue infections	
current	6.1–32.0% among PWID (including non-opioid users)
past 6–12 months	6.9–37.3% among PWID (including non-opioid users)
ever	6.2–68.6% among PWID (including non-opioid users)
Infective endocarditis (ever)	0.5–11.8% among PWID (including non-opioid users)
Quality of life	Worsened but no availability of quantitative evidence
Mental health (depression, anxiety)	Worsened but no availability of quantitative evidence
Criminal activity	Highly increased likelihood Rate ratio: 5.84 (1.36–10.32)
Contact with criminal justice system	Increased likelihood Rate ratio: 2.97 (1.43–4.51)
Experience of non-fatal overdose (ever)	41.5% (34.6–48.4%) among PWID (including non-opioid users)
Poor neonatal outcomes	
low birth weight	Higher risk Relative risk: 4.61 (2.78–7.65)
neonatal abstinence syndrome	50–95% of infants exposed to opioids
pre-term birth	Increased risk but no availability of quantitative evidence
Fatal outcomes	
Overdose	Higher mortality rate Standardized Mortality Ratio: 58.43 (38.09–89.64)
Other accidental injuries	Higher mortality rate Standardized Mortality Ratio: 6.85 (4.41–10.64)
Suicide	Higher mortality rate Standardized Mortality Ratio: 8.52 (6.00–12.10)
Cancer	Higher mortality rate Standardized Mortality Ratio: 2.69 (1.84–3.92)
AIDS-related	Higher mortality rate Standardized Mortality Ratio: 18.50 (8.15–41.99)
Overall mortality	Higher mortality rate Standardized Mortality Ratio: 9.90 (7.52–13.05)
Viral hepatitis	Higher mortality rate Standardized Mortality Ratio: 35.94 (16.06–80.42)
Overall mortality	Standardized Mortality Ratio 9.90 (7.52–13.05)

Source: Louisa Degenhardt et al., "Global patterns of opioid use and dependence: harms to populations, interventions, and future action," *The Lancet*, vol. 394, No. 10208 (London, 26 October 2019), pp. 1560–79.

Notes: Measures: PWID – based on studies of people who inject drugs, not necessarily opioids specifically. The level of evidence in this table is from high quality systematic reviews of cohort, case-control or cross-sectional studies.

tablets has increased in comparison with those using or injecting methamphetamine; there has also been an increase in demand for treatment for amphetamine use in comparison with opiates, which remain the main drug of concern among people in treatment.[126]

There is clear harm associated with the use of NPS, such as toxicity and dependence syndromes, which can have a significant health impact at the individual level and which are reported in emergency departments and among psychiatric inpatients. However, as the use of NPS is typically limited to certain population groups or to a small number of people within the general population, the aggregated harms from the use of NPS are relatively few compared with the national or global levels of harm caused by the use of other drugs.[127]

Patterns of drug use

Many individual factors, including age of initiation of drug use, mediated by patterns of use can also determine the health impact of drug use.

In comparison with non-injecting routes of administration, the practice of injecting drugs has been associated with a higher frequency of drug use in one day, especially in the case of methamphetamine use; more days of use in a month; the acquisition of infections, including soft tissue infections; endocarditis; accidental injuries; and overdose (see table 1).[128, 129, 130, 131, 132] Moreover, concurrently injecting and smoking stimulants (e.g. methamphetamine) has been associated with more days of drugs use, a higher frequency of injecting and more violent behaviour than either injecting or smoking stimulants such as methamphetamine.[133] Smoking or snorting different drugs can also affect health by, for example, causing nasal septum perforation or damaging the respiratory system by giving rise to various lung diseases.[134]

Injecting drug use remains a major risk factor for the transmission of bloodborne infections including HIV, tuberculosis and viral hepatitis (see table 1). People who inject drugs, among other key populations, continue to drive new HIV infections globally, with the relative risk of acquiring HIV being 14 times higher for people who inject drugs than for the wider adult population.[135] In 2023, an estimated 1.7 million people who inject drugs were living with HIV, and injecting drug use continues to be a significant driver of the global hepatitis C epidemic. The use of methamphetamine, along with other drugs, as part of sexualized drug use has been associated with high-risk sexual behaviours and with the increased risk of contracting sexually transmitted infections such as HIV and viral hepatitis.[136, 137]

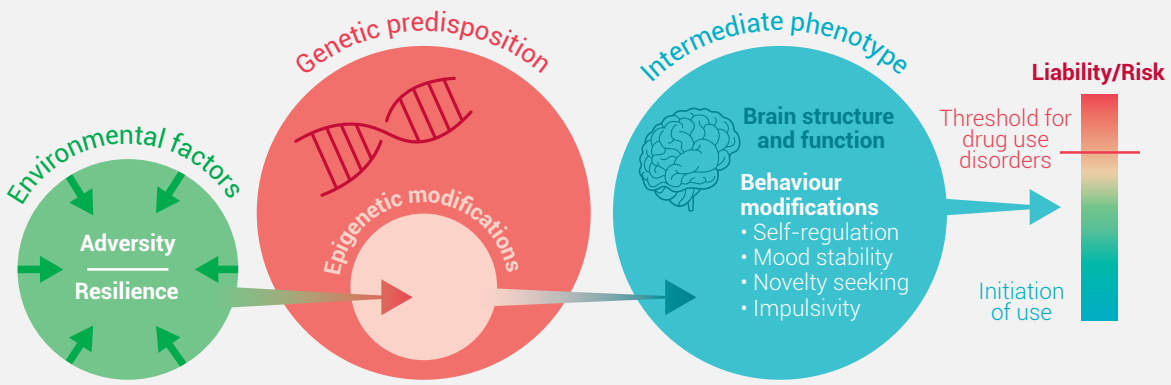
Trajectories of drug use and drug use disorders

Different longitudinal studies looking at the trajectory from the initiation of drug use to its progression to a drug use disorder, mainly conducted in Europe and North America, have shown that only a certain percentage of people who initiate drug use develop drug use disorders, and that that percentage varies according to drug type and other factors.[138, 139, 140, 141] People who initiate drug use progress to different patterns of use and outcomes, with some, usually the majority, stopping shortly after occasional experimental use or continuing a regular but sporadic pattern of use. Others increase the frequency of drug use and the quantity of drugs used and progress to harmful patterns of use and dependence. In a cohort study of the trajectory of opioid use among adolescents in the United States, for example, the majority were identified as experimental users, while a small proportion of the cohort were still using opioids at a higher frequency at the time of follow-up.[142, 143]

The rate of transition from the initiation of substance and drug use to harmful patterns of drug use and drug use disorders depends on several factors, including the type of substances used, the frequency of use and a number of sociodemographic, environmental and interpersonal risk factors, such as a person's age, sex, underlying mental health disorders and living conditions. The biological risk of developing drug use disorders emerges early in life but changes over a person's life stages, since it is differentially influenced by the contextual factors affecting the life stages of that person and manifests through different pathways (see infographic on the next page).[144]

This pattern of drug use is also observed in population-level drug use surveys, where a small proportion of people who have used drugs in the past year are considered drug dependent. In Chile, for example, 10.5 per cent of past-year users of any drug were regarded as having problematic patterns of use, while 27 per cent of past-year cocaine users and 21 per cent of past-year users of cannabis were considered to have drug use disorders.[145] In a drug use survey conducted in Nigeria, 20 per cent of people who self-reported the past-year use of any drug (other than tobacco and alcohol) were considered drug dependent, and 20 per cent of those who had misused pharmaceutical opioids (such as tramadol, codeine and morphine) in the past 12 months met the criteria for having a drug use disorder.[146] Thus, as shown in different studies, a small yet high-risk group of people who develop tolerance to and dependence on drugs, or who engage in polysubstance use, are responsible for the major public health outcomes and impacts of drug use.[147, 148, 149]

Factors that determine different pathways to substance use and substance use disorders



Source: UNODC, *World Drug Report 2018*, booklet 4: *Drugs and Age* (United Nations publication, 2018).

Note: The figure shows the two main categories of factors that confer risk of substance use for adolescents: genes and the environment. Genetic variants are like switches: they are either turned on or off, but their expression is influenced by experience (i.e. epigenetic modifications). Environmental factors are more like dials that are turned up or down, also depending on experience. Risk or adversity factors include childhood maltreatment, poverty, poorly equipped schools, dysfunctional families, discrimination and witnessing violence. Resiliency or protective factors include high-quality education, housing, healthcare, social attachments and parenting. The combination of switches and dials crosses a liability threshold that, when predominantly negative, primes the brain for substance use. The functional relationship between factors is not linear, nor is it static; it fluctuates throughout a lifespan. Some environmental influences confer resiliency and may attenuate the effects of genetic predispositions. Thus, psychosocial interventions and practices are of the utmost importance in determining final outcomes.

INDIVIDUAL MODIFIERS

- Age
- Gender
- Socioeconomic status
- Race/ethnicity

Characteristics that modify the intensity and nature of the health impact of drug use: individual modifiers

A variety of individual characteristics or factors modify the pathways of impact of drug use on health. Individual factors include genetics, gender and the life developmental stage at which exposure to drugs first occurs, as well as personality features such as early exposure to adverse childhood experiences and vulnerability to, or pre-existing, mental health disorders. However, those factors are, in turn, modulated by socioeconomic inequalities, normative behaviours regarding the use of different drugs and other contextual modifiers.

Age modifies the pathway between drug use and its health impacts

Adolescence is characterized by transformations in the body, brain and behaviour. Those transformations are influenced by social and physical environmental conditions, resulting in the "biological embedding" that shapes the pathways of adulthood. Individual-level characteristics, such as personality and genetics, thus interact with life experiences and exposure to socioenvironmental factors to directly affect the developing brain's structure and functions, which, in turn, influence the resultant behaviour, such as drug use, and its impacts.[150]

Different studies indicate that the use of cannabis during adolescence has the potential to result in impaired cognitive performance, disrupt the personal or academic life of adolescents and lead to difficulties with educational achievement, occupational prestige and the transition to adulthood.[151, 152] The initiation of cannabis use during adolescence also greatly increases the risk of developing cannabis use disorders compared with initiation during adulthood, as well as increasing the risk of the use of other drugs.[153, 154, 155] Moreover, the age of initiation of cannabis use is associated with the age of onset of psychosis and the age at first hospitalization due to psychosis, even adjusting for confounding factors. Regular cannabis use, especially when initiated during adolescence, can cause or precipitate the onset of psychosis or mood and anxiety disorders.[156, 157] Another health outcome is that young people (those less than 30 years of age) who inject drugs are reported to be at a higher risk (relative risk of 1.5) of acquiring HIV and hepatitis C infections than older people who inject drugs.[158] They are also reported to be at risk of experiencing non-fatal and fatal overdose attributed to injecting opioids and to polysubstance use.[159, 160]

Older people

In recent years, evidence has been emerging of an increasing prevalence of drug use among older people.[161] For example, the use of cannabis has been on the rise among people aged 55 to 64 in some of the most highly populated countries in Western Europe. Annual prevalence data for the period 2006–2015 from France, Germany, Italy, Spain and the United Kingdom show that cannabis use among people in that age group increased at a higher rate than among any other age group.[162] Many older people who use drugs in those countries may have continued their drug use into later life, as an ageing cohort of regular users of different drugs,[163, 164] but others may also begin using drugs such as opioids, benzodiazepines or cannabis as a form of self-medication in the absence of care, owing to emotional distress, loneliness, insomnia, anxiety or depression, or for pain management.[165, 166, 167] Among older people who use drugs, the risk of a range of health complications associated with the use of drugs and the related risk of their harmful interaction with different drugs, as well as with medication, also increase.[168] These complications are often exacerbated by pre-existing health conditions or are simply due to ageing, and may include damaging falls, cancer, heart disease and mental health conditions.[169, 170]

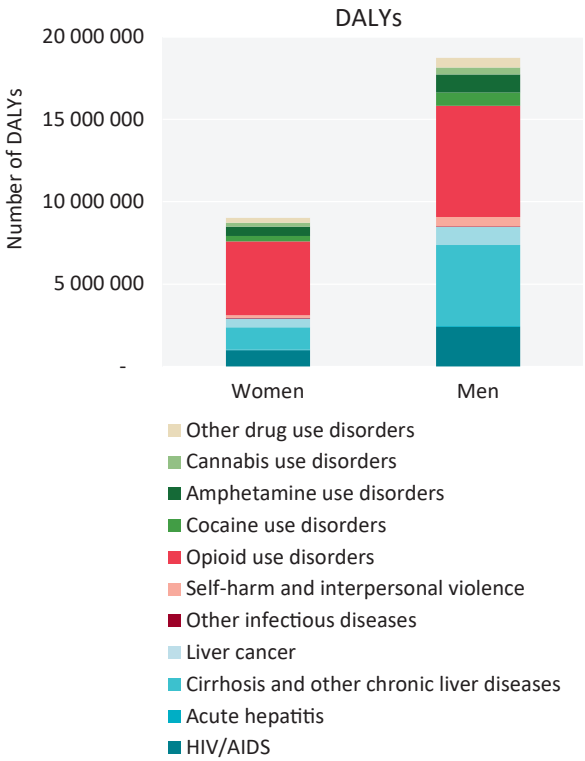
Sex and gendered roles

Globally, more men than women use drugs, with just one third of people who use cannabis, cocaine or heroin being women. However, in the case of the non-medical use of pharmaceutical drugs such as opioids, sedatives and tranquillizers and stimulants, the share of men and women misusing such substances is almost equal.[171] With regard to the non-medical use of pharmaceutical opioids, the risk of opioid misuse remains higher among women than men, as women are more likely than men to receive prescriptions for opioids, as well as self-medicate for pain management or to deal with negative experiences.[172]

Research has shown that there may be differences in individual-level factors, such as the neurobiology, personality and psychiatric comorbidity of a person; in sociocultural factors, such as socially gendered roles and power structures; and in histories of abuse that may interact with other factors and modulate or mediate the initiation of and progression to harmful patterns of drug use and treatment outcomes among men and women.[173, 174]

At the individual level, women generally initiate drug use later in life than men and, as observed among women in treatment, tend to increase their rate of consumption of different substances more rapidly than men. This translates into an accelerated progression from initiation of drug use to harmful patterns of such use, the development of substance use disorders and, lastly, entry into substance use disorder treatment.[175] Women entering treatment for drug use disorders are often diagnosed with severe medical, behavioural and psychological problems and often have a history of trauma and abuse, as well as an overall low quality of life that persists after treatment.[176, 177, 178] Moreover, although more men than women inject drugs, the relative risk of acquiring HIV (RR 1.4) and hepatitis C (RR 1.2) is higher among women.[179] In addition, owing to their drug use, women face a higher degree of stigma than men and more barriers to accessing drug treatment and other health services that can address their specific needs and comorbidities.[180, 181] For instance, a study in the Islamic Republic of Iran reported that women had a higher prevalence of comorbidity of drug use disorders and mental health disorders than men and faced considerable barriers, including stigma and discrimination, to accessing appropriate care.[182] Furthermore, as women have a higher life expectancy than men (there was a five-year age gap in global life expectancy in 2021),[183] they suffer the various health impacts of drug use disorders more and for longer periods than men.

FIG. 3 Healthy years of life lost due to disability and premature death, or disability-adjusted life years (DALYs), attributable to the use of drugs, 2021



Source: Global Burden of Disease Study 2021 (GBD 2021) Results. (Seattle, United States: Institute for Health Metrics and Evaluation (IHME)), 2022.

At the aggregate, population level, the per capita rate of DALYs associated with all causes attributed to the use of drugs in 2021 was nearly two times higher among men (18.7 million DALYs, or 472 per 100,000 men) than women (nearly 9 million DALYs, or 228 per 100,000 women). This was mainly driven by the greater number of men who use drugs or have drug use disorders.[184] For some of the causes, such as HIV and AIDS, cirrhosis and liver diseases and cocaine use disorders, the DALYs among men were twice or more than double those attributed to women. In the case of opioid use disorders, however, the difference in DALYs between men and women was less pronounced, at 4.5 million for women and 6.7 million for men.

Socioeconomic disparities: racial, ethnic and other minority groups

The high rates of drug use and drug use disorders, access to drug use disorder treatment and treatment outcomes in minority ethnic or other subpopulation groups are often mediated by the social determinants of health that have been associated with poor health outcomes and a lower life expectancy.[185, 186, 187]

Although there are no global figures on the prevalence of drug use, nor systematic reviews of drug use by ethnicity or subpopulation group, some country-specific studies (mainly in North America) have pointed to higher rates of drug use and drug use disorders, more severe health impacts and poorer treatment outcomes among particular racial, ethnic and other subpopulation groups.[188] In the United States in 2021, for example, the past-year use of any drug, as well as the rate of substance use disorders, was higher among Native Americans and African Americans than among other ethnic groups.[189] Moreover, the past-year misuse of pharmaceutical opioids was also highest among Native Americans, while the rate of misuse among African Americans was lower than among white people. Conversely, while the rate of synthetic overdose deaths increased for all population groups in the United States between 2013 and 2022, the rate of overdose deaths among African American men and women surpassed, with a widening gap, the rate of overdose deaths from synthetic opioids and stimulants among white men.[190] In addition, treatment engagement was low and treatment outcomes were less favourable among African Americans and Native Americans.[191] Thus, certain ethnic minorities or similar groups experience disproportionately more adverse health consequences from their drug use than the general population.[192, 193]

CONTEXTUAL MODIFIERS

- Policy environment
- Stigma and discrimination
- Availability of services
- Conflict

Contextual factors that modify the relationship between drug use and health impacts

Contextual factors, the overall policy environment, the availability of services and the existence of stigma and discrimination are another set of factors that overlap and interact with the individual-level factors and socioeconomic inequalities that can mediate the impact of drug use and drug use disorders on health.

Policy environment

Two issues remain at the forefront of the policy environment – the criminalization of drug use and compulsory drug treatment. As noted by INCB, disproportionate responses to drug-related offences can undermine the overall principles of the international drug conventions, the rule of law and the enjoyment of the right to health. Recognizing drug use and drug use disorders as a public health concern that require responses that are health-centred and less reliant on punitive sanctions is entirely consistent with what is foreseen in the international drug control framework.[194, 195]

Policies that target people in relation to their drug use add to the stigma and discrimination against such people and can also exacerbate the negative impact of drug use on health. For example, incarceration resulting from such policies has severe negative consequences for people with drug use disorders, their families and their communities that can worsen the underlying health and social conditions and the overall impact on health.[196] A study in 17 European countries conducted between 2006 and 2020 showed that, among people who inject drugs who were recruited from the community, a history of incarceration was associated with a positive HIV and HCV serostatus.[197] Other studies have shown that people who use drugs and who are incarcerated have an increased risk of drug-related death within a few weeks of their release from prison, particularly from drug overdose in the case of people with opioid use disorders, as well as of relapse and reincarceration.[198, 199]

The international standards for the treatment of drug use disorders state that treatment interventions must always be voluntary and based on the patient's informed consent.[200, 201, 202] A 10-year follow-up study in Canada of people who had been coerced into drug treatment (either mandated through the criminal justice system or by a

physician), compared with people voluntarily attending treatment or not attending treatment at all, showed that there was no significant difference in the improvement of substance use outcomes between the three groups. This essentially implies that coerced treatment for people with substance use disorders was not helpful in improving their substance use outcomes.[203]

The United Nations system has raised concerns about compulsory treatment and detention centres for drug users where people using drugs are confined without their consent, and often without the due processes of diagnostic assessment and evidence-based and ethical treatment for substance use disorders.[204] There is limited scientific literature evaluating compulsory treatment as opposed to coerced treatment, for example, treatment mandated through court as an alternative to punitive measures. However, the published evidence does not, on the whole, suggest improved outcomes related to compulsory treatment approaches. Some studies even suggest that such interventions can potentially cause harm.[205, 206, 207, 208] They indicate, for instance, the increased likelihood of people dying from overdose or other related causes within the first few weeks following compulsory drug treatment.[209, 210]

Stigma and discrimination

Stigma is a contextual factor that is neither overt nor easily measured, but it has a profound impact on the health outcomes of people who use drugs or who have drug use disorders. Stigma, either perceived or enacted, results in the greater social isolation of people who use drugs, risky patterns of drug use, such as injection practices, the increased sharing of needles and syringes, risky sexual behaviours and the risk of overdose.[211, 212]

Stigma remains a major barrier for people who use drugs to access treatment for substance use disorders, services that minimize the health and social consequences of drug use and other healthcare services voluntarily.[213] In addition, for those in treatment or accessing healthcare, stigma results in a low level of retention in treatment and poor treatment and health outcomes.[214, 215] In Nigeria, for example, nearly 40 per cent of people with high-risk drug use reported that they wanted help or treatment for their drug problems but were unable to obtain such assistance, mainly owing to the cost of treatment and the stigma attached to drug use.[216] In Kazakhstan, because of stigma and social rejection from communities, women who use drugs were not allowed to use crisis centres for victims of violence.[217]

Stigma often extends to service providers in drug treatment and healthcare settings, thereby hindering the availability of trained staff and the provision of high-quality, evidence-based substance use disorder treatment and healthcare services within the public health system.[218] Also owing to stigma, drug treatment or low-threshold services that minimize the health and social consequences of drug use are often either located in isolated settings or confined to disadvantaged neighbourhoods, which further increases the stigma surrounding people utilizing services in such settings.[219, 220]

Availability of services

The availability of age- and gender-appropriate, scientific evidence-based services for the prevention of drug use, interventions that minimize the adverse health and social consequences of drug use and treatment for drug use disorders are the key contextual factors that can mitigate the impact of drug use on health.

Scientific evidence-based prevention interventions eliminate or reduce the overall aggregated health consequences of drug use from the very outset. Prevention is aimed at ensuring the safe and healthy development of children and young people and thereby reducing the number of people who may begin using drugs or progress to harmful patterns of use and dependence. However, factors that promote drug use, such as poor parenting and childhood neglect or the availability of drugs, as well as some individual-level factors, are often beyond the control of the individual. Therefore, prevention works best when it is conducted both at the individual level and in the developmental contexts within which individuals evolve (particularly within families and in schools).[221, 222] In addition, other components of drug prevention interventions include policies and practices that address the social determinants of health and attend to vulnerabilities that increase a person's likelihood of drug use, such as the availability of substances, poverty and unstable housing.[223]

When they are evidence-based, treatment interventions are cost-effective, reduce drug use and improve overall health, social functioning and productivity, thereby mitigating the negative impact of drug use among individuals.[224] Currently, there is no effective pharmacological treatment for stimulant or cannabis use disorders, only for opioid use disorders. Nevertheless, psychosocial interventions such as cognitive behavioural therapy, motivational interviewing and contingency management are among interventions that have proved to be effective in reducing drug use, promoting abstinence and preventing relapse for the different drug use disorders.[225, 226] Moreover, scientific evidence suggests that treatment outcomes are improved when treatment modalities are offered in combination with an integrated treatment plan that simultaneously addresses drug use disorders, psychiatric comorbidity and other health issues.[227]

TABLE 2 Evidence of effectiveness of opioid agonist treatment compared with no treatment in the community

	Measure of effect	Level of evidence*
Opioid use	52% less likely to happen Relative risk: 0.48 (0.41–0.55)	A
Injecting frequency	Decreased levels of frequency Standardised mean difference: –0.59 (–0.91–0.26)	A
Sharing needles/syringes – injecting risk behaviour	47% less likely to happen Relative risk: 0.53 (0.4–0.7)	A
Linkage to and initiation of HIV treatment and care	87% more likely to happen Hazard ratio: 1.87 (1.50–2.33)	C
HIV treatment adherence	More than twice as likely to happen Odds ratio: 2.14 (1.41–3.26)	C
HIV treatment attrition/discontinuation	23% less likely to happen Odds ratio: 0.77 (0.63–0.95)	C
HIV viral suppression	45% more likely to happen Odds ratio: 1.45 (1.21–1.73)	C
HIV incidence	54% less likely to happen Relative risk: 0.46 (0.32–0.67)	C
HCV testing	73% more likely to happen Odds ratio: 1.73 (1.19–2.51)	C
HCV linkage to and initiation of treatment and treatment	40% more likely to happen Odds ratio: 1.40 (0.90–2.17)	C
HCV treatment sustained virological response	No significant difference Odds ratio: 0.75 (0.45–1.25)	C
HCV incidence	50% less likely to happen Relative risk: 0.50 (0.40–0.63)	C
Mental health problems	Improved levels Standardised mean difference: 0.49 (0.35–0.63)	C
Quality of life (social – WHO Quality of LifeAssessment–BREF)	Improved levels Standardised mean difference: 0.29 (0.16–0.42)	C
Criminal activity	Reduced Standardised mean difference: 0.57 (–1.00–0.13)	
Contact with the criminal justice system	No significant difference Relative risk: 0.75 (0.46–1.23)	C
Overdose mortality	Reduced by 75% Rate ratio: 0.25 (0.18–0.36)	C
Suicide mortality	Reduced by 52% Rate ratio: 0.48 (0.39–0.59)	E
Other injury mortality	Reduced by 60% Rate ratio: 0.40 (0.34–0.46)	E
All-cause mortality	Reduced by 67% Rate ratio: 0.33 (0.28–0.39)	C

Source: Louisa Degenhardt et al., "Global patterns of opioid use and dependence: harms to populations, interventions, and future action," *The Lancet*, vol. 394, No. 10208 (London, 26 October 2019), pp. 1560–79.

Notes: Level of evidence: A – Consistent conclusions across meta-analyses, high quality systematic reviews, or multiple RCTs; B – Evidence from one or two randomised controlled trials only; C – high-quality systematic reviews of cohort, case-control or cross-sectional studies; D – systematic reviews with inconsistent conclusions from authors, or multiple consistent ecological studies; E – cross-sectional association, case series suggesting outcome, single cohort study.*

Opioid agonist therapy (using buprenorphine and methadone) has proved to enhance a person's health-related quality of life, reduce morbidity (e.g. HIV) and mortality (from overdose), decrease criminality and diminish the rate of drug-related problems in the overall population (see table 2).[228, 229, 230, 231, 232, 233, 234, 235]

Interventions aimed at minimizing the adverse health and social consequences of drug use are, by definition, designed to reduce the health impact of drug use and typically include needle and syringe programmes, opioid agonist treatment and other evidence-based drug treatment services, HIV testing and counselling and the availability of naloxone in the community. Opioid agonist treatment, the provision of needle and syringe programmes and the availability of naloxone in the community are considered by WHO[236] to be essential for reducing the health impact arising from HIV and AIDS, hepatitis C and the use of opioids in terms of opioid use disorders and overdose deaths – the three main contributors to the global burden of disease attributed to drug use.

Despite the evidence of their effectiveness, the availability and coverage of opioid agonist treatment and needle and syringe programmes remain moderate to low in most countries.[237] Canada, Czechia, Netherlands (Kingdom of the) and Switzerland reported that other interventions, such as supervised consumption rooms and sites, drug-checking services and heroin-assisted treatment, were also components of their national programmes for minimizing the adverse health and social consequences of drug use.[238, 239, 240, 241]

The adequate provision and coverage of needle and syringe programmes and the reduction of structural barriers to access, in combination with other interventions, have been associated with a reduction in injecting risk behaviours and a decreased incidence of HIV and other bloodborne infections.[242, 243, 244, 245] The impact of interventions aimed at reducing the adverse health and social consequences of drug use is felt not only in terms of the dynamics of the spread of infectious diseases between individuals but also in the broader community.

A review of services that minimize the adverse health and social consequences of drug use in France, Spain and Switzerland has shown that the implementation of such services has been followed by a reduction in injection practices, HIV prevalence and deaths from overdoses among people who inject drugs, as well as having a positive impact at the population-level.[246, 247] Moreover, a review by the Cochrane network from 2018 showed that current enrolment in opioid agonist treatment resulted in a 50 per cent reduction in the risk of hepatitis C

Issues related to the impact on public health and healthcare services of substance and drug use disorders

Scientific evidence suggests that integrating care for drug use disorders into mainstream healthcare systems can increase the quality, effectiveness and efficiency of the care provided by addressing drug use disorders and other medical and psychiatric comorbidities.[a] Moreover, the provision of effective drug treatment services requires a sufficient workforce of health professionals to be trained and equipped with the necessary tools for the development and delivery of effective prevention services that minimize the health and social consequences of drug use and of treatment interventions and services in healthcare settings.

Data from high-income countries show that compared with the general population, people with drug use disorders have more contact with general physicians and much more contact with psychiatrists and emergency visits and admissions to hospital.[b] However, in low-resource settings, the provision of care to address the high burden of disease caused by drug use disorders often results in essential resources (such as trained staff and treatment slots) being diverted from other pressing healthcare needs and services. Similarly, in settings where mental health services are limited and burdened by the need to provide inpatient treatment for drug use disorders, people with severe mental health disorders may compete for limited treatment slots, causing another level of inequality in access to treatment services for those people. The same problem may apply to other specialized healthcare services for infectious diseases, where resources may not effectively address diseases such as HIV, hepatitis and multidrug resistant tuberculosis, for which the burden of disease may also be substantial in the general population. Likewise, a large burden of acute drug use intoxication, psychosis or overdose cases significantly hinders the capacity of emergency care services, be they hospitals, mobile services or first responders, to provide care to the general population.

[a] SAMHSA and Office of the Surgeon General (US), "Chapter 6: Health care systems and substance use disorders", *Facing Addiction in America: The Surgeon General's Report on Alcohol, Drugs, and Health* (US Department of Health and Human Services, 2016). Drugs, and Health} (US Department of Health and Human Services, 2016

[b] Luk Van Baelen et al., "Use of health care services by people with substance use disorders in Belgium: a register-based cohort study", *Archives of Public Health*, vol. 79, No. 1 (December 2021), p. 112. including contacts with general practitioners (GP

acquisition, but there was weaker evidence for needle and syringe programmes. However, the combined provision of opioid agonist treatment and needle and syringe programmes was associated with a 74 per cent reduction in the risk of acquiring HCV.[248, 249] Similarly, the availability of take-home naloxone kits and the availability of naloxone in the community have also proved to reduce adverse events and overall overdose mortality.[250]

Conflict

The individual, family and environmental risk and protective factors and the causes of initiation of substance use, transition to harmful pattern of substance use and the development of substance use disorders among people in conflict situations or humanitarian emergencies are not necessarily different from those among the population at large.[251]

The social and mental health problems, including substance use and substance use disorders, that people in conflict situations experience may either be caused by an exacerbation of pre-existing, environmental, family or individual-level factors during the conflict or by living in a protracted conflict situation.[252] Drug use among people living in conflict settings may therefore be seen as an adaptation – a coping mechanism – to the ongoing or post-conflict environment. In a study in Ukraine, for instance, the use of drugs for stress relief was identified as the second main driver of drug use in the country.[253]

In conflict settings, the impact of drug use can have more serious consequences because the healthcare infrastructure is affected, resulting in a lack of healthcare services. Mental health and substance use disorder treatment services are also often a low priority in conflict situations or are simply unavailable.[254] In instances where such services are available, burnout among healthcare providers delivering drug treatment services, mental health services or other health services has been reported, especially in protracted conflicts.[255]

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DRUG TRAFFICKING AND ORGANIZED CRIME

Key takeaways

► **Illicit proceeds from drug trafficking are considerable.** Estimates vary, but the illegal trade in drugs generates hundreds of billions of dollars each year worldwide. The illegal production of, trafficking in and distribution of controlled drugs is a particularly important income-generating activity for organized criminal groups, which are known to operate in virtually all drug markets around the globe, and drug trafficking may represent the dominant activity for most such groups. Although the largest illegal incomes from drug trafficking are generated in destination markets, they only represent a small proportion of the national economies of relatively high-income countries. In the case of some countries with limited rule of law, however, the income generated by drug trafficking as a proportion of national GDP may be considerably larger.

► **Organized criminal groups vary in their roles and functions.** Differences exist between groups that specialize in one drug or one drug-related activity, such as importation, distribution and manufacture, and groups that are involved in multiple drugs or activities. Organized crime groups that engage in drug trafficking differ greatly in terms of their structure, make-up and goals, with groups generally appearing to be oriented towards trade or towards governance. Those oriented towards trade are generally more agile and prioritize market transactions and profit maximization, whereas those oriented towards governance are found to be more hierarchical and seek to control territories, or the markets and people within them.

► **Although resilient, drug trafficking groups can be disrupted.** Over decades it has been shown that drug markets can be highly resilient to law enforcement pressure and both endure and adapt to local conditions and competition. That said, depending on the internal organizational structure, context and activities of drug trafficking networks, it is possible to identify strengths and weaknesses that can make law enforcement operations against them more effective. Highly connected and decentralized groups limit disruptions to trafficking by using multiple channels to exchange information and realize transactions. Conversely, highly centralized hierarchical organizations minimize exposure to law enforcement by layering and controlling information flows, making them hard to infiltrate and sometimes even capable of challenging the State through violence and corruption. Decentralized groups are less susceptible to indiscriminate law enforcement action.

► **Group structure is a key factor.** Efforts to identify and remove key players with a high degree of social capital, such as information brokers, or those with a high degree of human capital, such as money-launderers, are more likely to be successful against decentralized groups. Similarly, it may be possible to exploit such groups through a combination of strategies aimed at getting members to turn on others, such as the intensive investigation of criminal activities in order to build cases through informants. By contrast, hierarchical groups may be more effectively disrupted by targeting mid-level managers who control the flow of information and translate decisions taken by group leadership to the rank and file. Some studies show that violence increases only when those at the very top are removed, suggesting that inner-and inter-group conflict emerges from power vacuums.

► **Well targeted disruptions of drug trafficking groups can be impactful.** Indiscriminate law enforcement actions against drug trafficking does little to disrupt drug markets. Efforts to disrupt groups engaged in drug trafficking can be more impactful if they are well targeted. Understanding variations in the nature of such groups can help shape strategies aimed at dismantling or diminishing them. Therefore, it is vital to be aware that different group structures are more resilient to some interventions and more vulnerable to others.

Introduction

Drug trafficking is an important income-generating activity for organized criminal groups, with estimated annual global retail sales in the hundreds of billions of dollars.[1] In addition to the monetary value of drug trafficking, violence and corruption, which are typical hallmarks of organized crime,[2] destabilize State institutions and society. With this in mind, United Nations Member States have increasingly voiced concern over growing links between drug trafficking and other forms of organized crime, including arms trafficking.[3, 4]

The relationship between organized crime and drug trafficking is not a straightforward one, however. Some criminal groups specialize in drug trafficking, while others earn an income from a diverse portfolio of crimes. Researchers have attempted to develop a typology of the many groups involved in drug trafficking, understood as the illegal production, manufacture, transportation, delivery, transit, distribution, sale, import and export of controlled substances.[5, 6, 7] Groups vary in terms of their structure and activities and can adapt to their environment. Furthermore, groups often adapt to a changing world and to judiciary and law enforcement action, complicating efforts to limit their activities.

Like other types of business, the illegal drug trade is conducted using a variety of organizational structures and strategies. There is evidence that drug trafficking often involves networks of peers that seek to remain hidden, rather than hierarchies that engage in top-down decision-making with clear ranks and roles.[8, 9] In other instances, organized trafficking groups are increasingly fragmented and highly competitive, sometimes engaging in violence with rival groups to enforce control over territory.[10] Similarly, the organized crime landscape has undergone changes, with larger criminal groups giving way to smaller "service providers" that specialize in transportation, laundering or corruption within a particular segment of the larger supply chain.[11, 12]

With the aim of improving understanding of the links between drug trafficking and organized crime, the present chapter first examines the financial importance of drug trafficking to organized criminal groups, citing examples in Europe, the United States of America and a selection of other places. The chapter then looks at the role played by drug trafficking activities in organized criminal groups, before turning to the nature of groups that engage in drug trafficking, including their activities, structure and composition. The concept of governance- and trade-oriented groups is explained, and the way in which groups display certain levels of orientation towards that dichotomy is examined. After considering the adaptations made by different groups to further drug trafficking, the chapter explores strategies for responding to the threat of drug trafficking by organized criminal groups.

Given that indiscriminate drug law enforcement action is thought to be the least effective approach to reducing group operations, understanding the nature and structure of organized criminal groups that engage in drug trafficking offers a basis for more strategic criminal justice responses to their activities. For example, focusing on key individuals in a group is often pointed to as a strategy for dismantling groups.[13] However, the impact and success of that strategy vary depending on the organizational structure and activities of the criminal enterprise or the environment in which it operates. In some countries, for example, strategies targeting leadership positions, known as decapitation strategies, can result in fragmentation of the group, which has not only advantages but also disadvantages, including the potential for greater levels of violence.[14, 15]

Financial importance of drug trafficking to organized criminal groups

With the exception of the information gleaned from a small number of studies mostly conducted in high-income regions and long-standing destination markets, little quantitative information is available about the financial importance of drug trafficking to organized criminal groups. Yet while the geographical scope of those studies is limited, they can provide an idea of the possible financial magnitude of drug trafficking and its importance to organized crime.

Several indicators are generally used to measure the financial scope of drug trafficking:[16]

- Gross income from drug trafficking or retail drug sales, which refers to the total financial gain made from selling drugs (quantities sold multiplied by prices)
- Net income from drug trafficking, which refers to gross income less costs, for example, expenditure on raw material and precursors in the case of producers or the costs of purchasing drugs from intermediaries in the case of drug traffickers

Defining organized criminal groups

The United Nations Convention against Transnational Organized Crime defines "organized criminal group" as "a structured group of three or more persons, existing for a period of time and acting in concert with the aim of committing one or more serious crimes or offences [...] to obtain, directly or indirectly, a financial or other material benefit. It goes on to define "serious crime" as "conduct constituting an offence punishable by a maximum deprivation of liberty of at least four years or a more serious penalty" and "structured group" as "a group that is not randomly formed for the immediate commission of an offence...". Those definitions provide a global legal reference point and are not intended to provide detailed policy guidance on how to differentiate the typologies of organized criminal groups that might vary over time and across regions. They encompass virtually all drug trafficking, as that activity usually involves two or more individuals who operate together over a period of time to commit the crime of drug trafficking, often for pecuniary rewards. Moreover, in many countries drug trafficking is considered a serious crime carrying a term of imprisonment of four years or more, as defined in the international drug control conventions. At the national level, countries sometimes include other defining characteristics of organized crime in their domestic laws, including elements of hierarchical organizational structure, financial motives, transnationality and the use of violence.[a]

The academic literature offers additional defining characteristics of such groups in terms of membership hierarchies, the use or threats of violence, the use of corruption, continuity beyond present membership and group adherence to an internal code or rules of governance.[b, c, d, e, a] Much of the academic literature argues that violence is a constitutive factor of organized crime.[f, g] However, some organized criminal groups, including those that traffic drugs, rarely employ or threaten violence.[h, i]

[a] Sabrina Adamoli, ed., *Organised Crime around the World* (Helsinki, European Institute for Crime Prevention and Control, 1998). Available at https://doi.org/10.15496/publikation-23606.

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[i] Peter Reuter and John Haaga, "The Organization of high-level drug markets: an exploratory study" (Santa Monica, RAND Corporation, 1989).

- Market size, which refers to the aggregated gross income of all actors at the national, regional or global level
- Illicit financial flows, which are a measure of the value of illicit transactions related to drug trafficking as calculated by the volume of inbound or outbound transactions that cross national borders

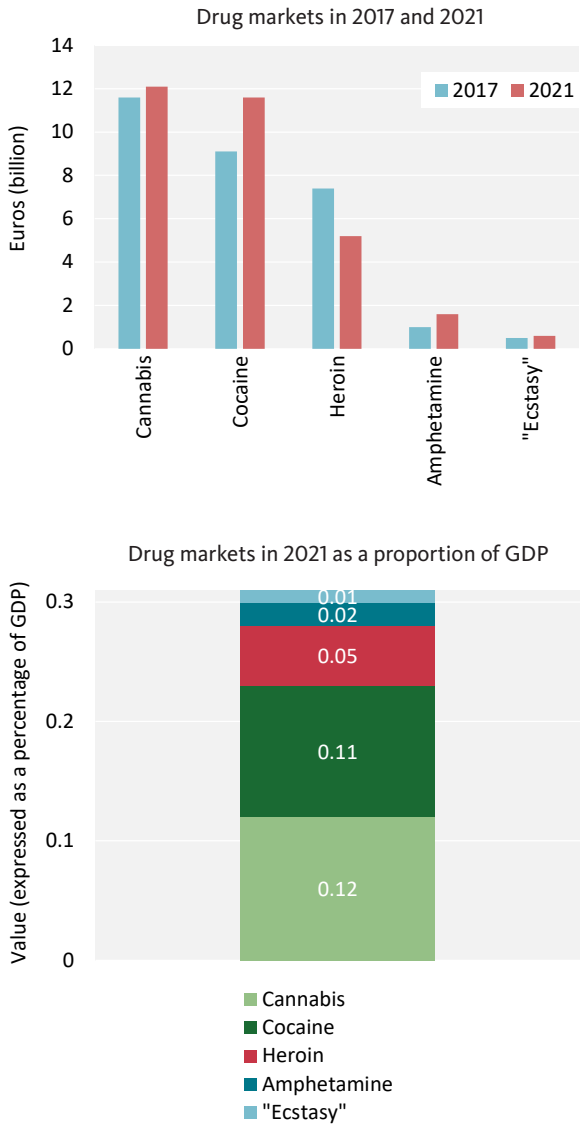
The different indicators used in the various studies each tell a different story about the financial magnitude of drug trafficking and its importance to organized criminal groups. Similarly, these indicators are sometimes compared with the size of national economies to offer some degree of comparative magnitude within or between countries. A number of the indicators have been considered in the case of the following regions and countries.

Europe

On the basis of country estimates for the period 2008–2012, drug-related gross income in the European Union, when the United Kingdom of Great Britain and Northern Ireland was still a member, amounted to €27.7 billion. That figure was equivalent to roughly a quarter of the gross income generated by organized crime,[17] or 0.2 per cent of the overall GDP of the European Union, with national estimates ranging from 0.05 to 0.55 per cent of member State GDP.[18]

There are indications that the European drug markets might have grown over the past decade (see figure 1). In 2021, it was estimated that retail drug markets in the European Union generated some €31 billion in sales, equivalent to 0.3 per cent of the region's overall GDP, a significant proportion of which is likely to have benefited organized crime.[19, 20] The United Kingdom was no longer

FIG. 4 Value of retail drug markets in the European Union, 2017 and 2021



Sources: EMCDDA and Europol, *EU Drug Markets Report 2019* (Luxembourg, Publications Office of the European Union, 2019); EMCDDA and Europol, *EU Drug Markets Analysis 2024: Key Insights for Policy and Practice* (Luxembourg, Publications Office of the European Union, 2024).

a member of the European Union by then, but the figure would have been even higher had it included the country.

In 2021, the estimated gross income generated by the retail drug markets in the European Union mainly came from sales of cannabis (39 per cent) and cocaine (37 per cent), followed by heroin (17 per cent) and ATS (7 per cent).[21] Compared with the 2017 estimate, which included the United Kingdom, that income had increased in the case of all drugs, with the exception of heroin,[22, 23] which accounted for 0.05 per cent of the GDP of the European Union in 2021.

United States

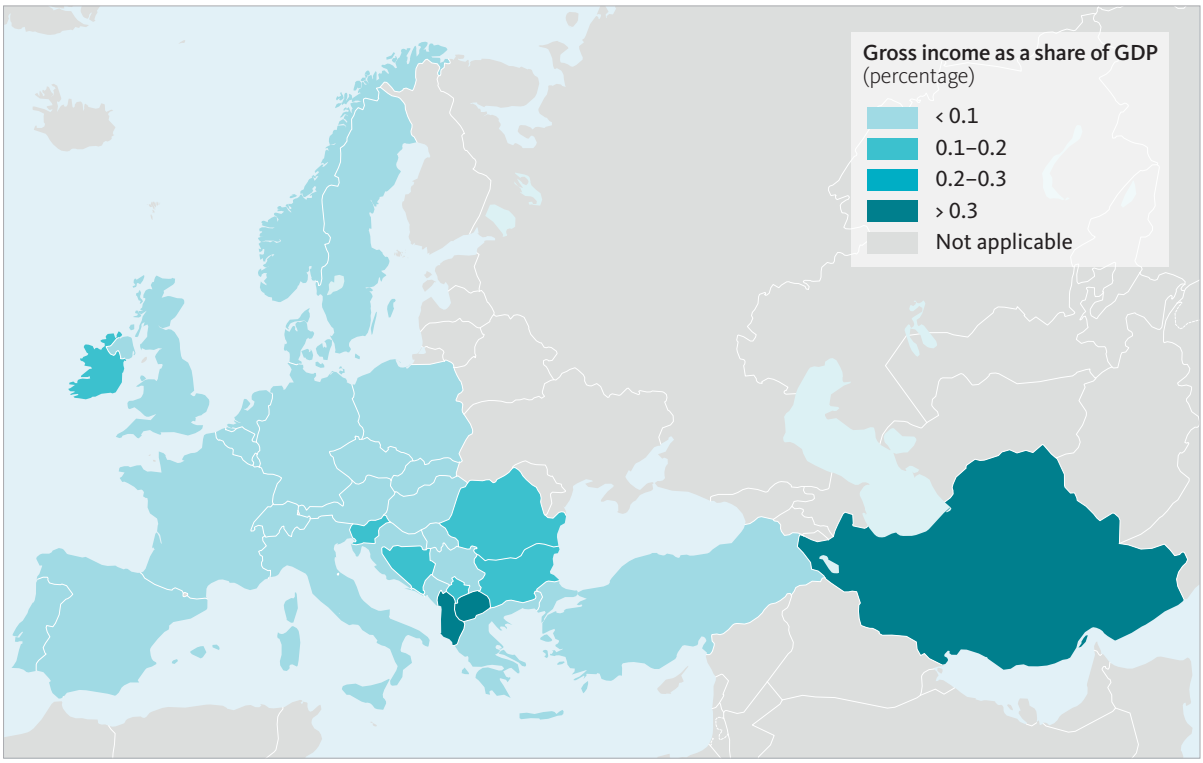
A 1990 study estimated that the retail income generated from drug sales in the United States, which at the time were dominated by cocaine (63 per cent), followed by heroin (18 per cent), cannabis (14 per cent) and other drugs (5 per cent), totalled $97 billion, equivalent to 47 per cent of all identified criminal proceeds, including from drug trafficking, fraud, prostitution, loan sharking, motor vehicle theft, illegal gambling, larceny/theft, burglary, robbery, trafficking in persons, counterfeiting and arson fraud.[24]

Another study estimated that the annual retail income of $110 billion generated from illegal drug sales[25] over the period 2000–2010 in the United States[26] was close to 40 per cent of the overall income generated by organized criminal groups in the country.[27] That finding supports the observation that the overall gross income generated by the retail drug market in the United States (accounting for 0.7 per cent of GDP in 2010) has traditionally been larger than that generated in the European Union (accounting for 0.2 per cent of GDP in 2010). The gross income generated from retail sales of drugs in the United States rose from $124 billion in 2010 to $146 billion by 2016,[28] equivalent to 0.8 per cent of GDP, of which 36 per cent was related to cannabis, 29 per cent to heroin, 18 per cent to methamphetamine and 16 per cent to cocaine.[29]

Other places

Aside from the estimates resulting from the studies undertaken in the European Union and the United States, few other systematic estimates have been made of the monetary value of drug markets as a whole. However, some estimates have been made in relation to markets for specific drugs. For example, UNODC estimated that the annual gross income generated from trafficking opiates – mainly heroin – from Afghanistan through Central Asia and the Russian Federation was roughly $10 billion

MAP 1 Gross income generated by the opiate and methamphetamine markets as a share of GDP



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan.
The final status of Jammu and Kashmir has not yet been agreed upon by the parties.

Source: UNODC, *Opiates and Methamphetamine Trafficking on the Balkan Route: Drug Flows, Illicit Incomes and Illicit Financial Flows* (United Nations publication, 2025).

between 2016 and 2019. On average, that figure accounted for 0.5 per cent of GDP of the countries along that route.[30] Meanwhile, the annual gross income generated along the Balkan route was $15.5 billion between 2019 and 2022, or an average of 0.14 per cent of GDP of the countries along that route.[31] The annual net income generated from opiate and methamphetamine trafficking along the Balkan route was $13.9 billion in the same period.[32] The gross income from opiate and methamphetamine trafficking varies across countries along the Balkan route (see map 1).

In Afghanistan and Myanmar, the illicit opiate economy has traditionally accounted for a large proportion of GDP. In 2021, the latest year for which data were available for Afghanistan, the value of potential opiate exports was between roughly $1.7 billion and $2.6 billion, or 9–13 per cent of the country's GDP.[33] In Myanmar in 2023, the value of opiate exports ranged from $589 million to $1.57 billion, representing between 0.9 and 2.4 per cent of the country's GDP that year.[34]

In the case of methamphetamine, estimates of income generated from the manufacture of and trafficking in the drug are available for the Balkan route and for parts of Asia and the Pacific. The annual gross income generated from methamphetamine trafficking along the Balkan route was $2 billion between 2019 and 2022,[35] or an average of 0.02 per cent of GDP of the countries along the route, while the annual net income was estimated at $1.6 billion.[36]

The retail value of the methamphetamine markets in South-East Asia and neighbouring East Asia, Australia, New Zealand and Bangladesh in 2019 was estimated to have ranged from $30.3 billion to $61.4 billion.[37] Markets in South-East Asia accounted for over 40 per cent of that amount, in East Asia for nearly one third, and in Australia and New Zealand for about 18 per cent.

In addition to estimates of the income of drug traffickers, for a few countries estimates have also been made of

TABLE 3 Inward and outward illicit financial flows related to drug-trafficking for countries where data are available

Country	Drug	Average annual inward illicit financial flows ($)	Average annual outward illicit financial flows ($)
Colombia (2015–2019)	Cocaine	1.2–2.6 billion	227 million
Mexico (2015–2018)	Cocaine Methamphetamine Heroin	4.5 billion 2.8 billion 4.8 billion	337.5 million
Peru (2015–2017)	Cocaine	1.5 billion	
Afghanistan (2018–2021)	Opiates	1.3–2.2 billion	
Bangladesh (2017–2021)	Heroin "Yaba" (methamphetamine) Phensedyl (cough syrup) Buprenorphine		61.9 million 140.3 million 215.4 million 63.1 million
Maldives (2020–2021)	Heroin Cannabis		7.25 million 8.7 million
Nepal (2019–2021)	Heroin		4.6 million
Myanmar (2018–2022)	Opiates	0.5–1.3 billion	

Source: UNODC, "Crime-related illicit financial flows: latest progress", 2023.

drug-related illicit financial flows that capture the inward value generated from the export of drugs and the outward value related, for example, to the intermediate purchasing of drugs or precursors (see table 1). Those outward flows represent roughly 1 per cent of national GDP in the case of Mexico[38] and 0.4–2.8 per cent of national GDP in the case of Colombia.[39]

Role played by drug trafficking activities in organized criminal groups

Law enforcement and prosecutorial analyses of organized criminal groups engaged in drug trafficking in key destination markets in high-income regions reveal some similarities between such groups, even though definitions of organized crime, methodologies and samples vary across regions and years. In European Union countries, the United Kingdom, Australia and Japan, drug trafficking is a major activity for a considerable proportion of organized criminal groups, from more than one third of groups in European Union countries to about 80 per cent in Australia.

A comparison of information on groups gleaned from national criminal justice systems shows that although there are differences in the organized criminal groups engaged in drug trafficking, the majority comprise just a few members or associates and only a small proportion are much larger (see table 2). In Australia, for example, there are many smaller groups (2 to 10 people). Irrespective of their size, many groups participate in, or infiltrate, legitimate business sectors as part of their criminal activity. This includes operating, enlisting the support of or infiltrating legitimate businesses such as transport and logistics companies to facilitate the movement of contraband, real estate and financial firms to launder criminal proceeds, other third parties or even relatives, in some cases.[40, 41]

Many drug trafficking groups in the European Union are not vertically integrated across the various levels of the drug supply chain and only operate stages of it. For instance, certain groups cultivate cannabis while others take care of its distribution. Similarly, a group may specialize in delivering cocaine from containers in ports or in transporting drugs, providing services to other groups. Some groups participate in a supply segment while others

TABLE 4 Comparison of organized criminal groups, 2003–2023

Characteristic	European Union (2023)	Germany (2003–2023)	United Kingdom (2020–2023)	Australia (2021)
Approximate number of organized criminal groups analysed	800	7 000	5 000	900 (700 of which were analysed in greater detail)
Proportion of groups involved in drug trafficking	36% primarily focused on drugs; 18% polycriminal, including drug trafficking	Average of 38% of those investigated between 2003 and 2023; 41% in 2023	37% in 2020	58% engaged in importation; 81% engaged in manufacturing, trafficking and distribution
Primary drugs trafficked	Cocaine (41%), cannabis (16%), polydrug (40%)	Cocaine (35%), cannabis (33%), poly-drug (25%)	Not specified	Methamphetamine, cocaine, cannabis, heroin
Average number of members per group	30	11 (70% had 3–10 members; ~3% had 50 or more members)	73	10 (largest share 2–5 individuals)
Average period of activity of groups	More than 34% active for 10 or more years	Not specified	Not specified	Not specified
Other characteristics	86% had infiltrated legal businesses; 71% engaged in corruption; 68% used violence	36% engaged in violence; 15% engaged in corruption; 94% had infiltrated or operated legal businesses	61% of drug groups, mostly urban street gangs, engaged in violence; 29% had links to firearms	Polydrug groups dominated; strong focus on drug importation and distribution; 21% involved in violence, extortion and abduction; 10% trafficked other illicit commodities

Sources: Europol, *Decoding the EU's Most Threatening Criminal Networks* (Luxembourg, Publications Office of the European Union, 2024); United Kingdom, National Crime Agency, *National Strategic Assessment of Serious Organised Crime* (2020, 2023); Bundeskriminalamt, *Organisierte Kriminalität: Bundeslagebild 2023* (and earlier years); Anthony Morgan and Christoper Dowling, "Enablers of illicit drug trafficking by organised crime groups", Trends & issues in crime and criminal justice, Australian Institute of Criminology, 2023.

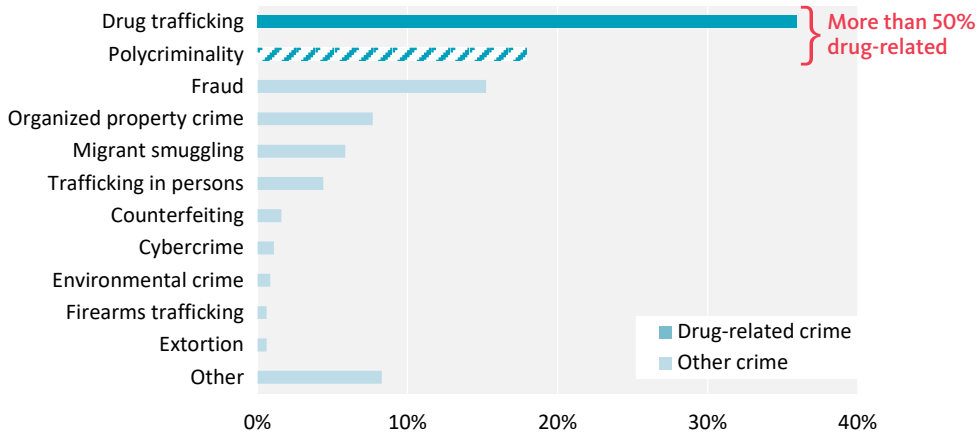
Note: Definitions of what constitutes organized crime may vary substantially, contributing to some of the differences reported.

exert control over multiple parts of the supply chain, from importation to retail. Groups that cover only part of the process tend to be active for fewer years than those with end-to-end control.[42]

Analysis also shows that drug trafficking is strongly linked to other serious crimes. For example, almost half of money-laundering operations in Europe stem from drug offences, while just one third stem from fraud.[43] Drug trafficking groups may also benefit from or engage directly in trafficking in persons. In some cases, this involves forcing victims to engage in or aid drug trafficking, sometimes by acting as spotters or distributors.[44] A correlation has also been found between firearms and drug trafficking, which sometimes form an important bidirectional trade. In the case of Haiti, for example, firearms are illegally imported while drugs are illegally exported, sometimes using the same modes of transport or groups, highlighting an important symbiotic relationship.[45]

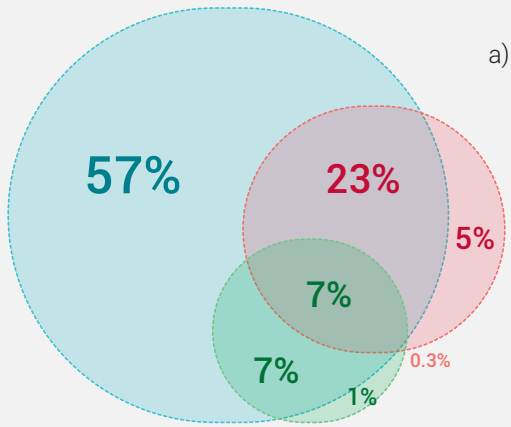
In the United Kingdom, drug- and firearm-related crime often overlap, and there is a strong connection between drug supply and the use of firearms.[46] Violence linked to drug trafficking groups is seemingly more prevalent than violence linked to organized crime in general in the country, with reports noting the involvement of groups engaged in retail drug distribution. In Germany, investigations into organized criminal groups in 2023 suggest that most groups do not engage in violence or high-level corruption and are structured like a commercial entity.

FIG. 5 Main activity of the criminal networks in the European Union assessed by Europol, 2024



Source: Europol, *Decoding the EU's Most Threatening Criminal Networks* (Luxembourg, Publications Office of the European Union, 2024).

Investigations into organized criminal groups in Germany, 2023



a) The use by groups of commercial or business-like structures:
602 investigations (94%)

b) The use by groups of violence or other means of intimidation:
231 investigations (36%)

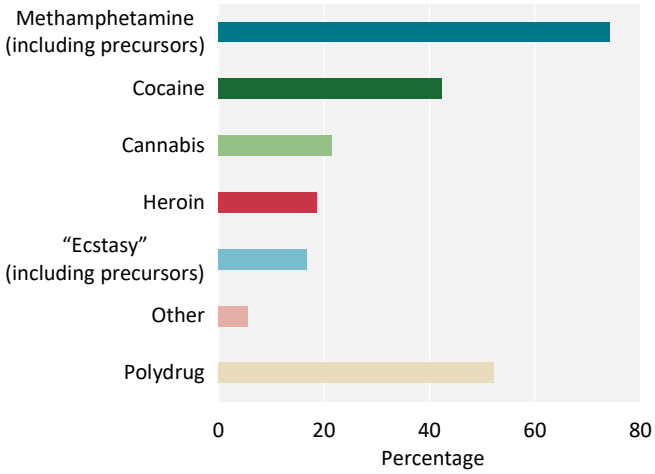
c) The influencing by groups of politics, the media, public administration, the judiciary or the economy:
97 investigations (15%)

Source: Bundeskriminalamt, *Organisierte Kriminalität: Bundeslagebild 2023*.

In Australia, variations exist between groups that specialize in supplying a single type of drug (mono-drug trafficking), and those that supply many different types (polydrug trafficking). More than half of drug trafficking groups in the country in 2023 were involved in polydrug trafficking and were significantly more likely than mono-drug trafficking groups to be involved in drug manufacture (39 per cent versus 25 per cent) and distribution (86 per cent versus 66 per cent). They were also significantly more likely than mono-drug trafficking groups to be involved in multiple stages of the supply chain (67 versus 39 per cent).[47] This may be the result of differences in the activities, goals or risk tolerances of the different groups. Research revealed an overall emphasis on trafficking in methamphetamine, followed by trafficking in cocaine, cannabis and heroin,[48] unlike the situation in the European Union, where cocaine dominated trafficking activities.

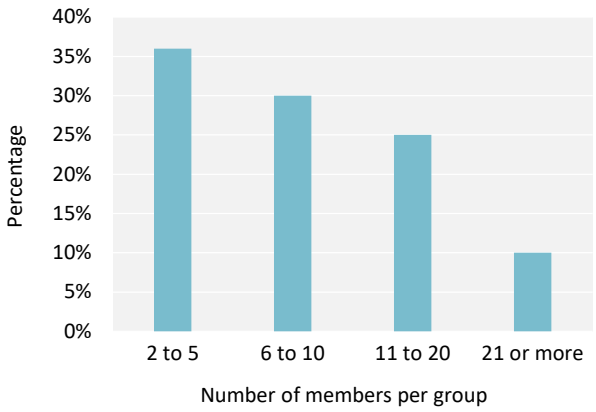
In Japan, the police report that drug trafficking, in particular methamphetamine trafficking, is the main source of income for criminal organizations, including the Yakuza.[49] In 2020, members of the Yakuza were implicated in about

FIG. 6 Types of drugs trafficked by 587 organized criminal groups in Australia



Source: Anthony Morgan and Christoper Dowling, "Enablers of illicit drug trafficking by organised crime groups", Trends & issues in crime and criminal justice, Australian Institute of Criminology, 2023.

FIG. 7 Number of members of 587 organized criminal groups involved in drug trafficking in Australia



Source: Anthony Morgan and Christoper Dowling, "Enablers of illicit drug trafficking by organised crime groups", Trends & issues in crime and criminal justice, Australian Institute of Criminology, 2023.

31 per cent of drug offences, with methamphetamine involved in over 80 per cent of those cases, followed by cannabis in 15 per cent.[50]

In other countries, it is more challenging to quantify the involvement of organized criminal groups in drug trafficking. However, limited information shows that:

- In Uzbekistan between 2020 and 2024, between 4 per cent and 6 per cent of drug law offences were committed by a group.[51]
- In Brazil in 2023, drug trafficking was the most frequently referenced predicate crime to financial crimes, accounting for 31 per cent of all such predicate crime. This represents an increase from 17 per cent in 2014, when corruption was the most frequency referenced predicate crime, and is believed to result from the expansion of organized criminal activities related to drug trafficking in the past decade.[52]
- In Türkiye in 2024, some 60 groups involved in drug trafficking were dismantled, with an average number of 12 members per group arrested.[53]
- In Albania in 2022 and 2023, drug production and trafficking were the most important activities for organized criminal groups, with roughly 60 per cent of groups operating on a national scale, facilitating trafficking in cannabis, heroin and cocaine to the European Union.[54]
- In Serbia between 2019 and 2022, roughly 19 per cent of all criminal charges filed against members of organized criminal groups related to drug trafficking.[55]
- In Afghanistan in 2020, small drug trafficking groups were found to have been formed mainly on the basis of family structures, shared tribal connections and local neighbourhoods.[56]
- Several other countries, including Iraq, Myanmar and Pakistan, noted the strong and mutually reinforcing connection between organized crime and drug trafficking, which often causes substantial harm, such as violence or corruption.[57, 58, 59]

Nature of the organized criminal groups that engage in drug trafficking

As well as varying in terms of their activities and structure, organized criminal groups are shaped by their environment.[60, 61, 62] Groups that regularly or specifically trade in contraband for economic gain, for example, are influenced by market dynamics and business interests.[63, 64] Other groups that engage in drug trafficking may be driven by or participate in other activities, including establishing parallel governance structures or attempting to penetrate existing social, economic or political structures. In other cases, groups with explicit political aims, such as terrorist groups, may engage in drug trafficking as a means

of supporting their ultimate goals.[65, 66] In other ways, the composition of a group can vary according to the need to achieve its goals.[67] Last but not least, the underlying political, cultural and social conditions that give rise to organized crime can also explain group variations. For example, groups are often shaped by local conditions such as the limited presence of State institutions, cultural attitudes favouring clientelism and a general social acceptance of the use of violence.[68, 69]

In other words, group characteristics are fluid, and the interplay between different characteristics coupled with the specific environmental conditions make every group unique. A particular group can also display different characteristics across places and time. It is therefore challenging to rigidly identify clusters of groups with the same characteristics, although some overarching considerations can help to broadly differentiate groups for the purposes of understanding their vulnerability to disruption efforts.

The following text box describes groups according to their organizational activities and structure, looking at those that are oriented more towards governance or towards trade and those that are more decentralized or centralized. No group is found at either extreme, but groups do display certain levels of orientation towards those dichotomies, which can help improve understanding of how law enforcement authorities can respond to them.

Organizational activities

Since criminal groups can be placed along a continuum of activities that are oriented towards governance and

Categorizing organized criminal groups: an analysis of the academic literature

The academic literature has analysed how drug trafficking groups vary in their activities and structure. However, analysing this topic through existing studies is challenging because research on the diversity of organized criminal groups often looks at a wide range of criminal or even political activities rather than focusing solely on drug trafficking, complicating efforts to directly compare groups engaged in drug trafficking.[a, b, c] Furthermore, different groups may be involved in specific aspects of the illegal drug trade, from production to final sale, and this may shape their activities and organizational design.

Research conducted on the structural models of organized criminal groups in recent decades has examined law enforcement intelligence and surveillance data in order to quantify variations in group structure.[d] Studies of drug trafficking groups are focused on independent organizations in large destination markets (the United States, Canada, Australia and Europe), with a few including links to actors in South America. Several examined "mafia-style" criminal enterprises in Mexico, Italy and Colombia.[e, f, g, h] One looked at an outlaw motorcycle gang in Canada[i] and another at the participation of the Yakuza in drug trafficking in Japan.[j] Two studies examined drug trafficking groups in South-East Asia.[k, l] Most of the studies reported similar findings regarding variations in group structure based on the complexity of the trafficking mode, the internal needs of the group or external threats posed to the group.

Like any other social organization, drug trafficking groups often find ways to adapt to the environment in which they operate. Groups engaged solely in retail distribution, for example, are likely to have different structures to groups that facilitate international trafficking and participate in different activities. Moreover, external pressure from the State or competitors can also affect group size and behaviour. These differences in the illegal drug trade have significant implications for law enforcement efforts to target drug trafficking.

[a] Niles Breuer and Federico Varese, "The structure of trade-type and governance-type organized crime groups: a network study", *The British Journal of Criminology*, vol. 63, No. 4 (2023), pp. 867–88.

[b] Paolo Campana and Federico Varese, "Organized crime in the United Kingdom: Illegal governance of markets and communities", *The British Journal of Criminology,* vol. 58, No. 6 (2018).

[c] Anja Shortland and Federico Varese, "State-building, informal governance and organised crime: the case of Somali piracy', *Political Studies*, vol. 64, No. 4 (2016), pp. 811–31.

[d] Gisela Bichler, Aili Malm and Tristen Cooper, "Drug supply networks: a systematic review of the organizational structure of illicit drug trade", *Crime Science*, vol. 6, No. 1 (December 2017).

[e] Francesco Calderoni, "Strategic positioning in mafia networks", *Crime and Networks* (Routledge, 2013), pp. 163–81.

[f] Francesco Calderoni, David B. Skillicorn and Quan Zheng, "Inductive discovery of criminal group structure using spectral embedding", *Information & Security* 31, No. A (2014), pp. 49–66.

[g] David C. Hofmann and Owen Gallupe, "Leadership protection in drug-trafficking networks", *Global Crime*, vol. 16, No. 2 (2015), pp. 123–38.

[h] Anthea McCarthy-Jones, Caroline Doyle, and Mark Turner, "From hierarchies to networks: the organizational evolution of the international drug trade", *International Journal of Law, Crime and Justice*I, vol. 63 (2020).

[i] Carlo Morselli, "Hells angels in springtime'" *Trends in Organized* Crime, vol. 12 (2009), pp. 145–58.

[j] Martina Baradel and Niles Breuer, "Mapping drug smuggling networks in Japan: a social network analysis of trial documents', *Global Crime*, vol. 25, No. 3–4 (2024), pp. 220–41.

[k] Hai Thanh Luong, "The organisational structure of transnational narcotics trafficking groups in Southeast Asia: a case study of Vietnam's border with Laos', *Trends in Organized Crime*, vol. 23 (2020), pp. 385–411.

[l] Fathurrohman and Gisela Bichler, "Explaining the positional importance of actors involved in trafficking methamphetamine into Indonesia", *Global Crime*, vol. 22, No. 2 (2021), pp. 93–122.

those that are oriented towards trade, one way to examine and explain the diversity of groups engaged in drug trafficking is to consider their activities.[70, 71, 72]

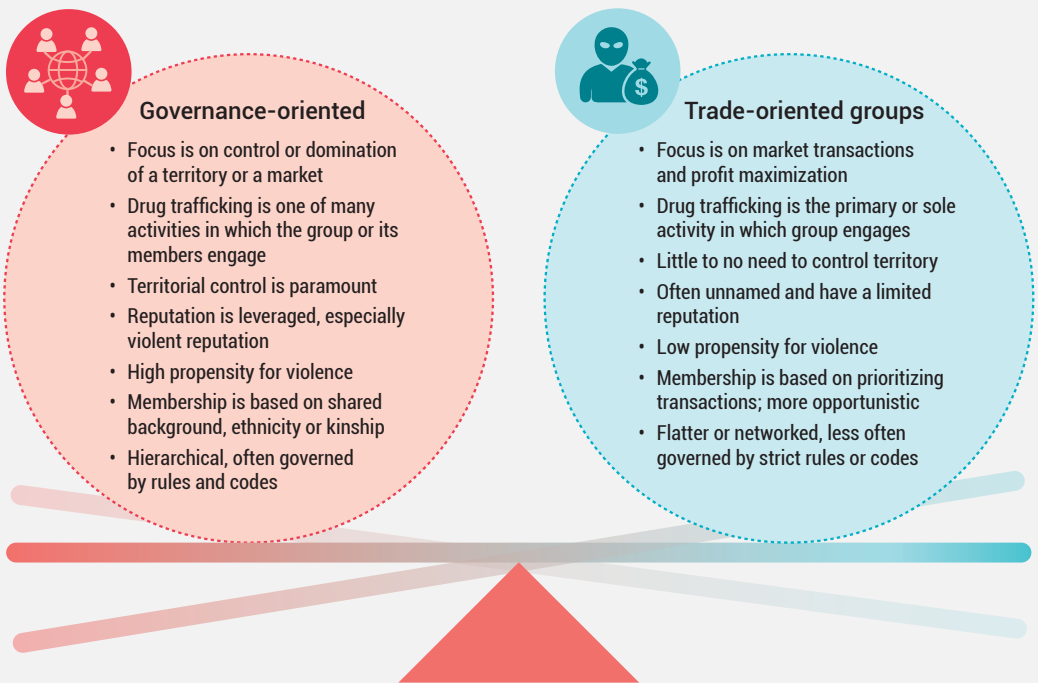
Governance orientation[73, 74]

Groups oriented towards governance can be classified as engaging in a variety of activities, both legal and illegal, in order to dominate a market or a geographical area.[75] This can include groups that traffic or distribute drugs, although governance-oriented groups appear to act primarily to control their environment.[76] There is some evidence that an emphasis on control over a territory, economy or polity limits group expansion into more fluid, higher-risk, market-oriented activities such as trafficking.[77, 78] Governance-oriented groups may have fixed hierarchies and use internal codes of conduct to maintain order. They typically regulate criminal (and sometimes non-criminal) activities, employing violence or its threat to establish or maintain control of their territory, as well as to keep members in line, settle disputes or protect the group's reputation. Corruption may also be utilized, including high-level corruption that compromises State institutions. Control is paramount to governance-oriented groups, especially control over physical territory. Control can also extend to extortion in the form of a tax levied on the activities, licit or otherwise, that are carried out in that territory or market. This is the case with armed groups that use the proceeds of drug trafficking to fund other activities, such as FARC-EP, AUC and various armed groups in the Sahel.[79, 80]

Trade orientation[81, 82, 83]

By contrast, groups that are oriented towards trade focus on the efficient, short-term exchange of illegal goods. Therefore, they often have flatter structures than governance-oriented groups that facilitate the completion of transactions, enable flexibility in membership and roles and display little desire for enduring hierarchical control.[84] This reinforces their adaptability in different markets or regions. Such groups are often categorized as exhibiting low barriers to membership with frequent turnover of members.[85] Members are motivated by financial gain rather than other intangible rewards such as ideology or honour. Depending on where in the drug supply chain such groups operate, they tend to be less inclined to hold on to territory or uphold their reputation than governance-oriented groups.[86] Groups oriented towards trade typically leverage global supply chains and exploit

Drug trafficking groups can be characterized around a continuum of activities that are oriented towards governance or trade

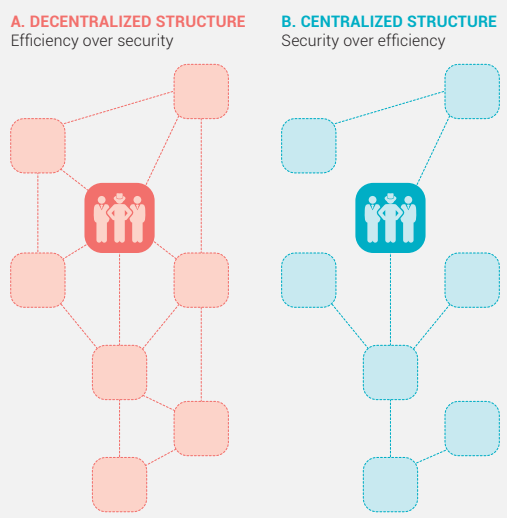


vulnerabilities in order to move drugs across multiple countries.[87] Overall, trade-oriented groups are less likely to engage in violence, as it draws the attention of the authorities. They may take the form of loose networks and establish membership ties based on opportunity rather than shared characteristics such as ethnicity.

Organizational structure

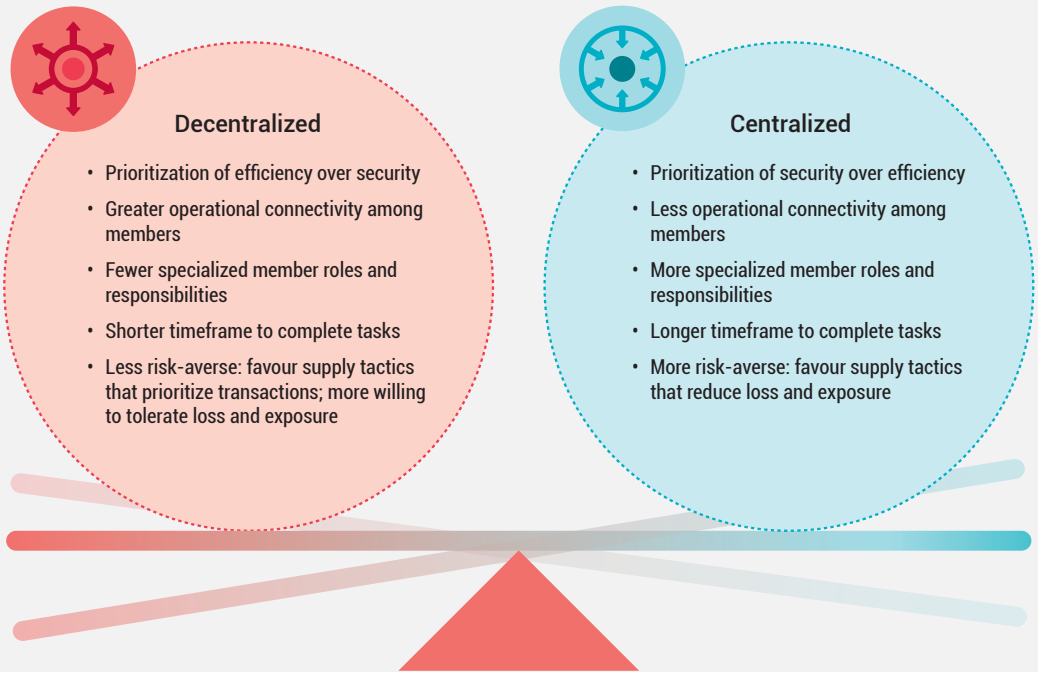
Another way to examine the composition of organized criminal groups is through their level of structured decentralization. Any organization, be it licit or criminal, must decide how to divide responsibilities and make decisions; research on the structural differences between drug trafficking groups has described criminal group structures as exhibiting varying degrees of centralization.[88] This is sometimes conceptualized as an efficiency/security trade-off, whereby a criminal group has to organize the connections between its members in ways that balance the need to realize its operations with the need to protect both members and operations, especially from law enforcement authorities or competitors.[89]

Decentralized and centralized structures of organized criminal groups



Source: Adapted from Gisela Bichler, Aili Malm and Tristen Cooper, "Drug supply networks: a systematic review of the organizational structure of illicit drug trade", *Crime Science*, vol. 6, No. 1 (December 2017).

Comparison of drug trafficking group structures



Decentralized groups

Drug trafficking groups that tend towards greater decentralization also tend to prioritize organizational efficiency based on their information and task requirements, time constraints and the need to minimize disruptions to operations. These groups are often characterized as having a higher degree of interconnectivity than centralized groups.[90, 91, 92] Greater connectivity among members, typically among a core group of key individuals, allows for quicker information flow and decision-making. It also means that the removal of a single individual does little to disrupt the organization's functions.[93] In panel A of the figure to the left, removal of the dark-red node will not disrupt the group's overall activities as neighbouring nodes are independently connected.

Centralized groups

Increased connectivity between members of a group may lead to greater exposure to law enforcement authorities or rival groups. For this reason, some drug trafficking groups that tend towards centralization prioritize organizational security to protect members, as well as the overall group, from outsiders and law enforcement authorities. Centralization reduces the risk of infiltration or leaks, and core members sometimes conceal their involvement through additional layers, or brokers.[94] Information flows and decisions are the responsibility of key individuals.[95, 96, 97] Centralized groups are described in the literature reviewed as being particularly risk-averse and as often having longer time frames for accomplishing goals than decentralized groups. Several studies have found that, in some instances, the information and logistics necessary for a trafficking operation may be less complex for this type of group than for decentralized groups.[98, 99] In panel B of the figure, the removal of the dark-blue node will effectively sever the connection between the clusters of nodes.

Examples of the varying natures of organized criminal groups that engage in drug trafficking

Ultimately, a combination of factors determines the composition of a drug trafficking group and makes it oriented towards either governance or trade, with varying degrees of centralization. Some studies suggest that groups oriented towards governance restrict membership and require managerial layers and hierarchies that generally limit their size and number of members.[100, 101, 102, 103] That said, other studies indicate that drug trafficking groups such as *Primeiro Comando Capital* (PPC) and *Comando Vermelho* (CV) in Brazil exhibit a certain amount of vertical hierarchy across the entire organization, with local affiliates operating with varying structures and limited independence that some have considered to be similar to a franchise model.[104, 105] According to a study of outlaw motorcycle gangs, some that engage in drug trafficking also operate based on a franchise model that allows for expansion and variation in group activities.[106]

In some instances, governance-oriented groups can be embedded in social systems and some even seek to supplant State services and dominance. Organized criminal groups that engage in drug trafficking in Mexico and Colombia exert significant influence over the areas in which they operate, including the Andes, Central America and Mexico.[107] A study of the Sinaloa Cartel, for example, noted that the group has long-term aims that persist beyond the current membership and that the group relies on its reputation to ensure its longevity.[108]

Many Serbian organized criminal groups have a clear hierarchy and division of members' roles, making them more governance-oriented. The rules of hierarchy and internal discipline are strict and are enforced in some groups by threats of violence.[109] Meanwhile, drug traffickers based in the Sahel operate independent, fluid networks held together by ties of kinship.[110] Communities in northern Mali, the Niger and Chad tend to engage in a variety of smuggling activities, including the smuggling of commercial goods and fuel, as well as drug trafficking.[111, 112, 113] Revenue generated from drug trafficking, which can be substantial, is often used to challenge traditional power structures within and across those communities and has led to the emergence of powerful traffickers who appear to have long-term political goals beyond trafficking in drugs.[114]

TABLE 5 Summary of key examples of organized criminal groups engaged in drug trafficking based on their varying natures

Group nature	Key examples
Oriented towards governance and centralized	FARC-EP; Sinaloa Cartel; Serbian organized criminal groups; PCC; the Camorra
Oriented towards governance and decentralized	The 'Ndrangheta; outlaw motorcycle gangs; armed groups in the Sahel
Oriented towards trade and centralized	Family-based clans engaged in cocaine trafficking in Bolivia and Peru; small-scale land-based methamphetamine trafficking groups in South-East Asia; methamphetamine trafficking groups that use air couriers in Japan
Oriented towards trade and decentralized	Maritime methamphetamine trafficking groups in Japan or South-East Asia

Between governance and trade: the case of the Italian mafia

Although they are normally thought of as a single entity, the groups that comprise the "Italian mafia", such as Cosa Nostra, the 'Ndrangheta and the Camorra, are conglomerations of hundreds of clans or "families" that control portions of territories, each of them allied, federated, subordinated or in conflict with the others.[a] As such, each clan or family will adapt to local and global opportunities with differences in structure, operations and cultural practices that reflect diverse historical contexts and regional economies. In other words, conglomerates such as Cosa Nostra, the Camorra and the 'Ndrangheta fluctuate, to varying degrees, between governance and trade objectives.

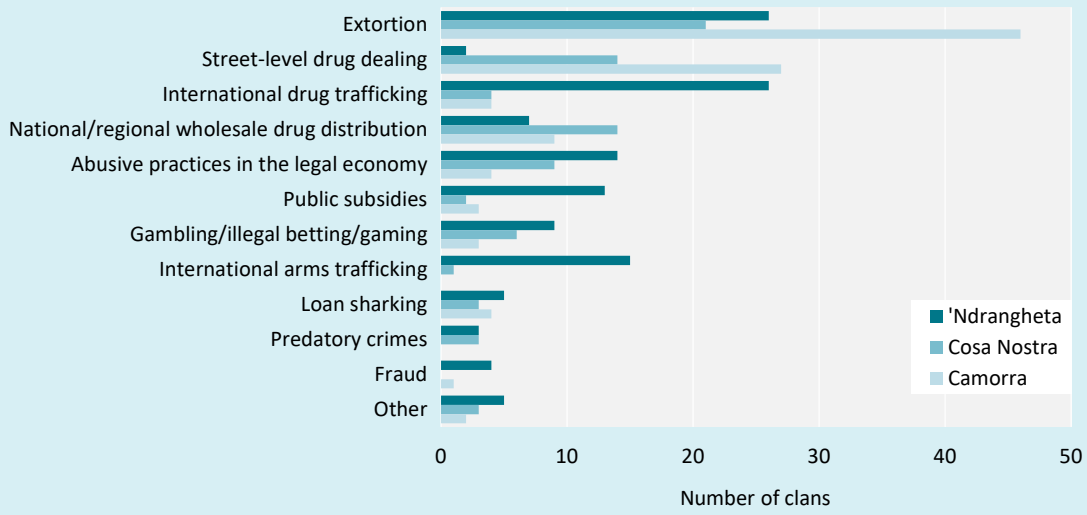
Italian mafia groups generally engage in local crimes, mostly extortion, dispute resolution and corruption. However, some are involved, in whole or in part, in drug trafficking and distribution. At one point in time, Cosa Nostra was estimated to play an important role in facilitating heroin trafficking into North America, supplying about one third of the entire North American market between 1975 and 1985.[b, c] However, the drug business was not an activity that was operated in a top-down fashion by the group. Rather, individual members leveraged their group connections to facilitate trafficking at the international level.[b, c]

In recent decades, successful law enforcement and prosecutorial action have drastically reduced the role played by Cosa Nostra in international drug trafficking.[a] Today, although most clans active in southern Italy engage in the illegal drug trade in one way or another, they are largely oriented towards other activities and few groups dominate international trafficking. For some groups, territorial control is necessary for facilitating trade: the dominant cocaine entry point into Italy, for example, is considered to be the port of Gioia Tauro, where drug trafficking is controlled by the 'Nadrangheta.[a]

The fact that clans are involved in local drug markets suggests that territorial control and governance-oriented structures are a prerequisite for dominating a regional market. In the figure below, this is seen, for example, in the larger share of clans that engage in extortion activities. A smaller share of groups engage in drug trafficking at the retail level (sometimes merely taxing the activity of other groups).[a] Inversely, groups with ties to the 'Ndrangheta are believed to engage in a higher number of trade-oriented activities, such as international drug trafficking and arms trafficking, and less frequently in street-level drug dealing.

Although Cosa Nostra was once suspected of controlling large portions of the international illegal drug trade, today the Italian authorities note that Cosa Nostra and the Camorra most often rely on rent-seeking activities, with drug trafficking and distribution now comprising a smaller share of their activities. Nowadays, the 'Ndrangheta is believed to be the most influential organization in cocaine trafficking originating in South America.[a] Yet the different facets of the 'Ndrangheta are an example of how the activities and structures of a group can vary.

Reported activities of 181 clans linked to the 'Ndrangheta, the Camorra and Cosa Nostra



Source: Direzione Investigativa Antimafia, "Rapporto Semestrale Al Parlamento Gennaio-Giugno 2023", 2023.

Note: Groups may engage in more than one activity. Breakdown by group affiliation was as follows: Cosa Nostra, 42 groups; the Camorra, 61 groups; and the 'Ndrangheta, 78 groups.

Several clans affiliated with the 'Ndrangheta maintain extensive drug-related business relations with criminal groups in Latin America and are active in Europe, North America and Asia and the Pacific, with some also engaged in trafficking activities in West and North Africa.[a] However, only a fraction of the groups that claim to be affiliated with the 'Ndrangheta can carry out international trade functions relevant to drug trafficking, with most clans under the 'Ndrangheta appearing not to have such an international trading capacity, although they may engage in wholesale drug distribution or control, directly or indirectly, and retail sales.[a] In their territories of origin, these clans have a very traditional structure and continue to exercise territorial control and operate as typical governance-oriented groups. However, their use of violence is limited, as they tend to maintain a certain level of coordination and communication among the different entities in order to reduce the risk of inter-clan violence.

In summary, Italian criminal clans offer a concrete example of the wide spectrum of organized criminal groups that are engaged in drug trafficking. Some have the capacity or willingness to engage in trade-based activities such as international drug trafficking, while others engage in or tax drug distribution activities at lower levels, including retail distribution. Therefore, variations exist across different Italian mafia conglomerates, with some being more balanced between governance and trade, such as some of the clans affiliated with the 'Ndrangheta, and some being more oriented towards governance, such as Cosa Nostra.

[a] Direzione Investigativa Antimafia, "Rapporto semestrale al Parlamento Gennaio-Giugno 2023", 2023.

[b] John Dickie, *Cosa Nostra: A History of the Sicilian Mafia* (Hodder & Stoughton, 2004).

[c] Giovanni Falcone and Marcelle Padovani, *Cose di Cosa Nostra*, 22nd edition (Milan, Rizzoli, 1991).

Other groups sometimes go unnamed and generally avoid attention or controlling localities, especially through the use of violence, for extended periods of time. Examples from the literature and elsewhere include small-scale trafficking groups that are generally oriented towards trade, such as groups that traffic methamphetamine over land borders in South-East Asia,[115] drug trafficking groups that utilize air couriers in Japan,[116] online vendors that distribute drugs using the darknet and postal systems[117] and Nigerian trafficking networks operating in Europe.[118] The goal of such groups is to complete transactions that can generate income and, by some accounts, they make up a large share of the drug trafficking groups operating in the European Union.[119]

Other examples, as reported by United Nations Member States, include small groups using commercial air routes to traffic cocaine from French Guiana to France.[120] Similarly, small amounts of cocaine have also been trafficked by air couriers from South America to Maputo airport in Mozambique.[121] Greater centralization and desire to conceal activities has also been noted elsewhere, with some drug trafficking groups in Bolivia (Plurinational State of) and Peru being found to operate as family-based clans and limit membership to close associates.[122]

Research has also revealed that drug trafficking groups are dynamic and can adapt to their environment, shifting their structural organization by increasing decentralization and replacing connections when threatened by law enforcement or when key nodes are removed, so as to reduce operational disruptions.[123] In other cases, studies have found that a group may shift its structure in the opposite direction by becoming more centralized and prioritizing security over efficiency after experiencing pressure from law enforcement authorities.[124] Adaptation strategies could depend on specific group dynamics and be directly related to law enforcement actions.[125]

Endurance and adaptation of drug trafficking groups and drug markets

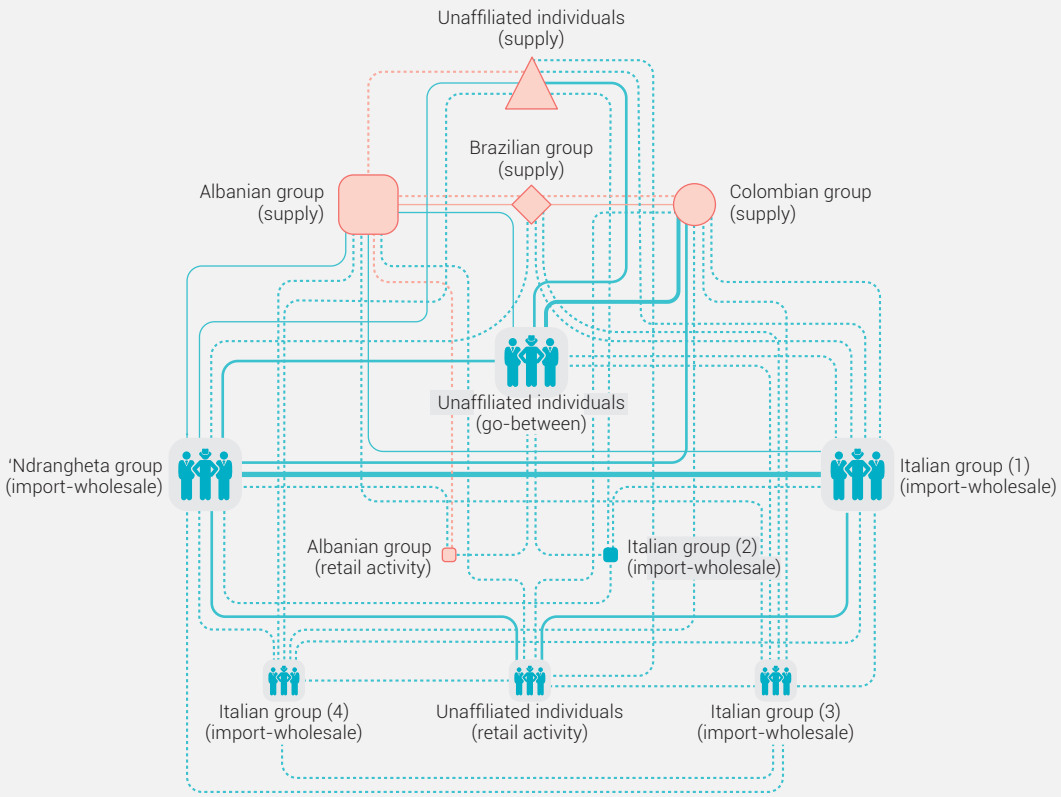
Some drug trafficking groups endure and adapt to market conditions, law enforcement pressure and competition, while many others disappear after a few years. The literature has examined concepts of resistance and resilience by criminal groups in the face of internal or external pressures.[126, 127, 128] There has been much interest in honing law enforcement responses to different groups in order to maximize disruption.[129, 130] Disrupting drug trafficking requires holistic actions to dismantle both the drug market and the groups engaged in trafficking. Drug markets and supply chains can endure in the face of State pressure, even if individual groups are dismantled.

Therefore, a focus on specific groups can lead to the broader perspective being overlooked as to why drug markets, as a whole, are highly resilient to law enforcement intervention.[131, 132] The dynamics of drug markets, whereby buyers and sellers transact drugs in varying quantities and at varying prices, are hard to eliminate, especially if entrenched.[133] That said, drug seizures and arrests can change the market equilibrium, sometimes reducing purities and increasing prices, but never eliminating the market as a whole.[134] Similarly, efforts to reduce demand for drugs can play an important role in shrinking markets and reducing the income of criminal groups.[135]

Nevertheless, even if drug markets are highly resilient, there are sometimes advantages to focusing on and dismantling specific groups, such as the most harmful, the most violent or the most corruptive. Understanding the structural design of a group may therefore help improve disruptive means. In the end, however, it is vital to consider the larger drug market and the fact that specific groups merely participate, sometimes temporarily, in the larger illegal drug trade. Efforts to identify and leverage market-wide disruptions are likely to have more desirable outcomes than identifying and targeting specific groups. For example, sudden shortages in the availability of illegal drugs in destination markets could make drug treatment services more attractive to people who use drugs,[136] reducing demand further and putting pressure on criminal groups by shrinking the market. The continued reduction of opium poppy cultivation and opium production in Afghanistan, for instance, could present one such opportunity to disrupt trafficking groups supplying major markets for Afghan opiates, as there could be severe shortages of heroin in the near future.[137]

Those looking to maximize the effects of market disruptions could devise strategies taking into account variations in groups. A highly centralized group can minimize its exposure to law enforcement investigations or targeting. For example, groups that utilize couriers often keep those roles separated from leadership so that those most likely to be arrested – the courier or the truck driver, for example – are the least likely to have knowledge of the internal operations or structure of the larger group. By contrast, decentralized groups, although more exposed to law

Example of a networked drug trafficking operation involving multiple criminal groups



Source: Valentina Tenti and Carlo Morselli, "Group co-offending networks in Italy's illegal drug trade", *Crime, Law and Social Change*, vol. 62, No. 1 (1 August 2014), pp. 21–44.

Note: Node size varies based on the number of direct contacts surrounding a node (the bigger the node, the higher the level of direct connectivity within the network). Node colour distinguishes foreign (red) from Italian (blue) network participants. Tie size between network participants varies according to the number of ties that two pairs share (the thicker the line, the greater the number of ties shared by two pairs).

enforcement pressure, can be more resilient owing to their ability to replace members after their arrest or reform with new connections and members.[138, 139] Moreover, the research suggests that the fact that membership roles are less specialized means that removed members can be more easily replaced.[140, 141, 142, 143, 144]

Apart from structural adaptations, criminal groups that engage in drug trafficking adapt in functional ways by innovating their means of production, trafficking or delivery with the aim of reducing risks of exposure or law enforcement pressure. The adoption and use of electronic communications devices and platforms such as cell phones decades ago reshaped the risks associated with the drug trade by reducing waiting times for transactions and the need to maintain a physical space for drug dealing.[145] Some of these adaptations have also shaped internal group structures, for example, the adoption of cell phones and pagers reduced meet-up times and shifted some retail drug markets to a delivery service model and away from street corners, moving distribution to more trade-oriented groups.[146, 147] Innovations in drug manufacture are increasingly being used to reduce risks and lower production costs. These innovations are likely to vary by group depending on their risk tolerance, needs relative to their position in the overall drug supply chain and the extent of their resources.

Overall, drug markets exhibit a high degree of networked inter-group connectivity, otherwise known as having "small world" properties.[148, 149, 150, 151] This means that many interdependent relations and opportunities for cooperation exist across groups. At the market level, drug trafficking groups or individuals can be resilient to law enforcement interventions, especially non-targeted or indiscriminate interventions.[152, 153, 154]

One helpful illustration comes from an analysis of prosecutorial documents relating to a drug trafficking network in Italy that existed from 2000 to 2002, with the 'Ndrangheta at its centre, but which also included organized drug trafficking groups in South America and the Balkans. The mapped operation involved 242 individuals spread across several countries; 55 individuals were unaffiliated, acting as freelance participants, while the other 187 belonged to nine criminal groups (five Italian, two Albanian, one Brazilian and one Colombian). Internally, groups varied in terms of their structural organization, size and tasks. Some were found to be more centralized than others;[155] some could be considered more trade- or governance-oriented. Nonetheless, collectively the broader network of trafficking groups suggests that there was, overall, greater resilience to intervention.

As illustrated by this case of a large, interconnected criminal network, the existence of various groups within the network suggests that wider illegal trade is resilient to law enforcement pressure. The removal of the most visible actors or groups can be mitigated by rerouting connections to other groups. However, the study of this interconnected criminal network comprising multiple groups shows that several brokers, many of whom were unaffiliated, served as key information hubs, connecting suppliers with import-wholesalers.[156] While the 'Ndrangheta groups were the most connected with other nodes, groups consisting of go-betweens were deemed to be critical for bridging or linking supply groups that engaged in importing or trafficking drugs.

The larger dynamic of interconnected groups participating in a criminal network suggests that partnerships and cooperation, rather than hierarchy and dominance, characterize criminal groups that traffic drugs. Instead of seeking to control the entire supply chain, the Italian case shows that various groups were motivated to collaborate and branch out when working in a larger system.[157] This broader network structure is increasingly being taken into account by law enforcement authorities and scholars[158, 159] and can explain why drug trafficking systems are resilient to law enforcement interventions.

Responses to organized criminal groups that traffic drugs

Given that drug trafficking is the most important source of income for many criminal groups, generating billions of dollars of income each year, and that it accounts for a substantial share of police cases against criminal groups, focusing and placing pressure on drug trafficking groups are prominent methods used by law enforcement authorities. Supply reduction is an important component of drug policy in many parts of the world, especially considering the harm, including violence and corruption, caused by some groups.

Findings from the literature suggest that the various group structures are resilient to some law enforcement interventions yet vulnerable to others. Indiscriminate drug law enforcement action is thought to cause the least disruption, especially in the case of highly decentralized groups,[160] whereas targeting individuals or entities that serve as go-betweens can disrupt the flow of information across the wider group structure.[161, 162] Although the removal of such individuals or entities may not result in the unravelling of an entire group or groups involved in

TABLE 6 Disruptive responses to various organized criminal groups engaged in drug trafficking

Group characteristics	Strengths	Vulnerabilities	Disruptive responses
Oriented towards governance and centralized	Hierarchy and limited information flow protects against infiltration	Group reliant on key individuals to operate	Targeting of members with highest decision-making capacity or those with greatest skills (e.g. money-launderers or chemists) to disrupt operations; uprooting of group structure may be possible through removal of leadership
Oriented towards governance and decentralized	Greater connectivity among members increases resilience to law enforcement pressure	Trust among members can be damaged through use of informants; groups might be easier to infiltrate	Removal of top leadership, especially in places experiencing high levels of violence, may generate more violence. Instead, removal of mid-level members that serve as bridges between leaders and operatives may be more disruptive
Oriented towards trade and centralized	Hard to infiltrate and go to great lengths to keep operations from discovery; often smaller networks	Group reliant on key individuals to operate	Interventions may require extensive surveillance and mapping to identify key nodes and work to damage trust within networks
Oriented towards trade and decentralized	Greater connectivity among members and lower barriers to membership make groups highly resilient to law enforcement	Trust among members can be damaged through use of informants	Interventions may require extensive surveillance and mapping to identify key nodes and work to damage trust within networks

the drug trade, it can cause temporary disruption and make it harder for different clusters or groups within the broader network to operate. Similarly, decentralized groups can be exploited through infiltration and degradation of trust.[163]

By contrast, highly centralized groups may be more vulnerable to targeted pressure on the individuals who serve as hubs, who have the highest degree of connectivity, rather than on those who serve as information brokers, who make decisions or who wield the most influence.[164] Strategies that focus on mid-level members with a great deal of social capital or on members with specialized skills, such as money-launderers and chemists, could cause greater disruption to the operations of a highly centralized group.[165, 166]

These strategies differ from those aimed at group leaders, which work to disrupt group cohesion and operations by removing individuals at the top. In some cases, targeting a group's leadership or command structure may be highly effective, but it depends on the activities or structure of the group in question. The literature reveals that such targeting efforts have produced the desired disruptive results when applied to insurgent and terrorist groups, some of which, such as FARC-EP, may benefit from taxing or directly engaging in the illegal drug trade.[167, 168]

However, as drug trafficking is business oriented, groups that rely heavily on it may be less susceptible to strategies targeting top leaders. In fact, such strategies may result in unwanted outcomes even if the removal of organizational leadership sends a strong anti-impunity message or if supply is temporarily disrupted. Several studies have empirically assessed the relationship between removing the leadership of drug trafficking organizations in Latin America and outcomes associated with drug trafficking and violence. In Guatemala, targeting the leadership of drug trafficking groups was associated with an overall reduction in violence, but there was no change in the volume of trafficking.[169] In Colombia, efforts targeting FARC-EP leadership were associated with a decrease in the number, but not severity, of insurgent attacks.[170] In Mexico, the killing or capture of a group's leader was associated with an increase in violence at the local level because of group fragmentation and competition.[171, 172, 173, 174]

One study found that the removal of mid-level subordinates such as lieutenants was not associated with an increase in violence or was only associated with a brief spike in violence in the immediate area where the group operated.[175] Another study found a medium-term decrease in homicides after the successful removal of mid-level individuals.[176] It is thought that the targeting and removal of mid-level management could result in more desirable disruption without an unwanted increase in violence because mid-level actors serve as important hubs for a group's operations.[177] This is because they handle daily business operations, oversee the functions of the workforce and translate the decisions taken by leadership to the rank and file. Therefore, they have a high degree of social connectivity, linking leaders with subordinates and serving as information brokers within the group.

Employing different responses to target segments of a larger network has been put forward as a more targeted strategy for combating drug trafficking.[178] Drug trafficking groups are largely unaffected by random or indiscriminate pressure, which is a common type of drug law enforcement response. By contrast, depending on the mapping of a group or network, responses that focus on critical members could cause greater disruption.[179, 180, 181, 182] Some of these responses are summarized in table 4.

Detailed mapping of a criminal group or network can be challenging for law enforcement authorities as it often requires extensive investigative work and surveillance. In one well-documented case of an international operation trafficking drugs to Canada, investigators seized in-bound drug shipments but did not arrest the recipients, building a more complete picture of the overall network over a period of two years before intervening.[183] In this case, investigators were able to map the organizational structure and identify the emergence of new nodes as some members came to distrust individuals whose product was seized. This deterioration of trust among members, coupled with the recruitment of new members, gave rise to more opportunities for law enforcement infiltration through informants.[184] Similarly, trafficking networks that have a high degree of connectivity among individuals could be exploited through a combination of efforts aimed at convincing members to turn on others. Efforts to fragment Colombian trafficking groups at the end of the 1990s, for example, included a policy of negotiated surrender among traffickers, so as to dismantle the broader network.[185]

In summary, the investigation and mapping of groups or networks engaged in drug trafficking have shown that they exhibit different characteristics, some of which highlight different vulnerabilities, making it possible to identify different types of individuals on whom to focus interventions. As a result, law enforcement authorities can affect the organizational shape and composition of groups engaged in drug trafficking. This means that law enforcement pressure has the potential to force groups to adapt in ways that are less socially harmful. For example, one strategy could be to publicly increase pressure on the most violent groups through focused deterrence.[186, 187] Targeting efforts could be specific to a country or market. In markets where violence is less of a concern, for example, law enforcement authorities could focus on the largest groups, the most corruptive ones or the ones engaged in trading in extremely potent drugs responsible for overdoses. A nuanced approach may help reduce some of the harm posed by groups even though the broader illegal drug market remains resilient. In some successful cases, the goal has been to initially reduce violence associated with the illegal drug supply rather than to reduce the volumes supplied.[188]

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THE IMPACT OF DRUGS ON THE ENVIRONMENT: THE CASE OF EUROPE

Key takeaways

► **Drugs and the environment.** Drugs impact the environment in three main ways: (a) through the cultivation and manufacture of and trafficking in drugs; (b) through drug use; and (c) through the policy responses put in place to address illicit drug economies. The scope and scale of the environmental impact of each can be measured in different ways, including their effect on deforestation and other land-use change and the pollution of air, land and water. The manufacture of drugs in laboratories produces substantial waste, which is subsequently discharged into or dumped in the environment. Drug use results in the presence of drug remnants and metabolites in wastewater, not all of which are removed during wastewater treatment. All three avenues mentioned above have potential spillover effects on the health of humans and animals and biodiversity and may entail significant societal costs in terms of cleaning up and restoring ecosystems. Each avenue also contributes to the carbon footprint of drugs, that is, the total greenhouse gas emissions they cause directly or indirectly.

► **Environmental harm is not a priority.** Drug policy responses are mostly focused on the short term, are reactive in nature and often seem to be disconnected from environmental policies. For example, samples taken at clandestine laboratories and dumping sites are normally only analysed for law enforcement purposes, in other words, to link criminals to the manufacture or dumping sites and – if possible – to recover the clean-up costs involved. No structural assessments are carried out to qualify or quantify the environmental harm.

► **General impact.** While the environmental impact of illicit drug crop cultivation and drug manufacture in Europe is relatively small compared with that of, for example, the legal agricultural or pharmaceutical industries, the effects can be significant at the local, community and individual levels.

► **Impact beyond Europe.** The illicit manufacture of synthetic drugs in Europe has significant environmental ramifications outside Europe, for example, in the form of the production of and trade in chemical pre-precursors and precursors. Some drugs consumed in Europe originate outside the continent and, vice versa, some drugs manufactured in Europe are consumed abroad, adding to the total environmental footprint, especially in terms of the carbon footprint and broader environmental impact related to transportation.

► **Carbon footprint of synthetic drug manufacture.** The first ever life cycle assessment – a method for evaluating the environmental impact of a product, process or service across its entire life cycle – of a synthetic drug, focusing solely on MDMA, has shown that the manufacture of 1 kg of MDMA HCl salt produces an estimated total carbon footprint of between roughly 400 and 1,500 kg of CO_2e (equivalent to between 0.07 and 0.31 kg of CO_2e per MDMA pill). This "cradle-to-laboratory-gate" (from raw material extraction to the finished product) assessment modelled a synthesis route that can be considered representative of current production methods.

► **Synthetic drug manufacture is on the rise in Europe.** The increase in the number of clandestine laboratories dismantled over the past six years in Europe in combination with their size suggests that synthetic drug manufacture is increasing there. While the size of laboratories varies significantly between countries, there is a trend in some towards bigger and more sophisticated facilities. The disconnect between the increase in the number of laboratories seized and the decrease in dumping sites reported indicates that much of the chemical waste in Europe is unaccounted for. In some countries, law enforcement officers are increasingly finding drug manufacture waste stored on-site when laboratories are abandoned.

► **Although a large share of European countries report the manufacture of synthetic drugs, few report dumping sites, suggesting in some cases a limited capacity to detect, register or address the environmental impact of synthetic drug manufacture.** The number of countries reporting dumping sites (nine in the period 2013–2023) is considerably lower than the number of countries reporting dismantled laboratories (36 in that same period), which suggests substantial underreporting of dumping sites. While other forms of waste disposal, such as direct discharge, and the smaller size and scope of manufacturing in some countries play a role in this disparity, the geographical distribution of illegal waste disposal sites across Europe may be much wider than reported.

→

► **Dominance of illicit indoor cannabis cultivation.** Illicit indoor cannabis cultivation is more widespread than outdoor cultivation in Europe. Most European countries (21) reported a larger proportion of indoor than outdoor cannabis cultivation in the period 2019–2023, while 14 reported the opposite. There is a clear geographical divide between countries in Northern and Western Europe reporting more indoor cultivation and countries in Eastern and Southern Europe reporting more outdoor cultivation. This divide can be partly explained by climatic factors[1] but may also involve socioeconomic factors such as economic resources and technological capabilities.

► **Indoor cannabis cultivation has a much larger carbon footprint than outdoor cultivation, but outdoor cultivation can also have a considerable impact in unique areas.** The dominance of indoor cannabis cultivation in Europe means a larger carbon footprint and gives rise to various associated risks and societal costs. Although the situation in Europe may be different, data from North America suggest that indoor cannabis cultivation can emit an average of around 50 times more carbon than outdoor cultivation. While outdoor cultivation significantly decreases the carbon footprint of production, its environmental impact can be considerable in other areas, such as land-use change, deforestation, excessive fertilizer use, the diversion of water from streams and springs and biodiversity loss.

Introduction

Building on research into the global dimensions of the environmental impact of illicitly produced drugs conducted for the *World Drug Report 2022*,[2] as well as case studies presented in the 2023 and 2024 editions, the present chapter examines the nexus between drugs and the environment in Europe.[3]

Although beyond the chapter's scope, the connection between the demand for drugs in Europe and the environmental impact of their production elsewhere should not be underestimated. Previous research in the Amazon Basin, from where the cocaine reaching Europe originates, has documented the environmental damage related to deforestation and loss of biodiversity caused by the production of cocaine converging with other crimes such as illicit mining, wildlife trafficking and illegal logging.[4]

In focusing on Europe, the intention is not to disregard or understate the global dimensions of the environmental impact in any way. On the contrary, the idea of zooming in on Europe is to qualify and quantify, where possible, the environmental impact of the illicit drug economy in a region with strong links to other parts of the world, whether as a producer, importer and exporter of drugs and their precursors or as a consumer. Criminal networks in European countries play an important role in this global context, for example, by extracting cocaine in laboratories, producing final products in processing laboratories, importing precursors from outside Europe and exporting "ecstasy" and other drugs to the rest of the world.

The analysis in this chapter relates mostly to cannabis and synthetic drugs. Other drugs have an environmental impact in Europe, whether through trafficking or use, but cannabis and synthetic drugs are the most relevant for the region in terms of domestic production. Nonetheless, where pertinent, other issues have been addressed, such as cocaine extraction and processing laboratories and the environmental effects of nitrous oxide (laughing gas). Drug use is touched upon in the chapter, but the analysis is predominantly focused on the cultivation and manufacture of drugs, as well as on selected responses to their environmental impact.

Although there is no single, universally accepted definition of "the environment", in this chapter it is understood in broad terms as the complex interaction between natural systems and the impact on them by human beings.

In addition to covering the physical environment, the chapter examines, where possible and relevant, the environmental impact of the illicit drug economy on society at large.

Following the comprehensive analysis in the *World Drug Report 2022*, the literature review conducted for the present chapter is predominantly focused on research published since 2021. Although new studies have appeared over the past few years, the topic of drugs and the environment continues to be characterized by limited data and knowledge gaps. While this chapter includes mention of most European countries, there is a greater focus on a select group of countries in the region. This geographical imbalance is partly logical, given the significance of some countries in terms of illicit drug manufacture, and partly the result of data availability. To reduce this imbalance as much as possible, an effort was made to conduct interviews in many European countries, but the feedback was uneven and the outreach produced selected coverage.

In addition to the literature review and analysis of the responses to the annual report questionnaire, oral and written interviews were conducted in 11 countries, namely, Albania, Belgium, Czechia, France, Germany, Italy, Netherlands (Kingdom of the), Poland, Portugal, Slovakia and Spain.

To complement the research, a life cycle assessment was carried out to estimate the carbon footprint of MDMA. This "cradle-to-laboratory-gate" assessment is the first of its kind conducted for synthetic drugs and, in addition to producing the first estimate of the carbon footprint of MDMA, it is aimed at encouraging further research into the contribution of synthetic drugs to climate change.

Environmental impact terminology

The present chapter uses the term "environmental impact" to describe the general (combination of) environmental effects related to illicit drugs. It uses the more specific term "carbon footprint" when referring to the total amount of greenhouse gases generated directly or indirectly by specific illicit activities or the manufacture of a specific substance. The term "carbon footprint" is also used in the sections addressing life cycle assessments of drugs, that is, the systematic analysis of the potential environmental impact of a drug throughout its entire life cycle. Such assessments, which are often used to calculate global footprints, generally use the term "climate change impacts", which are measured using the indicator "global warming potential". The carbon footprint calculations include various other greenhouse gases, but these are all measured in "CO_2 equivalents" (CO_2e).

Scope of the environmental impact of the drug economy in Europe

In parallel to the growing interest in climate change mitigation and environmental protection, the relationship between drugs and the environment has begun to attract greater attention in recent years but remains underresearched.[5] For example, while various European wastewater studies related to drugs have been conducted in recent years, they have generally focused on identifying trends in drug use rather than on calculating the environmental impact of drugs, although some recent studies do include an evaluation of ecotoxicity and other environmental effects.[6]

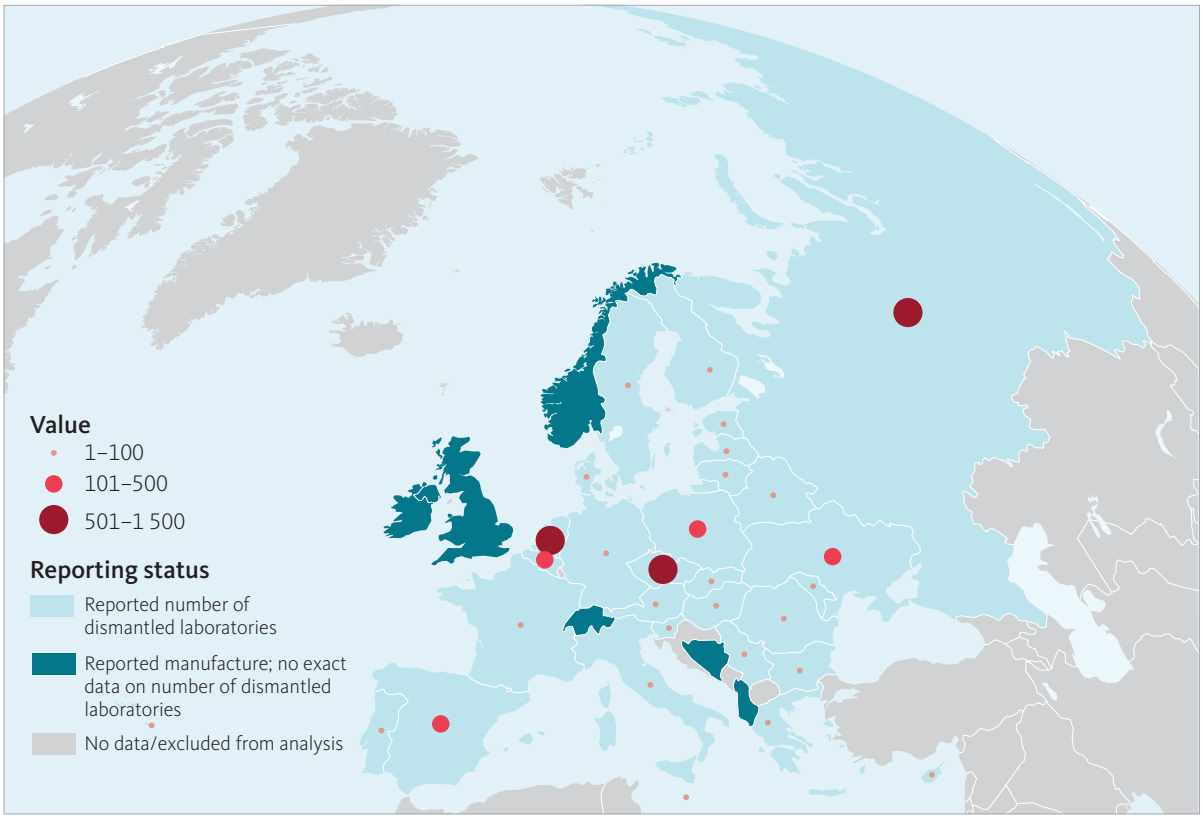
European countries vary substantially in terms of their approaches to policies on drugs and the environment. Some have formal strategies and action plans, but others do not. The drug strategies of Belgium[7] and France[8] are among the few national strategies in Europe that mention the environmental impact. Like Germany, Belgium has drug and environmental policy competencies at the subnational level,[9] while the Kingdom of the Netherlands has strong drug policy coordination at the national level.

For the 27 European Union member States, the umbrella European Union Drugs Strategy 2021–2025[10] addresses the environmental harm caused by illicit drug manufacture, emphasizing the need to manage the hazardous chemical waste, health risks and clean-up costs associated with synthetic drug manufacture, as well as the safe handling and disposal of seized drugs, precursors, chemicals and equipment.[11]

In April 2024, the European Union adopted Directive (EU) 2024/1203,[12] which addresses the environmental effects of unlawful and improper handling, transport and disposal of waste, including from drugs.[13] If implemented by all member States, this directive could make illicit drug manufacture and related waste dumping punishable as criminal offences under environmental laws rather than solely under drug laws.[14] In September 2024, European Union member States also discussed the nexus between synthetic drugs and crimes that affect the environment at a meeting of the Standing Committee on Operational Cooperation on International Security,[15] where they acknowledged the need to pay greater attention to this phenomenon.[16]

The European Union Drugs Agency (EUDA) has grouped environmental harm under the heading of "societal impact", noting that the environmental impact of the illicit drug trade is both direct, through the dumping of drug manufacture waste, and indirect, through the demand for

MAP 2 Number of clandestine drug laboratories dismantled in Europe, 2019–2023

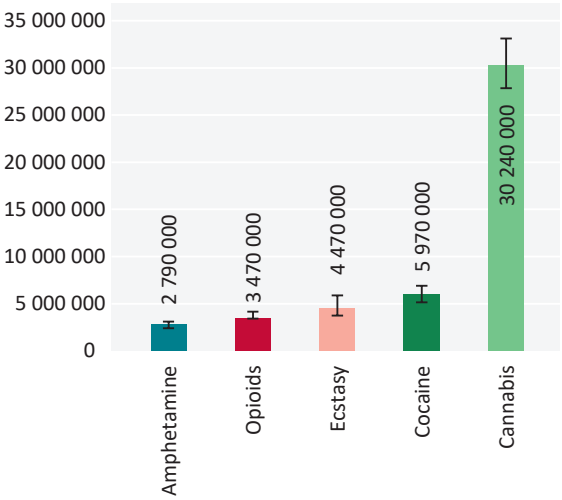


The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Source: UNODC, responses to the annual report questionnaire.

Note: During this period, no responses were received from North Macedonia or Türkiye.

FIG. 8 Estimated annual number of drug users in Europe, 2023



Source: UNODC, drug use data from 2023.

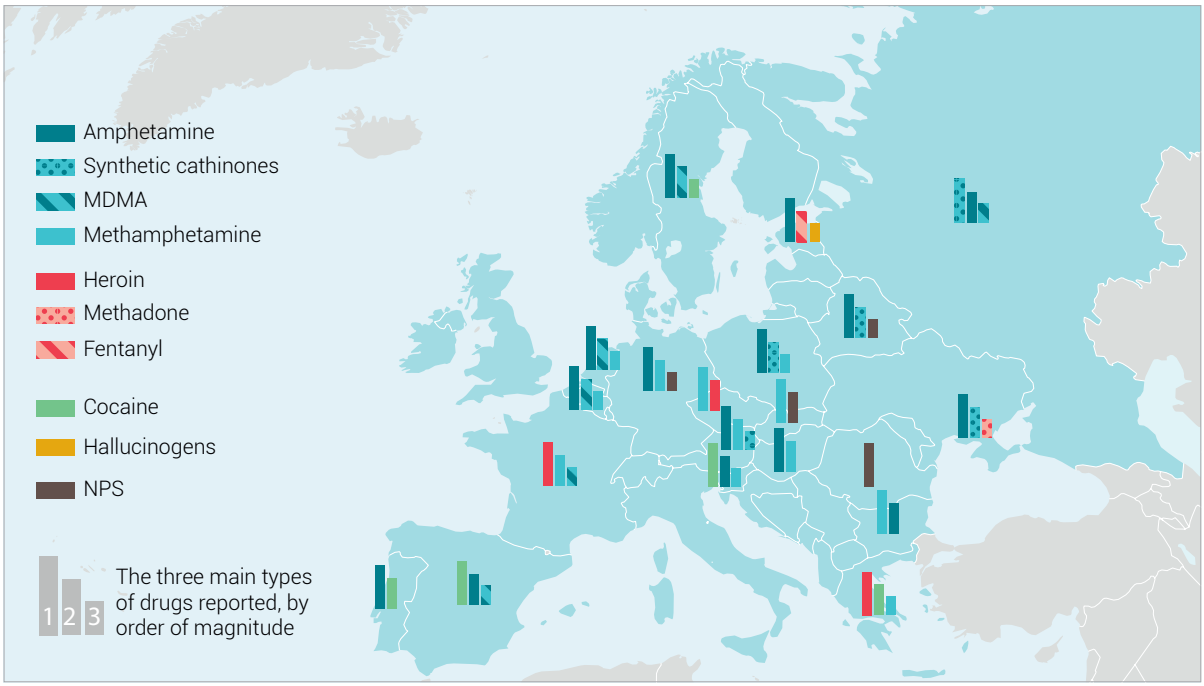
drugs produced in other regions of the world, where it can lead to deforestation or soil erosion, as well as to migration, destabilization and climate change in Europe.[17]

At the national level, however, drug policy barely touches on environmental issues. France has reported that it is working on a new national drug strategy that will highlight research and raise awareness about environmental harm.[18] Media coverage of the environmental impact of drugs in Europe is also relatively limited and focuses on the number of production and dumping sites identified. Belgium is the only country where media coverage of the environmental impact has been analysed extensively.[19]

Drug use, cultivation and production in Europe

Europe is an important region to study in terms of environmental impact because drugs are produced, traded and consumed on a significant scale in the region. Cannabis remains by far the most commonly used drug,

MAP 3 Main drug processed in clandestine drug laboratories dismantled in Europe, 2019–2023



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Source: UNODC, responses to the annual report questionnaire.

Note: The three main types of drugs processed in dismantled clandestine drug laboratories are shown in the order of magnitude of the amount found in each country. Some countries only reported one or two types of drugs. Only European countries with a minimum of 10 dismantled laboratories are included.

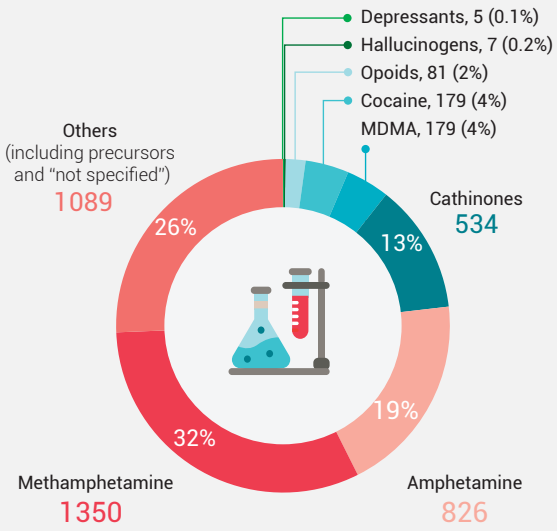
followed by cocaine and "ecstasy". Despite the lack of data inherent in the study of illegal economies, there is evidence to suggest that both the scale and complexity of illicit drug production are continuing to grow.[20]

Synthetic drug manufacture

The illicit manufacture of synthetic drugs has been detected in most countries in Europe, with a total of 36 having reported the dismantling of clandestine drugs laboratories to UNODC in the past decade.

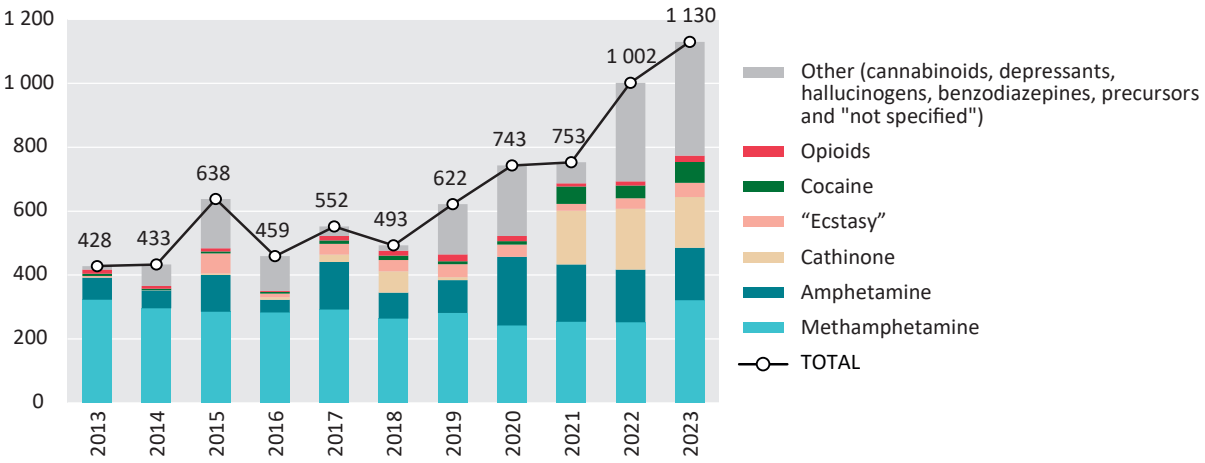
A total of 4,375 clandestine drug laboratories were reported dismantled in the region between 2019 and 2023, ranging from small-scale kitchen laboratories in countries such as Czechia and Slovakia[21] to highly professional industrial-scale manufacturing facilities in Belgium, Germany and Netherlands (Kingdom of the). There were also reports of clandestine laboratories in the western Balkans for the manufacture of synthetic drugs, including amphetamine and methamphetamine, which can pose significant threats to the environment in terms of toxic waste and pollution of the soil and water bodies such as rivers or lakes.[22] Most of the laboratories in Europe were used to manufacture methamphetamine, followed by

Dismantled laboratories in Europe by drug type, 2019–2023



Source: UNODC, responses to the annual report questionnaire.

FIG. 9 Number of dismantled clandestine drug laboratories in Europe, 2013–2023



Source: UNODC, responses to the annual report questionnaire.

The evolving drug market in Ukraine

During the war against Ukraine, the transition from traditional drugs such as heroin and cocaine to synthetic drugs has continued. Disrupted maritime and air drug trafficking routes have forced traffickers to adapt, shifting to land-based smuggling over the country's western borders with the European Union and the Republic of Moldova. This disruption, coupled with a surge in domestic demand for synthetic drugs, has taken place in parallel with a rise in the number of clandestine laboratories that are manufacturing synthetic drugs, in particular methadone, which is increasingly being manufactured domestically, adding to the environmental impact of the illicit drug economy within Ukraine.

Organized criminal groups, such as Khimprom, have capitalized on this shift, establishing themselves as key players in the manufacture and distribution of synthetic drugs and adapting their operations to the volatile conditions of the war. According to the Ukrainian authorities, there has been a significant increase in the number of clandestine drug laboratories dismantled, from 17 in 2019 to 79 in 2020, 94 in 2021, 61 in 2022 and 102 in 2023.

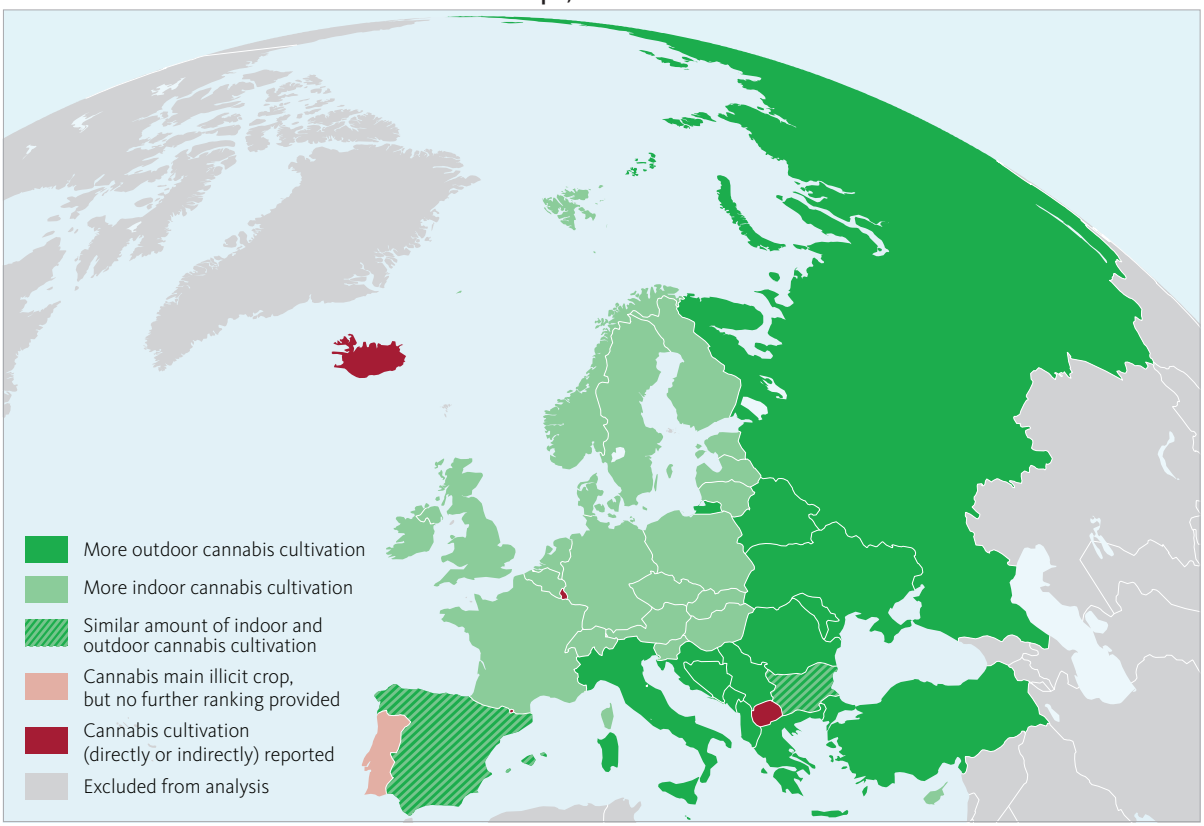
Source: UNODC, interviews with a synthetic drug producer, February 2024, and letter from the Ministry of Internal Affairs to the UNODC Regional Programme Office in Ukraine, 5 December 2023. See also Institute of Psychiatry, Forensic Psychiatric Examination and Drug Monitoring of the Ministry of Health of Ukraine, *National Report on the Drug and Alcohol Situation in Ukraine for 2022*.

amphetamine, cathinones and MDMA. Other clandestine laboratories manufactured cocaine, synthetic opioids, synthetic cannabinoids, hallucinogens, benzodiazepines, depressants or drug precursors.

Although all the European countries reporting dismantled laboratories mentioned the manufacture of various types of drugs, to some extent the manufacture of certain substances was concentrated in certain countries, such as methamphetamine (Belgium, Bulgaria, Czechia, Netherlands (Kingdom of the) and Slovakia), amphetamine (Belgium, Estonia, Hungary, Netherlands (Kingdom of the), Sweden and Ukraine), cocaine (Netherlands (Kingdom of the), Slovenia and Spain), heroin (France and Greece) and cathinones (Belarus, Poland and the Russian Federation). A small number of European countries (Albania, Italy and Malta) reported that they had not discovered any synthetic drugs laboratories on their territory.[23]

There seems to have been a general increase in the illicit manufacture of drugs in Europe, as reflected in the rising number of clandestine drug laboratories dismantled in the period 2013–2023, especially since 2018. That said, by itself, the number of dismantled laboratories in Europe is a poor indicator of the overall extent and distribution of drug manufacture in the region, mainly due to large differences in the size and scale of drug production facilities. Moreover, some countries may not register certain facilities, such as cocaine extraction laboratories, at the national level.[24] Another trend mentioned by some European countries is an increase in the scale and sophistication of drug manufacture, which generally means higher levels of production. This can, in turn, result in more waste, but

MAP 4 Main forms of cannabis cultivation in Europe, 2019–2023



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.

Source: UNODC, responses to the annual report questionnaire.

Note: The analysis is based on answers provided by Member States to a question about the "ranking of illicit cultivation of crops" and was complemented, where necessary, with the answers to other relevant questions, including those related to the "area under cannabis cultivation", "cannabis produced", "cannabis area eradicated", "cannabis plants eradicated" and "cannabis sites eradicated". While Spain has reported a similar amount of indoor and outdoor cultivation during this period, authorities report that the latest available data suggest increased indoor cultivation (Interview #17, Spain, organized crime experts, February 2025).

also in more efficient manufacturing processes that produce less waste, for example, by recycling solvents.[25]

Cannabis cultivation

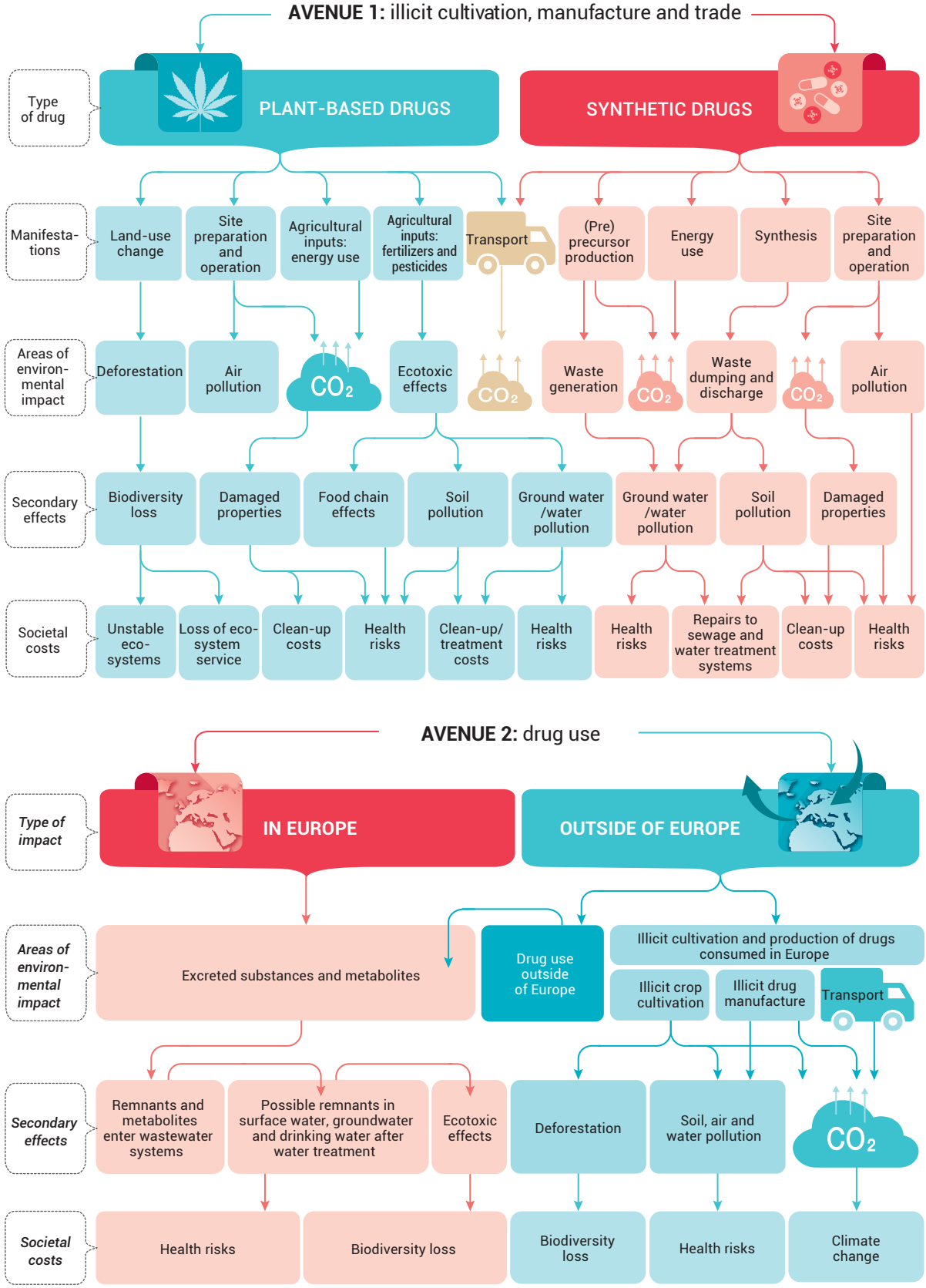
In the absence of systematic monitoring of cannabis production trends in Europe, it is difficult to establish where illicit cannabis cultivation is concentrated. A combined historical analysis carried out by UNODC of reporting on the country of origin (2014–2019) and the main country of departure (2014–2023) of seized cannabis suggests that production seems to be concentrated in Albania, Netherlands (Kingdom of the) and Spain, meaning that a substantial part of the production-related environmental footprint would also be concentrated in those countries.

Nevertheless, in the period 2019–2023 practically all European countries reported cannabis as the main crop illicitly cultivated on their territory. Most of them reported both outdoor and indoor cultivation, with different shares of indoor and outdoor cultivation.

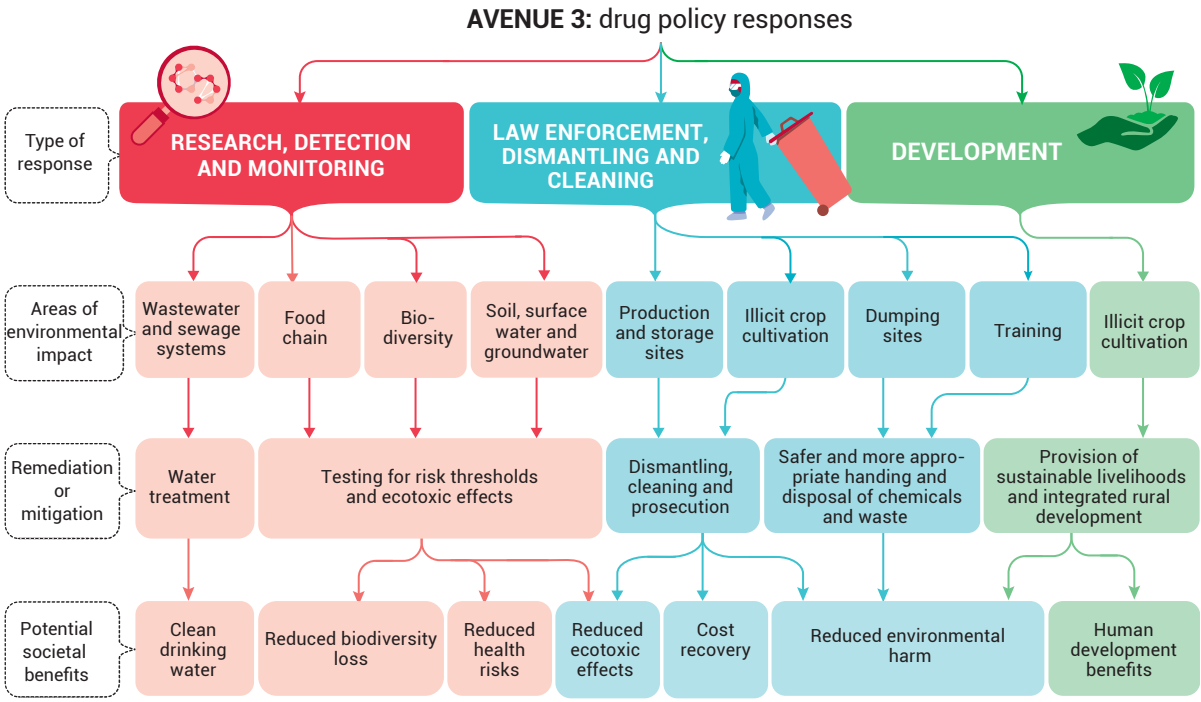
Main avenues of environmental impact of drug

Illegally sourced drugs affect the environment in three main ways: (a) through the illicit cultivation and production of and trade in drugs and their (pre-)precursors; (b) through drug use; and (c) through the responses put in place to deal with illicit drug markets.

Each avenue can have various types of environmental impact. For example, the environmental impact of the illicit cultivation of drugs can manifest itself through energy use or land-use change. Such impacts will, in turn, have various direct and indirect environmental consequences. Drug policy responses, whether focused on



Source: UNODC.



Source: UNODC.

Note: Negative or unintended environmental impacts are not included in the diagram, but each response will have a carbon footprint and might have negative side effects, for example, if the crops or livelihoods introduced as part of alternative development interventions have a large environmental impact.

environmental harm or not, will also have a carbon footprint and may have negative consequences for the environment.

Scale of the environmental impact of drugs in Europe

The scope and scale of the environmental impact of plant-based and synthetic drugs can be measured in various ways, such as by their carbon footprint, their effect on deforestation or land-use change, the pollution of air, land and water, as well as their indirect impact on biodiversity.

With regard to carbon footprint, the global environmental impact of illicit drug crop cultivation and drug manufacture is relatively small compared with that of the legal agricultural or pharmaceutical sectors.[26] While the carbon footprint of all drug manufacture in Europe is more limited, the environmental impact can be significant at the local, community and individual levels in terms of soil and water pollution resulting from synthetic drug production and waste dumping. In 2019, for example, at an industrial-scale clandestine drug laboratory in Preussisch Oldendorf, Germany, Dutch criminals drilled two deep holes, one to install a 12 m pipeline for dumping drug manufacture waste into the ground soil and another for extracting fresh water for use as a coolant in the manufacturing process.[27] In addition to substantial law enforcement and legal costs, such cases can entail considerable economic costs for environmental restoration.

Environmental impact of drugs in Europe

Using social cost analysis, a distinction can be made between direct, indirect and intangible societal costs related to the environmental impact of illicit drug crop cultivation and production.[28] Direct costs include costs incurred when dealing with the problem, such as when law enforcement agencies dismantle and clean up drug production, storage or dumping sites. These costs may be significant, for example when sites are large or when it is necessary to restart wastewater treatment plants.[29] Indirect costs include productivity losses caused by the problem, such as health-related consequences for people living in the area or working for agencies involved in the clean-up operation. Intangible costs are non-financial costs, such as those related to soil and water pollution and the effects on individuals and biodiversity.

Local societal effects can also be substantial, such as when neighbourhoods or local communities become exposed to the environmental hazards associated with synthetic drug production and dumping.[30] In Spain, for example, in 2020 there was a serious explosion at an indoor manufacturing site in the town of San Martín de la Vega, caused

Largest drug waste dumping site ever discovered in the Kingdom of the Netherlands

A dumping site discovered in a natural conservation area in North Brabant, Kingdom of the Netherlands, in 2021 was the largest drug waste site ever found in the country and was linked to a cocaine extraction laboratory. The affected area measured 2,500 m^3 – about the size of an Olympic swimming pool. The chemicals used to process cocaine had seeped 8 m into the ground, killing soil organisms and contaminating groundwater in an area that was used to produce drinking water. The clean-up operation required the felling of 400 trees. The operation, involving soil removal, air extraction and groundwater purification, has taken several years and is estimated to have cost millions of euros – all for a single dumping site in Europe. It shows that both the environmental degradation and protection costs of drug production can be huge.

There are several steps in the sanitation process. Somewhat paradoxically, most of them increase the environmental impact:

a) Soil testing to identify the chemicals involved and estimate the size and scope of the environmental harm;

b) The creation of an action plan for the soil clean-up process, including a cost calculation;

c) The removal of most of the affected soil and its transportation by waste processing companies;

d) The extraction, filtering and cleaning of the air released from the ground;

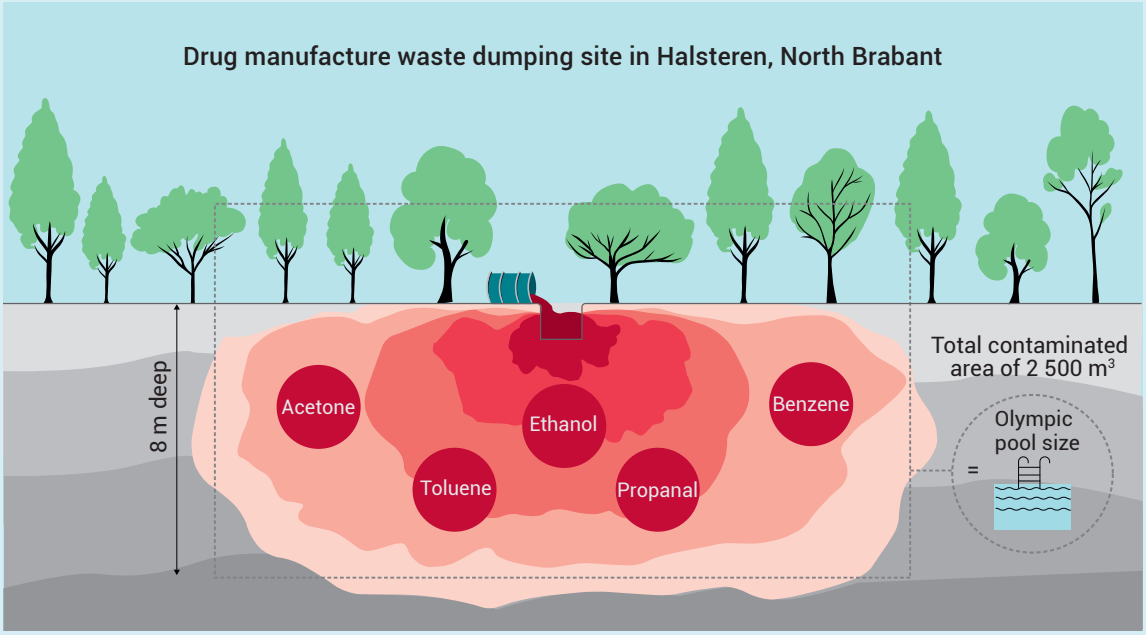
e) The thermal treatment of the soil in large ovens to destroy pollutants or turn them into non-toxic substances. Gases produced during this process are burned separately;

f) The recycling of soil, for example, for use in sound barriers next to roads;

g) The pumping, cleaning and restoring of groundwater.

Thermal treatment is relatively expensive and uses a great deal of energy, increasing the carbon footprint of the operation.

In the Kingdom of the Netherlands, this and two other substantial dumping cases in the same region have resulted in changes to the Government's drug waste subsidy arrangement, escalating the level of financial support in such cases from the municipal or provincial level to that of the Ministry of Infrastructure and Water Management.



Sources: Government of the Kingdom of the Netherlands, "Meer vergoeding voor opruimkosten drugsafvaldumpingen" (21 October 2022); Gordon Darroch, "Ecstasy and agony: How drug waste Is destroying Dutch nature", *DutchNews*, 10 February 2024. Available at https://www.dutchnews.nl/2024/02/ecstasy-and-agony-how-drug-waste-is-destroying-dutch-nature/ (last accessed on 24 April 2025); NOS op 3, "De Grootste Drugsput Ooit", 2024, video news item. Available at https://www.youtube.com/watch?v=2V0iAsQvc_g (last accessed on 24 April 2025). The infographic is based on data from NOS Nieuws, "Opruimen van enorme drugsafvalput in Brabant begonnen, 400 bomen gekapt", 30 November 2023, online news item. Available at https://nos.nl/l/2499816 (last accessed on 24 April 2025).

by the accumulation of flammable gases.[31] In the Kingdom of the Netherlands, since 2020 drug manufacture has increasingly been carried out in residential areas.[32] In 2023, almost half of the 151 dismantled drug production sites were found in residential areas, in particular in apartments and houses.[33] Police data have confirmed that residents have been pressured into making their homes available for drug production.[34]

Indoor cannabis cultivation is linked to various health, safety and environmental risks, including booby traps, unsafe electric wiring, toxic atmospheres, toxic liquids and chemicals, harmful ultraviolet radiation emitted by growing lights, mould and structural damage to buildings used for cultivation.[35]

Cross-border environmental effects of drug manufacture in Europe

The environmental impact of drug manufacture can also have a transnational dimension. This can be related to the dumping and discharge of drug manufacture waste affecting a neighbouring country through the cross-border flow of rivers, or to the cross-border operations of drug traffickers. Dutch traffickers, for example, have expanded their activities to the German State of North Rhine-Westphalia,[36] where Dutch criminals were found to be involved in various drug manufacture and dumping sites in 2024. Previously, in 2018, a truck with 10 tons of drug manufacture waste driven from the Kingdom of the Netherlands was left in Germany with liquids dripping from it.[37] Organized forms of cross-border waste dumping by Dutch criminal groups have also been known to occur in Belgium.[38]

Environmental challenges related to nitrous oxide

Environmental challenges related to nitrous oxide have been reported by various countries in Europe. The gas is mentioned in the drug strategy of Belgium[39] as an example of the link between drug consumption and the environment. Urban police forces report issues related to public nuisance and waste, including large quantities of discarded nitrous oxide capsules found on streets.[40]

In the Kingdom of the Netherlands, the number of nitrous oxide-related incidents in which the police have been involved (e.g. nuisance or disruptions of public order), which had been declining since 2020, has decreased further since the beginning of 2023, when the manufacture and sale of nitrous oxide for recreational use was criminalized. The primary environmental concern seems to be greenhouse gas emissions and not necessarily the metal canisters that contain the gas, which are more of a safety concern.[41]

In Germany, the authorities have observed an increase in the consumption of nitrous oxide since 2023. While this development can be partly linked to the ban introduced in the Kingdom of the Netherlands,[42] the consumption of nitrous oxide has become increasingly widespread in Germany, with the number of users increasing.

France mentions the risk of explosion,[43] stressing further that nitrous oxide, a potent greenhouse gas, contributes to climate change and remains in the atmosphere for up to 120 years. The cartridges, which are found in abundance in urban and natural settings, also pose a particularly challenging waste management issue at incineration facilities. When subjected to high temperatures in furnaces, gas residues can cause the canisters to explode and the furnace doors to blow open, shutting down furnaces and resulting in costly repairs. Moreover, the rubber or latex balloons used to inhale the nitrous oxide degrade very slowly in nature, posing another environmental issue.[44]

Synthetic drugs and the environment in Europe

As Europe is an important region for the manufacture of, trade in and use of synthetic drugs, the region's contribution to the global environmental footprint of these substances is undoubtedly significant. In addition to the manufacture and transport of pre-precursors and precursors, the environmental impact of synthetic drugs in Europe is mostly the result of the toxic chemical waste generated during the manufacturing process.[45] The amount of waste generated is relatively large for all synthetic drugs, but the exact quantities can vary substantially,[46] from 5 to 58 times the volume of the end product.[47] However, the waste not only varies considerably in terms of volume but also in terms of its composition, by the type of drug produced, the synthesis route used, the expertise of the producer and various other factors.[48]

Dumping and discharge of drug manufacture waste

Manufacturers of synthetic drugs typically dispose of the resulting waste in two ways: dumping and discharge, sometimes respectively referred to as the "visible" and "invisible" parts of waste disposal.[49] Dumping, the "visible" part, involves the disposal of synthetic drug manufacture waste in plastic barrels, jerrycans, metal drums and other containers, as well as in delivery trucks and other vehicles. The more "invisible" part, discharge, involves the direct or indirect discarding of liquid waste through the sewage system, onto the ground or into surface water. In Belgium and Netherlands (Kingdom of the), the number of dumping sites being discovered has recently decreased, suggesting

AMOUNT AND INDICATIVE COMPOSITION OF CHEMICAL WASTE GENERATED BY THE PRODUCTION OF SYNTHETIC DRUGS

Synthetic drug	Amount of waste generated by 1 kg of final product (in kg/kg)[i]	Examples of type of waste[ii, iii, iv]	Composition of waste[v]
MDMA	6–10[vi] >12[vii] 18[viii] 21–31[ix] ("high pressure method") 29–58[ix] ("cold method")	› Ethanol/isopropyl alcohol, methylamine; HCl, acetone, NaOH, Hg, $Al(OH)_3$, diethylether, MeOH; (pre-)precursors	› Major part of the total waste composition: aqueous acidic and alkaline solutions, organic solvents and reactants › Minor part: (pre-)precursors, by-products, end product and catalysts
Methamphetamine	5–6[x] 5–10[xi]	› From ephedrine: NaOH, I_2, P, organic solvents (e.g. ether, acetone, thinner, xylene); H_2SO_4, HCl, HI, methylamine › From BMK: ammonia, NaOH, LiOH, metals (Li), solvents (e.g. ether, acetone, DCM)	› Major part: aqueous acidic and alkaline solutions, organic solvents and reactants › Minor part: (pre-)precursors, by-products, end product and catalysts
Amphetamine	>16[vii] 19–39[ix] (using APAA or APAAN as a pre-precursor) 20–30[vi]	› Alkaline waste, formic acid, formamide, N-formylamphetamine, NaOH, NH4Cl, phenyl acetic acid, MeOH, H_2SO_4, H_3PO_4, acetone, ammonia; (pre-)precursors	› Major part: aqueous acidic and alkaline solutions › Minor part: (pre-)precursors, by-products and end product › No data: organic solvents and reactants

i Amounts are expressed in kg per 1 kg of final product, unless otherwise indicated.

ii Minnesota PCA (2021) (Minnesota Pollution Control Agency).

iii Felix Brongers, 'Vaten En Fauna. Een Groen Criminologisch Onderzoek Naar de Milieuschade Als Gevolg van Synthetisch Drugsafval' (Rotterdam, Erasmus Universiteit, 2021).

iv Not all chemicals are found in the waste in or from every laboratory. Reaction materials used depend upon the method of production. The solvent(s) used in manufacture may vary owing to availability, the trafficker's preference, etc.

v The chemical components of waste can be roughly divided into minor and major parts of the total waste. This is partly based on unpublished results estimates; residues of (pre-)precursors, by-products and final product are not often studied. However, some information is available about residues that are left in the reaction mixtures.

vi Pardel et al., 2021.

vii Riemersma, 2021 . Waste is expressed per kg of precursor.

viii Royal Canadian Mounted Police (RCMP), 2024.

ix Ter Laak and Mehlbaum, 2022.

x Lukas 1997, cited in Scott et al., 2003.

xi White 1998, cited in Scott et al., 2003.

a shift towards more invisible forms of disposal, such as direct discharge or the exploitation by criminals of licit waste disposal channels.[50] In those two countries and Germany, law enforcement officers are also increasingly finding drug manufacture waste stored on-site when laboratories are abandoned.[51]

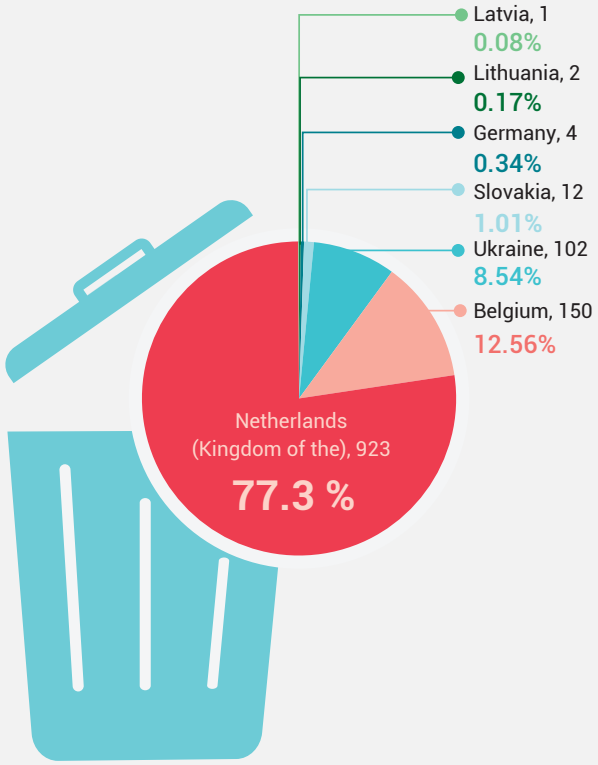
In the period 2019–2023, 1,194 drug manufacture waste dumping sites were reported to UNODC by seven countries in Europe. In the longer period 2013–2023, most dumping sites that were linked to specific drug manufacture were related to amphetamine (43 per cent), MDMA (35 per cent) and cocaine (8 per cent). During the latter period, the number of countries reporting dumping sites was slightly higher, at nine, with the addition of Spain (14 sites) and North Macedonia (1 site).

This means that there is a significant disconnect between the number of countries reporting dismantled clandestine laboratories, at 36 in the period 2013–2023, and the number of dumping sites reported. Indeed, 99 per cent of all the dumping sites reported in that period were reported by just three countries: Belgium, Netherlands (Kingdom of the) and Ukraine. Although this partly reflects their significance as synthetic drug manufacture hotspots, it does not tell the whole story.

Various factors may explain the disconnect between the reporting of dismantled clandestine laboratories and waste dumping sites. It is possible that drug waste is mostly discharged directly or mixed with other chemical waste that is disposed of through legal waste channels. It is also possible that in some countries, as has been reported by experts to occur in Germany and Slovakia, dumping sites are not linked to illicit drug manufacture or administratively registered as such.[52] In Slovakia, where substances found at manufacturing, storage and dumping sites are considered hazardous waste, there are national statistics on illegal waste dumping sites, but separate statistics are not kept on illicit drug-related waste dumping sites.[53] The situation may be similar in other countries, especially those that have limited drug manufacturing activity or limited experience of drug manufacture waste dumping sites. Some countries have either not identified synthetic drug manufacture (Italy) or have identified it only on a very limited scale (France), which explains their lack of reporting of drug manufacture waste dumping sites.[54]

Lastly, 14 European countries each reported fewer than 10 dismantled laboratories in the period 2013–2023, which greatly reduces the possibility of finding any related waste dumping sites. Regardless, it is likely that both the actual number of dumping sites in Europe and their geographical spread across the region are significantly larger than the data suggest.

Reported drug manufacture waste dumping sites in Europe, 2019–2023



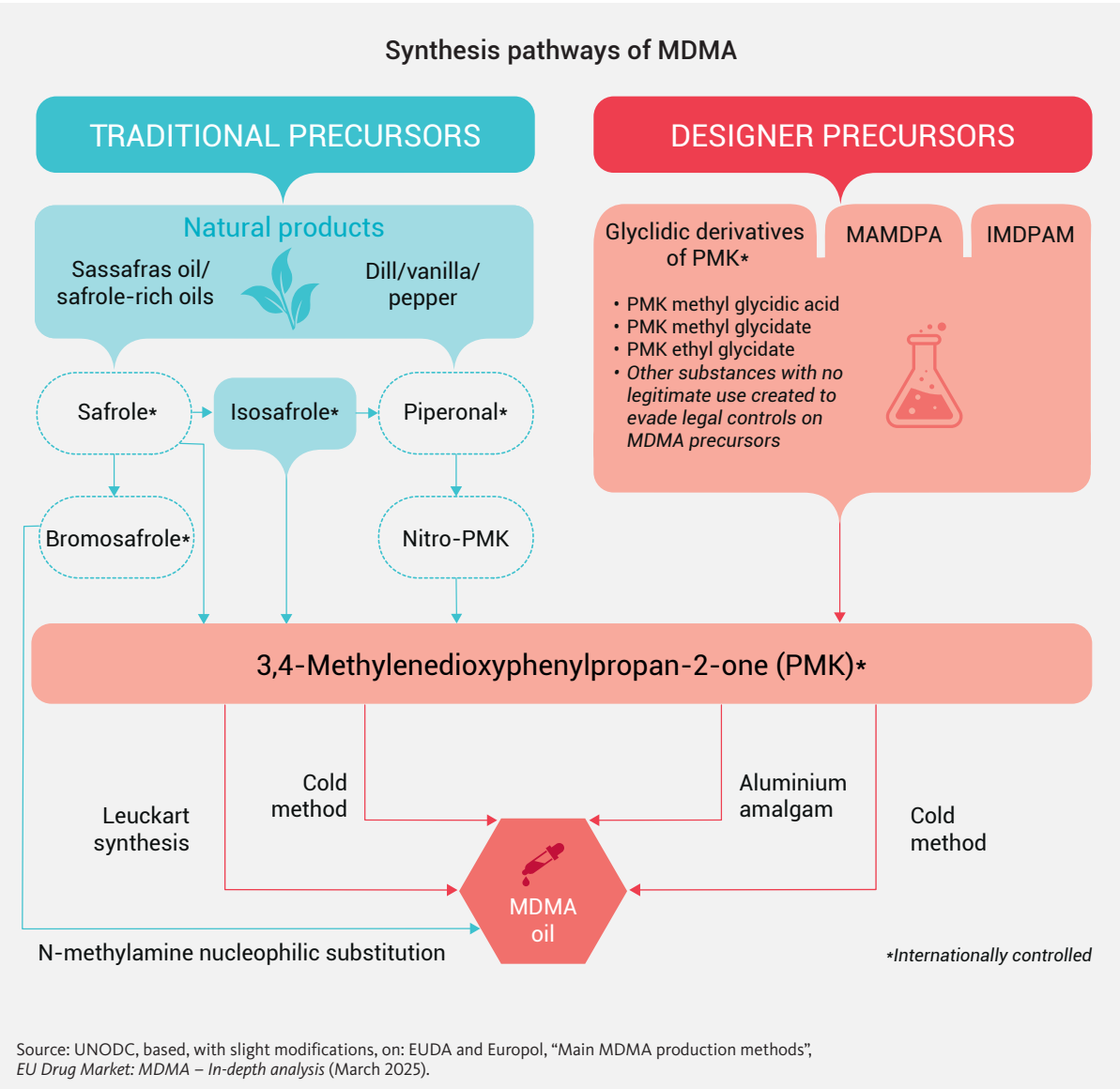
Source: UNODC, responses to the annual report questionnaire.

A life cycle assessment of MDMA

The environmental impact of illicit synthetic drug manufacture is not limited to waste generation and the associated harm, as such manufacture also creates a carbon footprint. An important indicator that quantifies the impact of humans on climate change, the carbon footprint can be estimated using a life cycle assessment.[55]

Estimating the life cycle impacts of illicitly produced drugs is challenging owing to the lack of data resulting from the illegal nature of the drug supply chain.[56] Another factor is the high degree of variability, not least because the illicit manufacture of drugs is in a constant state of flux, shifting between various cultivation methods and chemical inputs for plant-based drugs and between synthesis methods, associated pre-precursors and precursors, and laboratory conditions for synthetic drugs.[57]

Few life cycle assessments of illicitly produced drugs have been carried out. In the case of cannabis, there have been



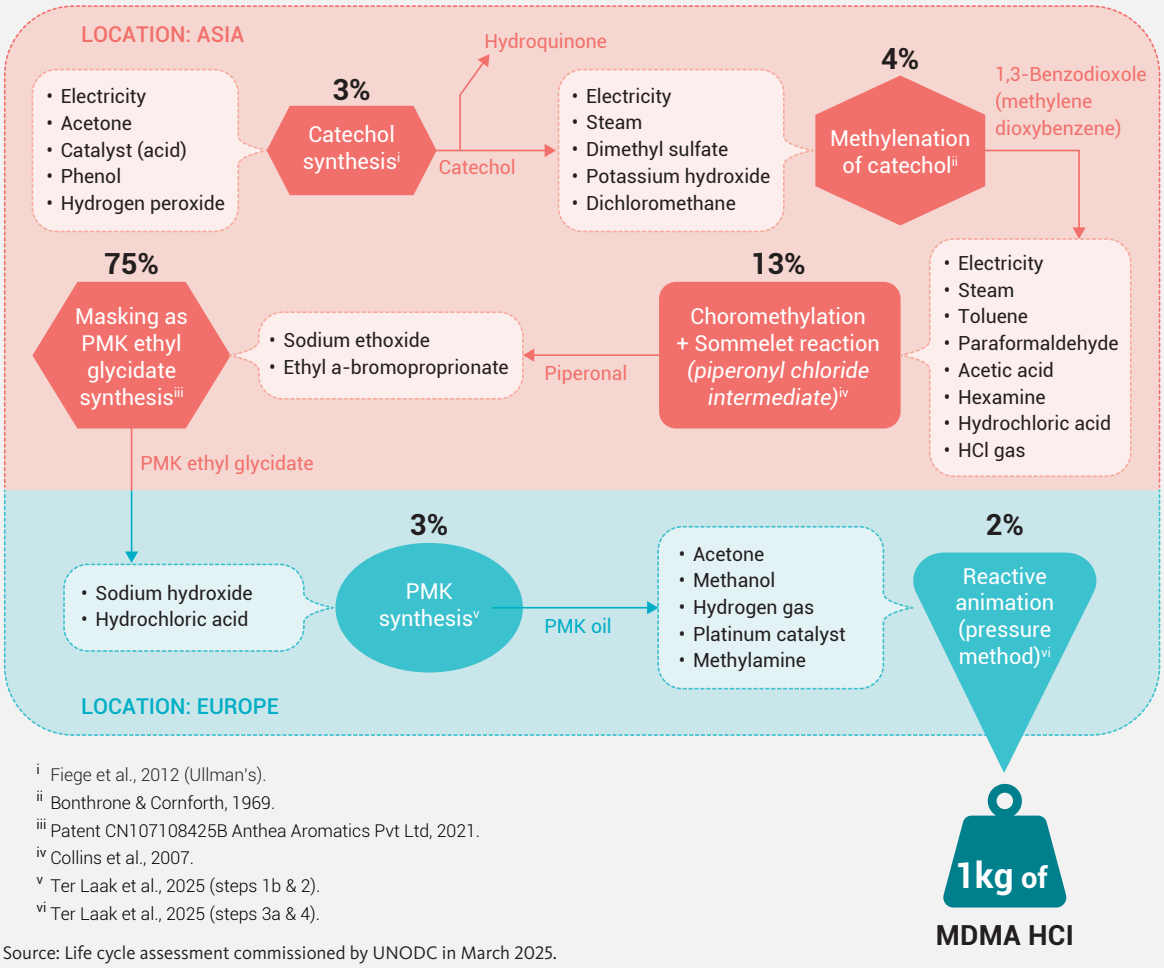
Source: UNODC, based, with slight modifications, on: EUDA and Europol, "Main MDMA production methods", *EU Drug Market: MDMA – In-depth analysis* (March 2025).

a handful of studies related to jurisdictions in North America in which the drug has been legalized.[58] In the case of cocaine, there has been just one study, related to Colombia,[59] and in the case of opium, there has been a "cradle-to-grave" assessment of medicinal morphine in Australia.[60]

No previous assessments of the illicit manufacture of synthetic drugs have been identified in the literature. For the present edition of the *World Drug Report*, UNODC commissioned the following life cycle assessment of MDMA, which is particularly relevant for Europe as most of the global supply of MDMA stems from this region. MDMA was also chosen as preliminary data from several scientific publications were available, providing a feasible starting point. It should be pointed out, however, that the life cycle assessment of MDMA faces significant data gaps and challenges that must be addressed to improve its accuracy and comprehensiveness. These include the need for detailed information on large-scale precursor synthesis routes in Asia and the related process data on chemical and energy inputs.

Such a life cycle assessment can help identify the environmental impacts and hotspots within the illicit MDMA value chain, thereby improving understanding of the drug's

Representative example of a possible synthesis route for MDMA HCl crystals as modelled in the life cycle assessment study



[i] Fiege et al., 2012 (Ullman's).
[ii] Bonthrone & Cornforth, 1969.
[iii] Patent CN107108425B Anthea Aromatics Pvt Ltd, 2021.
[iv] Collins et al., 2007.
[v] Ter Laak et al., 2025 (steps 1b & 2).
[vi] Ter Laak et al., 2025 (steps 3a & 4).

Source: Life cycle assessment commissioned by UNODC in March 2025.

Note: The estimated relative carbon footprint contributions of each step are indicated below the boxes. The environmental burdens of hydroquinone as a commercial by-product are subtracted from the system – a strategy that is often applied in life cycle assessments to deal with multifunctional processes (International Organization for Standardization, 2020).

overall environmental implications. The assessment applied a "cradle-to-laboratory-gate" model to set its boundaries, meaning that it did not account for environmental impacts related to the use and final disposal of MDMA after consumption.

Manufacture of MDMA from piperonal

There is no evidence that any specific synthesis process currently dominates in the illicit manufacture of MDMA, as synthesis pathways, especially those for precursors and pre-precursors, vary frequently over time and from country to country. Even though MDMA is predominantly manufactured in Europe, the synthesis routes used have ramifications far beyond the final location of synthesis, as shown by the use of phenol, a compound legally manufactured on an industrial scale in Asia from petroleum derivatives.[61]

In the modelling of the life cycle assessment, piperonal, a chemical used in fragrances and flavourings, was considered an important element in the MDMA synthesis chain, although it is not clear what the actual starting material is. A controlled precursor chemical under the 1988 United Nations Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances, it serves as a precursor of 3,4-Methylenedioxyphenyl-2-propanone

(also known as piperonyl methyl ketone (PMK) and 3,4-MDP-2-P), which until recently was produced from the chemicals safrole and isosafrole, oils that can be readily obtained from the bark of the sassafras tree and other plant species.[62] Recent evidence suggests that prior to its import to Europe, PMK is "masked"[63] as a variety of glycidate salts (using sodium or potassium) and esters, a number of which have recently been placed under international control.[64] The "masking" can be done, for example, by reacting piperonal with sodium ethoxide and ethyl-*alpha*-bromopropionate.[65] The glycidate salts and esters have reportedly been imported into the Kingdom of the Netherlands and serve as the starting precursor for the final synthesis of MDMA.

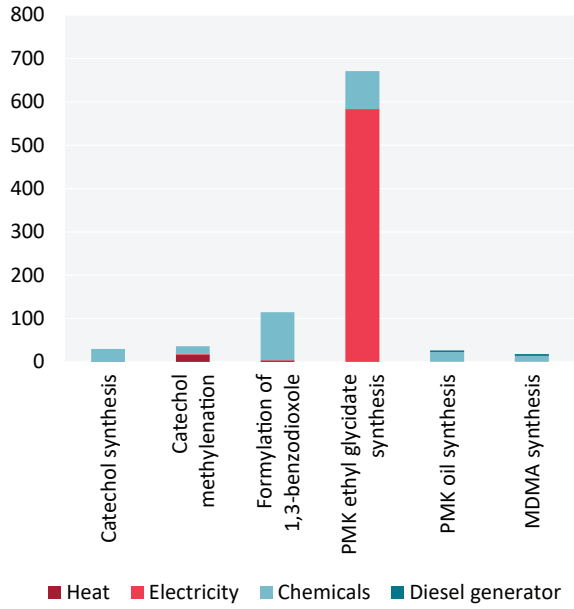
The subsequent conversion is likely carried out by subjecting the PMK to a reductive amination process with methylamine in the presence of hydrogen and a platinum catalyst, yielding an MDMA oil.[66] This oil is then dissolved in acetone and hydrochloric acid, leading to the crystallization of MDMA, which is subsequently distributed on the market.

The synthesis of MDMA from the PMK glycidate produces a substantial amount of waste, which is often disposed of in an uncontrolled manner, either in municipal sewer systems or directly in soil or water.[67] The waste identified so far has mostly consisted of the acidic aqueous waste from the conversion of the ethyl glycidate to PMK and unrecycled solvents such as methanol containing some methylamine, or mixtures with acetone and hydrochloric acid.[68]

Carbon footprint of MDMA

The carbon footprint associated with the manufacture of 1 kg of MDMA HCl salt likely falls within a range of 400 to 1,500 kg of CO_2e, with a representative average of roughly 900 kg of CO_2e.[69] The range is broad owing to the numerous uncertainties and inherent variabilities in the synthesis methods. As a result of such an energy-intensive process, the main contributor to the carbon footprint is the conversion of piperonal to PMK ethyl glycidate. At this stage, the most energy-intensive activity is the ventilation of a small-scale laboratory facility that runs for a long time (more than a day), although only a small quantity of PMK ethyl glycidate is produced in each batch. This calculation requires several rough assumptions for an initial estimate, however, which explains the broad range reported. In the model presented, this activity is carried out in Asia, where the electricity mix is still largely dominated by fossil fuels,[70] making this a significant contribution to the carbon footprint of the supply chain. Newer processes may exist for making the synthesis of the glycidate esters considerably shorter and more energy efficient, but none have been documented to date. Under more improvised or informal manufacturing conditions, the environmental impacts tend to be significantly larger.

FIG. 10 Contribution of chemical substances and energy use to the climate change impact of 1 kg of MDMA HCl salt manufacture (values reported in kg of CO_2e)



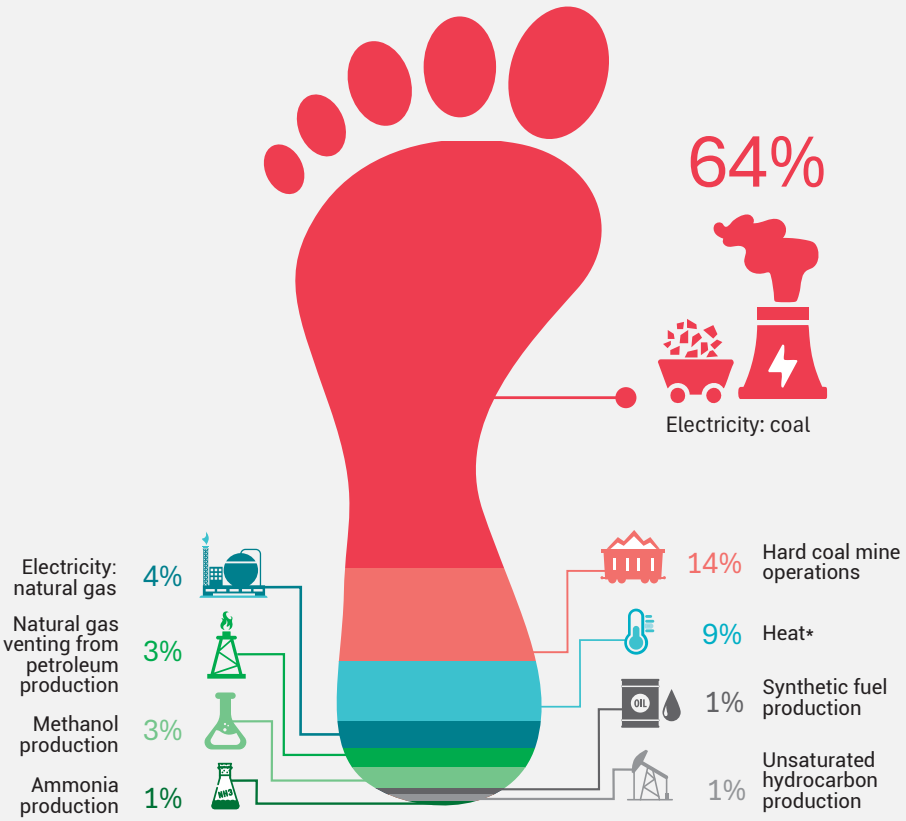
Sources: Life cycle assessment commissioned by UNODC in March 2025; Michael Collins et al., "Methyl 3-[3',4'-(Methylenedioxy)Phenyl]-2-methyl Glycidate: an ecstasy precursor seized in Sydney, Australia", *Journal of Forensic Sciences*, vol. 52, No. 4 (July 2007).

Note: The conversion of piperonal to PMK ethyl glycidate was modelled on the laboratory-scale process reported in the study by Collins. While there remains considerable uncertainty as to whether this intermediate step is applied in the way described in that study, in practice it is also important to note that the "masking" of PMK (going from piperonal to PMK through PMK ethyl glycidate) is not strictly necessary, since PMK can be synthesized directly from piperonal. Instead, the masking of PMK as its glycidate ester appears to be a strategy used by illicit producers to circumvent export restrictions.

Other key contributing factors include heat supply and the synthesis of several chemicals with substantial CO_2 footprints that are used in the full synthesis route, including acetic acid, formaldehyde, bromine, hydrochloric acid and ammonia.

Some 64 per cent of contributions can be attributed to electricity generated from coal in Asia.[71] Other direct sources of greenhouse gas emissions include the production of heat from natural gas and other sources in Europe, the operation of coal mines and coal preparation in Asia and the manufacture of ammonia, methanol, synthetic fuels and unsaturated hydrocarbons globally.

Processes directly contributing to the carbon footprint of MDMA HCl as a percentage of total kg CO_2e

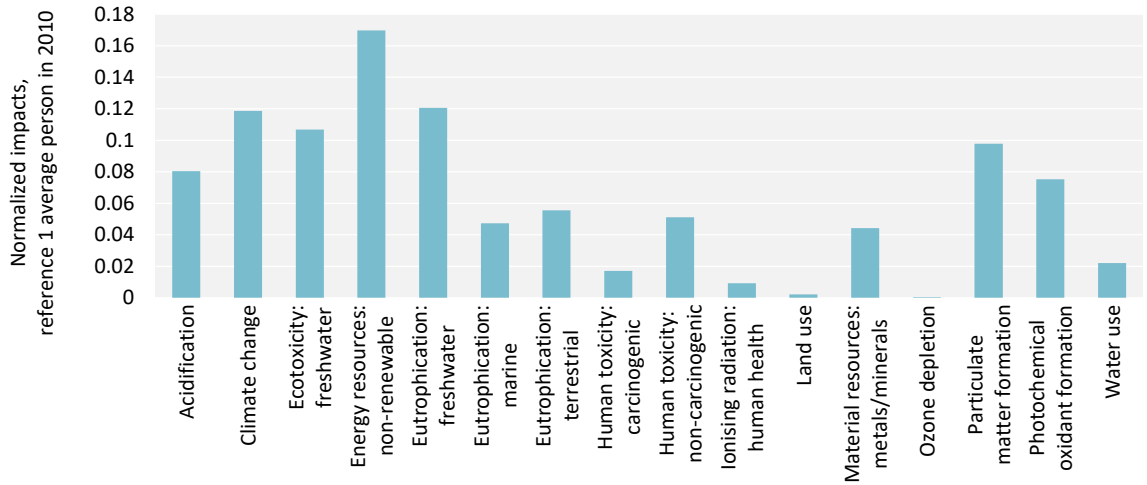


Sources: Life cycle assessment study commissioned by UNODC in 2025. Calculations based on Wernet et al., "The ecoinvent database version 3 (part I): overview and methodology", *The International Journal of Life Cycle Assessment*, vol. 21, No. 9 (2016); and Bassi et al., "Updated characterisation and normalisation factors for the Environmental Footprint 3.1 method" (Publications Office of the European Union, Luxembourg, 2023).

** "Heat" consists of direct heat sources supplied to industrial processes (e.g., from natural gas)*

Producing 1 kg of MDMA HCl salt can also have other relevant impacts. A common way to identify those impacts in life cycle assessments is to normalize the impacts of the assessed product versus the impacts of an average person in the world for a given year. In this comparison, the following four impact categories stand out next to climate change: the consumption of non-renewable energy resources; freshwater eutrophication; freshwater ecotoxicity; and particulate matter formation. The consumption of non-renewable resources is mostly linked to the mining of hard coal, which is required for electricity generation in Asia. Freshwater eutrophication is also dominated by the treatment of spoils from coal mining. Regarding particulate matter formation, most of the impact originates from the coal-based electricity mix in Asia, where the initial stage of the synthesis process takes place. The key contributors to the freshwater ecotoxicity category are the use of chemicals such as formaldehyde and dimethyl sulfoxide, as well as the coal mining required for the fossil-based share of electricity consumed in the masking of PMK as ethyl glycidate.

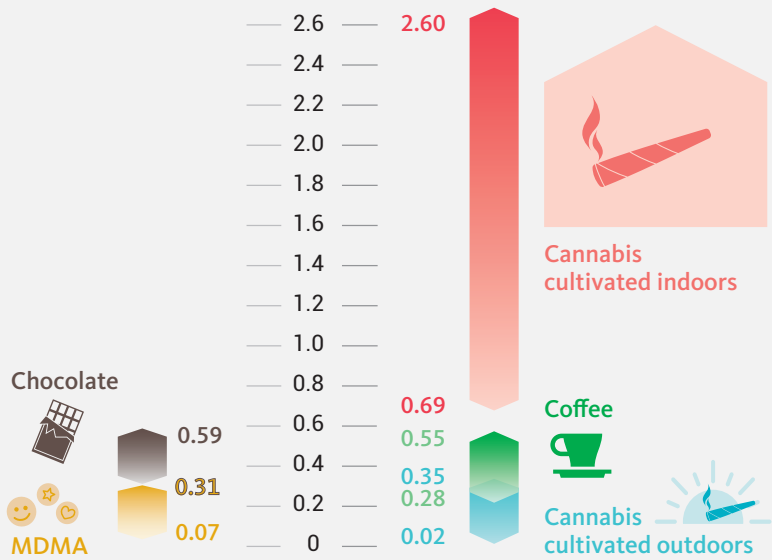
FIG. 11 Normalized life cycle impacts of 1 kg of MDMA HCl versus the average impacts of a single person in the world (normalized impacts, reference one average person in 2010)



Sources: Life cycle assessment study commissioned by UNODC in March 2025. Calculations based on Wernet et al., "The ecoinvent database version 3 (part I): overview and methodology", *The International Journal of Life Cycle Assessment*, vol. 21, No. 9 (2016); and Bassi et al., "Updated characterisation and normalisation factors for the Environmental Footprint 3.1 method" (Publications Office of the European Union, Luxembourg, 2023).

Carbon footprint comparison of MDMA with a cannabis joint, a cup of coffee and a chocolate bar

(kg of CO_2e per "joint", one pill, cup, 100 g "cradle-to-grave" chocolate)



Sources: Bianchi et al., "Environmental analysis along the supply chain of dark, milk and white chocolate: a life cycle comparison", *International Journal of Life Cycle Assessment*, vol. 26, No. 4 (2021), pp. 807–821; Konstantas et al., "Environmental impacts of chocolate production and consumption in the UK", *Food Research International*, vol. 106 (2018), pp. 1012–1025; Recanati et al., "From beans to bar: a life cycle assessment towards sustainable chocolate supply chain", *Science of The Total Environment*, vol. 613–614 (2018), pp. 1013–1023; Nab and Maslin, "Life cycle assessment synthesis of the carbon footprint of Arabica coffee: case study of Brazil and Vietnam conventional and sustainable coffee production and export to the United Kingdom," *Geo: Geography and Environment* 7, No. 2 (July 2020).

Note: The coffee data are based on carbon footprint estimates related to coffee produced in Brazil and Viet Nam and exported to the United Kingdom of Great Britain and Northern Ireland. For chocolate, the lowest figures relate to dark chocolate, while the highest figures relate to milk chocolate, in both cases consumed in Italy. The indoor and outdoor cannabis cultivation data are based on studies undertaken in the United States of America and do not include exportation. The highest estimate for MDMA is based on 1,500 kg of CO_2e per kg and 6,000 pills per kg. The lowest estimate is based on 400 kg of CO_2e per kg and 7,150 pills per kg.

Comparison of the environmental impact of an MDMA pill with a cannabis "joint", a cup of coffee and a bar of chocolate

The comparison of the environmental impact associated with the illegal manufacture of MDMA with that of the laboratory controlled manufacture of the substance for pharmaceutical research shows that illegal manufacture has a climate change impact that is at least 30 to 60 per cent larger.[72] For a more intuitive idea of the carbon footprint incurred, the infographic above compares the impact of producing one MDMA pill with the carbon footprint of a cannabis joint, a 100 g bar of chocolate and a cup of coffee. For reference, in Europe 1 kg of MDMA HCl is roughly equivalent to between 6,000 and 7,150 pills, based on an average purity of 80 per cent.[73]

Manufacture of MDMA from natural precursors

The manufacture of MDMA from natural precursors – specifically, safrole and its isomer, isosafrole – has a significant environmental impact[74] that has been well documented, albeit not from a full life cycle perspective. Typically, safrole-rich oil is extracted from plant material through a prolonged steam distillation process lasting several days.[75] In clandestine operations, the process often includes the burning of logs. For example, the *Cinnamomum camphora* tree is a known source of safrole, yet reports indicate that for every tree harvested for its oil, up to six additional trees may be burned to provide heat for the distillation process.[76] Given that the yield of safrole is generally around 2 per cent by weight,[77] the production of just 1 kg of safrole could result in the emission of several tons of CO_2e because of deforestation and uncontrolled wood burning.

Although safrole was once used directly as a precursor for synthesizing PMK, recent trends suggest that this direct route has largely been abandoned. Nevertheless, safrole may still play a role in the MDMA production chain. Research suggests that safrole may still be used as a precursor in the industrial-scale production of piperonal and could potentially find its way into illicit MDMA synthesis routes.

Another common natural precursor of piperonal is piperine, which is derived from black pepper. While less impactful in terms of deforestation, synthesis of the several kilograms of piperine required to synthesize 1 kg of MDMA could still produce up to 1 ton of CO_2e.[78]

Cannabis and the environment in Europe

The cannabis used in Europe is either imported, particularly in the form of cannabis resin, or cultivated domestically, increasingly in greenhouses. Although no studies exist on the carbon footprint of cannabis production in Europe or on illicit production in general, studies conducted on licit cannabis production outside the region can help assess its order of magnitude, albeit with a certain degree of uncertainty.

Indoor cannabis cultivation

The main contributor to the carbon footprint of indoor cannabis cultivation is the energy used in climate control and by growing lights.[79] The combined factors of lighting and heating, ventilation and air conditioning account for around 81 per cent of the total carbon footprint of licit indoor cannabis cultivation.[80]

A recent life cycle assessment undertaken in several provinces in Canada estimated the carbon footprint of licit cannabis to range from roughly 3,200 to 5,400 kg of CO_2e per kg of cannabis flower[81] produced.[82] A study in the United States of America provided estimates of 4,500 kg of CO_2e for commercial indoor cultivation and 2,150 kg of CO_2e for less-intensive home cultivation.[83]

Outdoor cannabis cultivation

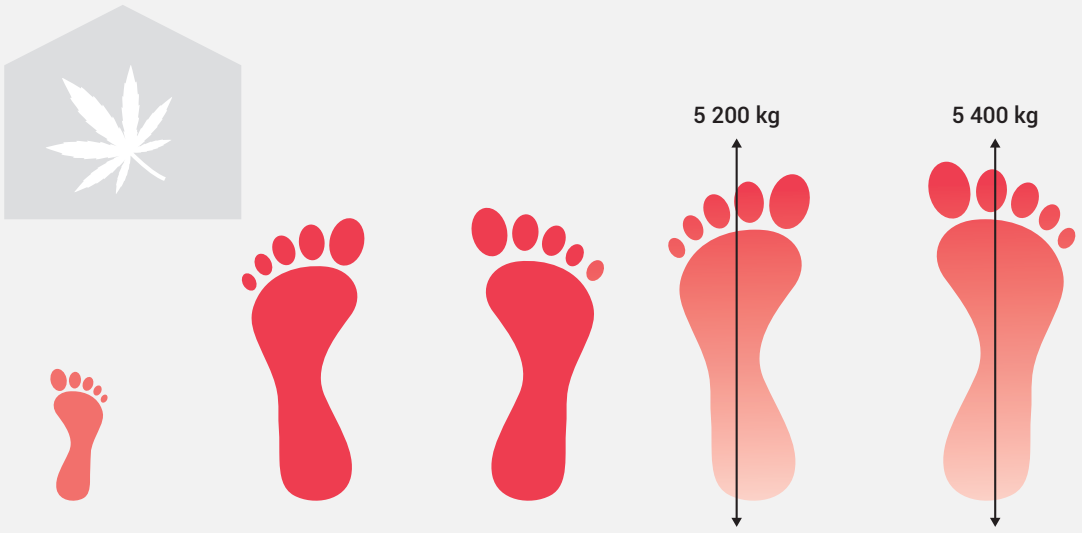
A recent Canadian study calculated the global warming potential of licit outdoor cannabis cultivation by measuring input and output values from two different fertilizer treatments involving significantly different quantities of fertilizer, as well as flower and THC yield.

When accounting for raw material extraction, transformation, transport and plant growth, the average global warming potential of cannabis grown using larger amounts of nitrogen and potassium was 61.8 kg of CO_2e per kg of dry flower, compared with 110.7 kg of CO_2e per kg of dry flower using smaller amounts.[84] Meanwhile, a recent study in the United States provided estimates of 2,500 kg of CO_2e per kg of cannabis flower for greenhouse cultivation and 700 kg of CO_2e per kg of dry flower for open-field cultivation.[85]

The marked difference in the carbon footprint of licit indoor and outdoor cannabis cultivation can principally be explained by the amount of energy used. Although outdoor cultivation, especially in greenhouses, may involve climate control, growing lights and automatic irrigation systems, the amount of energy required is much smaller than for cannabis cultivation in indoor settings.[86]

Carbon footprint of indoor cannabis cultivation

(kg CO_2e produced per kg of dry flower)



2 150 kg	4 500 kg	4 600 kg	2 300	3 200
Less intensive home cultivation	Intensive commercial production	Energy use	"Cradle-to-gate"	"Cradle-to-gate"
United States	United States	United States	United States	Canada
Mills, 2025	*Mills, 2025*	*Mills, 2012*	*Summers et al., 2021*	*Desaulniers-Brousseau et al., 2024*

Sources: UNODC, based on Desaulniers Brousseau et al., "Greener green: the environmental impacts of the Canadian cannabis industry", *Resources, Conservation and Recycling*, vol. 208 (2024); Summers, Sproul and Quinn, "The greenhouse gas emissions of indoor cannabis production in the United States", *Nature Sustainability,* vol. 4, No. 7 (July 2021), pp. 644–50; Mills, "Energy-intensive indoor cultivation drives the cannabis industry's expanding carbon footprint', *One Earth*, vol. 8, No. 3 (February 2025); Mills, "The carbon footprint of indoor cannabis production", *Energy Policy*, vol. 46 (July 2012), pp. 58–67.

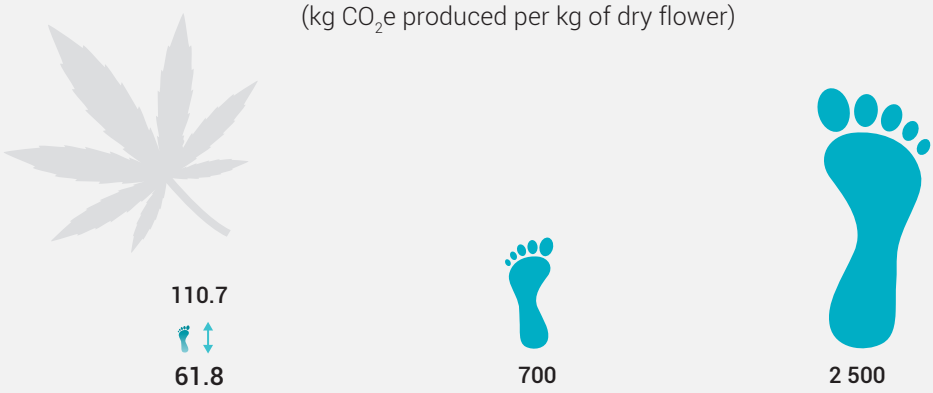
Energy use outdoors is often limited to areas used in specific stages of the process, such as seedling production or drying, which only account for an estimated 12 per cent of the environmental impact of indoor cannabis production.[87]

Recent research in jurisdictions where cannabis has been legalized shows that facilities rely heavily on fossil fuels for heating, highlighting the relatively minor contribution of electricity compared with that of natural gas.[88]

When calculating the total environmental footprint through life cycle assessments, it is also important to factor in any land-use change, such as deforestation, and what happens with cannabis plant materials that are confiscated. In Albania, for example, where illicit cannabis is mostly cultivated in remote public forests and pastures, which has been reported to result in deforestation,[89] confiscated plants are destroyed by burning.[90] In Italy, investigations by the Central Directorate of Anti-Drug Services show that in some provinces, cannabis producers exploit remote forest areas and national parks.[91] In Spain, illicit cannabis cultivation has also been found in several natural parks, for example, in the Provinces of Guadalajara and Málaga.[92]

Carbon footprint of outdoor cannabis cultivation

(kg CO_2e produced per kg of dry flower)

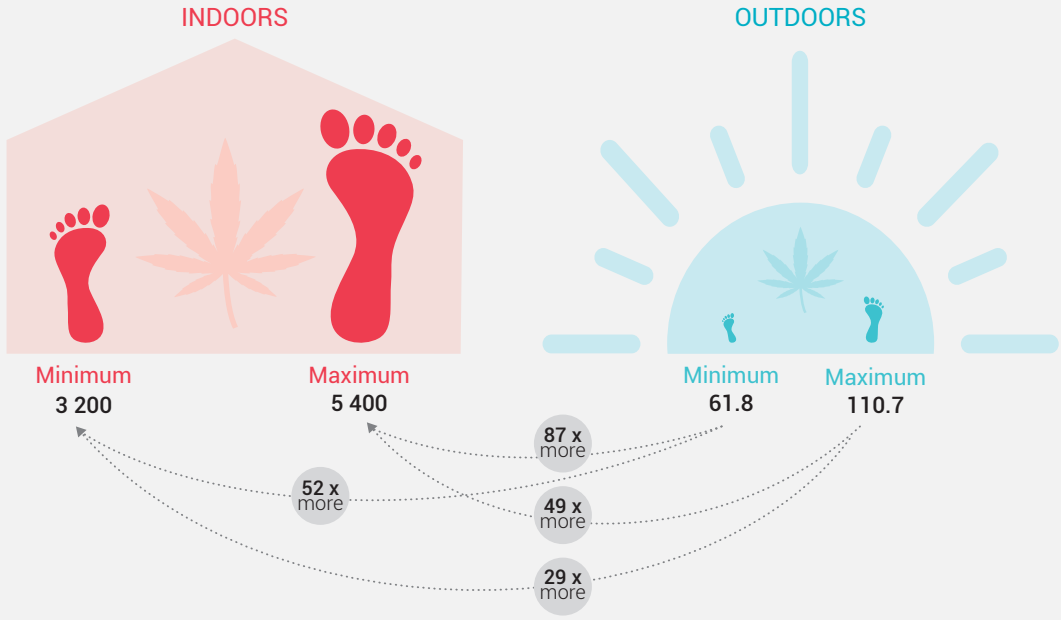


Open-field cultivation	Open-field cultivation	Greenhouse cultivation
Canada	United States	United States
Desaulniers-Brousseau et al., 2024	*Mills, 2025*	*Mills, 2025*

Sources: UNODC, based on Desaulniers Brousseau et al., "Environmental impact of outdoor cannabis production", *ACS Agricultural Science & Technology*, vol. 4, No. 7 (15 July 2024), pp. 690–99; Summers, Sproul and Quinn, "The greenhouse gas emissions of indoor cannabis production in the United States", *Nature Sustainability*, vol. 4, No. 7 (July 2021), pp. 644–50; Mills, "Energy-intensive indoor cultivation drives the cannabis industry's expanding carbon footprint', *One Earth*, vol. 8, No. 3 (February 2025); Mills, "The carbon footprint of indoor cannabis production", *Energy Policy*, vol. 46 (July 2012), pp. 58–67.

Note: The estimates from the United States are related to a "cradle-to-grave" life cycle assessment. The estimates from Canada refer to a "cradle-to-gate" life cycle assessment.

Comparison of the estimated carbon footprint of indoor and outdoor cannabis cultivation in Canada (kg of CO_2e produced per kg of dry flower)



Sources: UNODC, based on Desaulniers Brousseau et al., "Environmental impact of outdoor cannabis production", *ACS Agricultural Science & Technology*, vol. 4, No. 7 (15 July 2024), pp. 690–99; Desaulniers Brousseau et al., "Greener green: the environmental impacts of the Canadian cannabis industry", *Resources, Conservation and Recycling*, vol. 208 (September 2024).

Research on and responses to the environmental impact of drugs in Europe

Monitoring illicit drug manufacture and consumption across Europe involves diverse strategies, including sewage analysis, environmental testing and law enforcement interventions. Although the principal motive of such responses is not to address environmental harm, they generally have the potential to assess the environmental impact of drugs. Innovative sensor systems and wastewater epidemiology can detect the presence of drugs, while soil and water analyses assess contamination. Law enforcement efforts, supported by remediation subsidies, can mitigate environmental harm. This section discusses some of the relevant research and responses identified in Europe with the aim of encouraging discussion of their relevance for addressing and mitigating the environmental impact of drugs.

Detection and monitoring of the environmental and ecotoxicological impact of drugs in Europe

Monitoring of sewage systems

The illegal discharge of pollutants into sewage systems is a growing problem in Europe[93] and has prompted research in a number of areas to identify ways to detect, localize and quantify pollutants in wastewater networks. The European Union has supported various innovative research programmes focused on drugs over the past decade.[94]

Under one such project, known as microMole, which ran from 2015 to 2019, researchers designed and developed a prototype of a self-sufficient sensor system, the microMole, to be installed in sewage systems to track down sites at which synthetic drugs such as amphetamine and methamphetamine are manufactured.[95] The system comprised a series of microelectrodes that responded to specific substances.[96] In another project, known as the New Operational Sensing sYstem (NOSY), which ran from 2015 to 2018, similar sensor systems were developed for cocaine.[97]

As the technology used in microMole is relatively expensive and is battery-powered, the sensor system has been developed for targeted monitoring in cases where law enforcement agencies already suspect the clandestine manufacture of drugs and can confirm it in real time.[98]

Under a follow-up project funded by the European Union, known as SYnergy of integrated Sensors and Technologies for urban sEcured environMent (SYSTEM), which ran from 2018 to 2022, a broader, city-wide approach was taken whereby researchers created a prototype of a system of various simplified production monitoring systems that could potentially be employed for a longer period and bring together different types of sensor data for direct monitoring by law enforcement agencies.[99] Sensors were mounted on aerial drones or inside garbage trucks, for example.

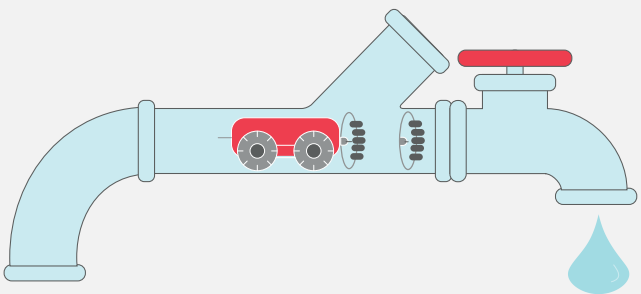
Wastewater analysis

Wastewater analysis is a rapidly developing discipline with the potential to provide near real-time data on regional and temporal variations in drug consumption. Since the early 2000s, wastewater analysis has increasingly been used to gauge the level of and trends in drug consumption in a defined geographical area. This method is efficient as the tool and methodology are easy to acquire and cost-effective.[100] A prerequisite for effective wastewater analysis is that drug consumption- or production-related substances need to exhibit a certain chemical and biological stability.

Wastewater analysis is also a useful tool for rapidly evaluating emerging trends in NPS use, complementing common indicators (i.e. population surveys and drug seizures) and contributing to the establishment of public health protection measures.[101]

Wastewater analysis is widespread in Europe, particularly in Western and Central and Southern Europe. Work by the Sewage analysis CORe group Europe (SCORE) and the EUDA multi-city wastewater analysis study has contributed to boosting and standardizing monitoring and research approaches. However, beyond such Europe-wide initiatives, there are many differences between studies, approaches and methodologies.

The microMole system for sewage monitoring



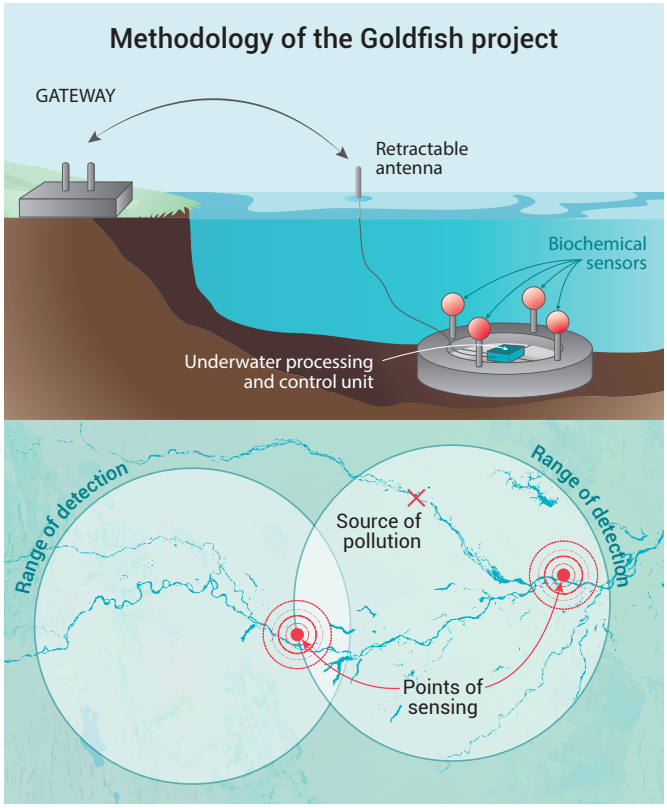
Source: UNODC, based on images from the microMole website. Available at https://micromole.eu/ (accessed 4 April 2025).

Note: A remote controlled crawler robot with a flexible working tool and various cameras places sensor rings into the sewage system for real-time monitoring.

Since 2011, the amount of methamphetamine and amphetamine identified in wastewater in Europe has steadily increased.[102] The same is true of MDMA, except during the hiatus caused by the COVID-19 pandemic.[103]

Measuring cannabis in wastewater is more complex, however. The analysis of excreted cannabinoids in wastewater can help identify consumption trends for a defined catchment area[104] but the drug presents unique challenges in view of its primary route of excretion and the chemistry of its metabolites.[105] Analysis of THC-COOH, a major cannabis metabolite, in European wastewaters shows a decrease in consumption of 12 per cent in 2024 compared with the previous year, but a relatively stable trend between 2011 and 2024.[106]

Wastewater analysis has the potential to assist in the monitoring of current and emerging synthetic cannabinoids.[107] When it comes to other NPS, wastewater analysis methodologies have seldom been applied in Europe and the substances pose unique challenges, such as a lack of information on excretion rates and metabolic pathways, the low concentrations of them in wastewater and their ever-changing nature.[108] Nonetheless, one study conducted in 12 European cities combining quantitative and qualitative analysis identified fentanyl, norfentanyl and 15 out of 311 NPS studied in influent wastewater.[109]



Soil, surface water and groundwater analysis

While wastewater analysis is carried out in most European countries, monitoring and analysis of the effects of drug production/manufacture waste on soil, surface water and groundwater are less widespread. For the conservation of fresh water and soil, it is important to improve understanding of metabolites, levels of contaminants, degradation conditions and possible toxicological effects.[110] For example, when synthetic drug manufacture waste enters the soil or water, it can change the pH level, which may affect ecosystems.[111] However, a limited field study carried out in the Kingdom of the Netherlands showed that drug manufacture waste residue in surface water, soils, sediments and groundwater was limited.[112] In general, the environmental impact will be different depending on the environmental media and the type of drug or drug manufacture waste involved, as well as the concentration, temperature and presence of oxygen, all of which determine the degradation rates of chemical substances.[113]

In Colombia, as part of a research project known as Goldfish, researchers developed a sensor system for the detection of illicit drug production waste in remote rivers.[114] The system triangulated concentrations of cocaine-related production waste with the speed of the water to establish the locations of clandestine production laboratories.[115] Several European agencies took part in the project and a Croatian university explored the possibility of powering the wireless sensor nodes in rivers by harvesting the energy of the river flow itself.[116]

Monitoring the effects of drug remnants on living organisms and biodiversity

At present, very little is known about the relationship between water pollution and human health. A few European studies have assessed the impact of illicit drug production remnants or waste on living organisms, but most of the results were produced in laboratory settings in which the effects of just one or a handful of micropollutants were examined.[117] Such studies included research on the effects of environmental methamphetamine concentrations on brown trout[118] and a planktonic crustacean,[119] the effects of cocaine concentrations on the skeletal muscle of European eels[120] and the detection of cocaine in freshwater shrimp.[121]

Monitoring of the effects of drug remnants and waste on the food chain

Although illicit drug production/manufacture waste dumped in or near manure storage areas can be absorbed into the agricultural process,[122] available research suggests that no alarming chemical waste residuals are found in crops grown in affected areas. In the Kingdom of the Netherlands in 2015, levels of amphetamine and MDMA in corn harvested in affected fields were found to be considerably higher than the maximum level of MDMA in corn-based fodder that could be fed to cows.[123] Nevertheless, the Netherlands Food and Consumer Product Safety Authority concluded on various occasions that the risks to human and animal health were very low or non-existent.[124]

More recently, research into the impact of methamphetamine manufacture-related waste on the cultivation of corn and onions[125] found that both food crops were unaffected by the synthetic drug manufacture waste.[126]

A risk assessment was also conducted on remnants of amphetamine and methamphetamine in digestate, the residual organic material that remains after anaerobic digestion in biogas plants and that can be used as a fertilizer.[127] The assessment concluded that the indicative risks for soil, groundwater and human health were minimal in the case of a one-off application of digestate containing 1 mg or less of amphetamine and methamphetamine per kg of fresh weight. The values found in samples were between 12 and 769 µg per kg in the case of amphetamine and a single concentration of 3.9 µg per kg in the case of methamphetamine.[128] These results suggest low risks in terms of harmful effects on the food chain, although the sample size was relatively small. For this reason, the Netherlands Food and Consumer Product Safety Authority concluded that further research was needed, in particular to help identify other possible risk factors.[129] One such factor is the cumulative effect on crops and animals: if substances are repeatedly applied, over several years, to the same land, what effect does this have on the risks? Another factor is the uncertainty over the effect of interaction between different chemical substances.

Mitigation and remediation of the environmental impact of drugs

Law enforcement responses

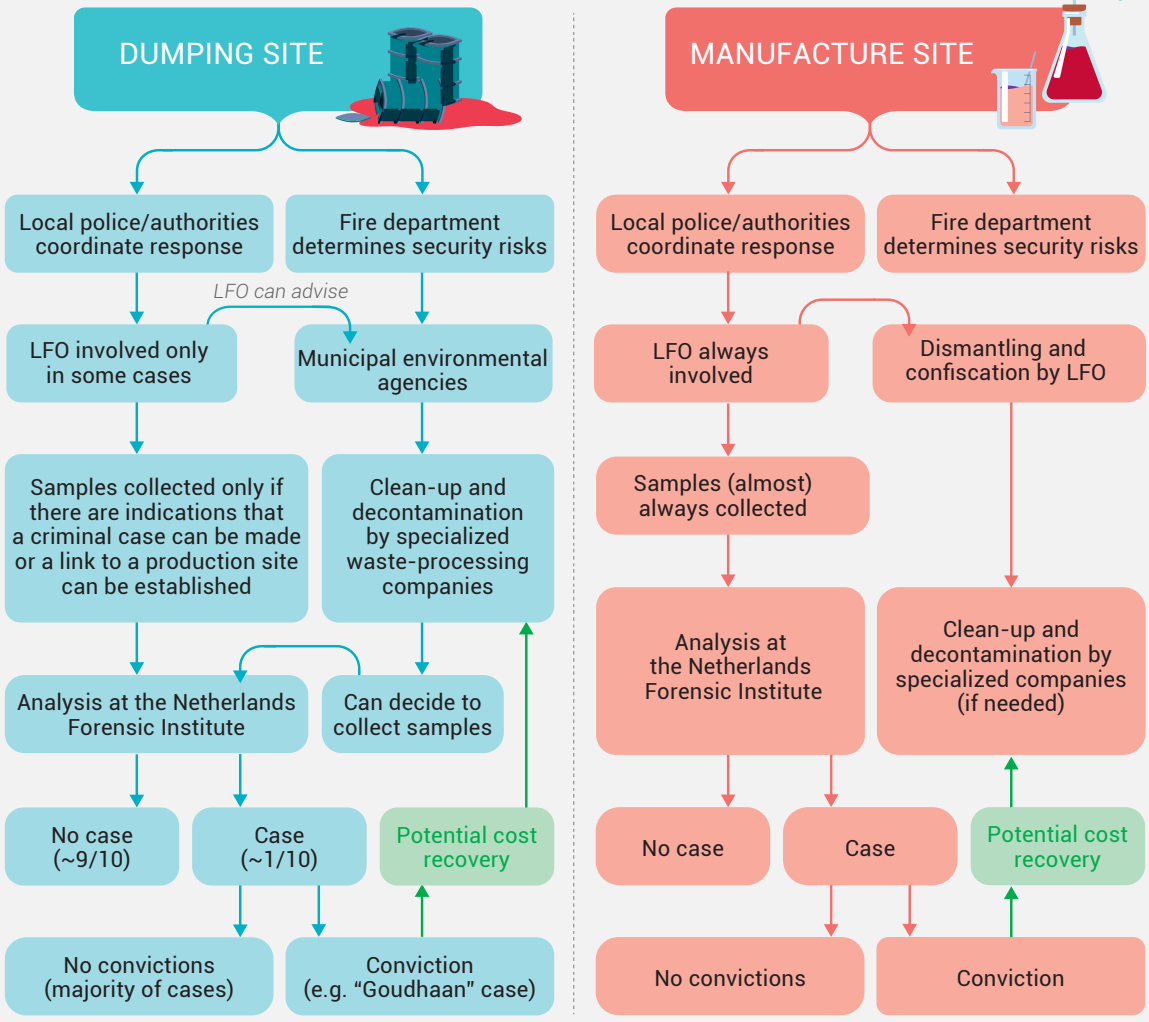
Law enforcement plays an important role in mitigating the risks associated with illicit drug production and waste dumping sites. In Europe, UNODC has been able to collect specific information on the role of national institutions in this area from Albania, Belgium, Germany, Netherlands (Kingdom of the) and Slovakia. Specialized agencies such as the National Facility Dismantling (LFO) in the Kingdom of the Netherlands and the Clan Lab Response Unit (CRU) in Belgium are responsible for the dismantling of production facilities and in some cases for the investigation of drug manufacture waste dumping sites.

Meanwhile, specialized forensic agencies such as the Forensic Science Institute in Germany and the Netherlands Forensic Institute investigate samples collected at production, storage and dumping sites, but they are not generally used for environmental impact analysis.[130] In some countries, such as the Kingdom of the Netherlands, both public and private property owners are ultimately responsible for further remediation, with environmental agencies determining the procedure for public institutions. In Belgium, where land or property owners are not responsible for remediation, the clean-up costs are first paid by the judiciary and may later be reclaimed from criminals.[131] The situation is similar in other countries such as Slovakia, where local government receives funding from the governmental budget to cover clean-up costs.[132]

In Belgium, the dismantling of synthetic drug laboratories and the cleaning of waste sites are also a multi-agency process.[133, 134] Local police initially secure the scene and alert specialized services, including the Federal Judicial Police, the fire brigade, CRU and civil protection services. The Federal Police then takes over the investigation, coordinating with entities such as CRU, the Technical and Scientific Police Laboratory (LTWP), the National Institute for Criminalistics and Criminology (NICC), civil protection services and specialized waste companies. CRU ensures safe access and oversees dismantling, while LTWP and NICC handle sample collection and analysis. Civil protection services or private contractors dismantle laboratories and clean up and transport waste, following instructions from CRU. In smaller cases, CRU may not be needed, with the civil protection service, LTWP and private waste companies handling the situation. Ultimately, property owners (public or private) are responsible for any necessary further remediation of the site. In contrast with the Kingdom of the Netherlands, in Belgium samples are always taken at drug manufacture waste dumping sites, which is more feasible given the much smaller number of sites discovered there each year.[135]

In France, the link between drugs and the environment has received more attention in recent years.[136] The Environment and Public Health Command (CESAN), a new department created in 2023 under the authority of the National Gendarmerie, deals with the environmental impact of drugs.[137] If a clandestine laboratory is discovered, a backtracking investigation is set up by the

Standard procedures at clandestine drug manufacture and waste dumping sites in the Kingdom of the Netherlands



Source: UNODC, based on interviews.

department of the National Mission for the Control of Chemical Precursors (MNCPC) with the aim of tracing the origin of chemical products discovered on-site and, if the investigation is successful, prosecuting the supplier.[138]

In Germany, the police forces of each federal state generally deal with small-scale laboratories, but the Synthetic Drugs Unit of the Federal Criminal Police is often requested to provide support in cases involving larger manufacture sites.[139] German federal authorities become involved in the following three ways: (a) through the precursor monitoring unit, which operates at the national level and includes both criminal and customs investigators; (b) when state criminal police departments or regional police units formally request forensic support at clandestine drug manufacture sites; and (c) through clandestine laboratory-related training activities conducted annually by the Federal Criminal Police.[140] Every time a laboratory is discovered, the chemicals used and, where available, the end product, are analysed, and the manufacture waste is assessed in order to calculate the scale of manufacture for prosecution purposes.[141] Often, the amount of amphetamine or methamphetamine base

found is small, which means that substantial effort is put into determining the scale of production on the basis of the waste encountered. If this leads to convictions, the German authorities also try to recover part of the costs incurred in forensic analysis, waste storage and clean-up operations.

In Slovakia, the National Drug Enforcement Unit is involved in large-scale cases.[142] Equipment and substances are seized and stored, and chemicals are discarded as hazardous waste.[143] The Unit also deals with cases where there is a dumping site directly linked to an ongoing criminal investigation.[144] An isolated dumping case may be dealt with by the recently established Environmental Protection Unit. In both cases, samples can be taken but, especially at the local level, substances are not always identified as precursors of drugs or reported as such at the national level.[145]

In general, it is extremely difficult to link dumping sites to manufacturing locations, even if they are right next to each other.[146] In the Kingdom of the Netherlands, there have only been a handful of cases where criminals have successfully been linked to environmental harm.[147] Several factors explain this, including changes in waste material over time and the fact that manufacturing sites are never consistent enough to produce the same waste from the same synthesis process each time.[148] Research into the pre-precursors and precursors used can sometimes help link waste to specific manufacturing sites or volumes, especially if large amounts of a pre-precursor have been bought by a criminal group.[149] A new multidisciplinary study in the Kingdom of the Netherlands is to investigate over a two-year period how to strengthen forensic analysis of drug manufacture waste dumping sites and go beyond merely identifying the substances encountered.[150]

It is also difficult to prosecute individuals working at production facilities in relation to associated dumping sites if no fingerprints or other forensic evidence are found,[151] making it very challenging to recover costs incurred in cleaning up dumping sites. In cases where criminals can be linked to such sites, they are often low-level criminals or subcontractors with few resources that can be confiscated.[152]

Additional penalties for crimes that affect the environment do not seem to be taken into consideration during the prosecution of drug-related offences in European countries.[153] In some cases, such as in Germany, this could be because any violations of narcotics laws are already punished severely, meaning that any potential additional penalty for crimes that affect the environment would be comparatively low.[154]

Classification of waste samples for forensic and environmental analysis

The research and forensic analysis carried out at drug production/manufacture, storage and dumping sites by or on behalf of European law enforcement agencies normally serve law enforcement purposes. They primarily contribute to the evidence needed to convict criminals and there is no time or capacity to determine environmental risks and impacts.[155]

When it comes to synthetic drug manufacture, waste is often the only substance found. As such, it is not only an important source of evidence but also an important source of information for calculating the potential environmental impact of synthetic drug production.[156] To help classify waste samples, five physicochemical parameters were adopted in a study based on amphetamine synthesis routes used in Netherlands (Kingdom of the) and Poland:[157]

1. **Conductivity**: the measure of a solution's ability to conduct electricity
2. **pH:** measure of the acidity or basicity of aqueous or other liquid solutions
3. **Density:** mass per unit volume
4. **Ionic load:** concentration and variety of dissolved ions (such as calcium, magnesium, chloride and sulphate)
5. **Presence of organic compounds:** substances that contain carbon

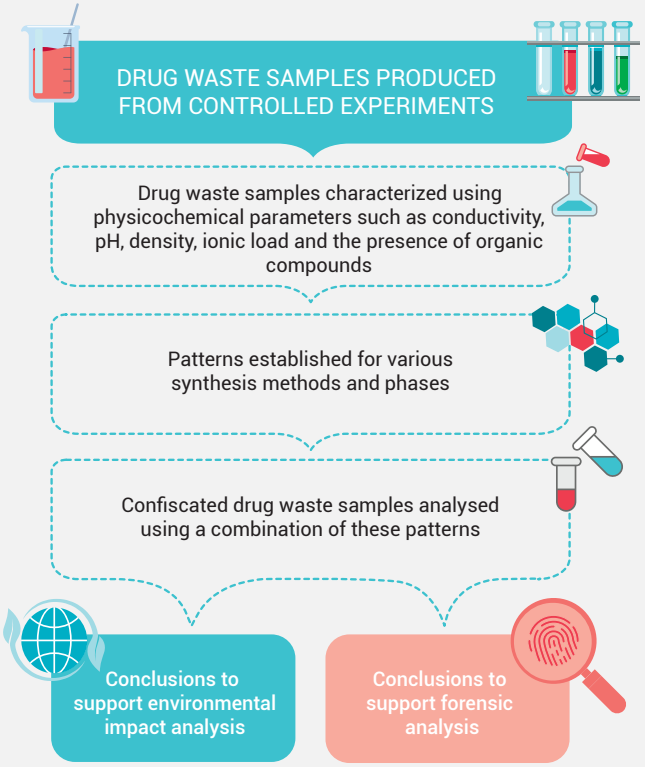
A combination of the above parameters allows patterns to be determined for classifying waste samples. By applying this methodology to samples collected at a clandestine amphetamine laboratory in the Kingdom of the Netherlands, it was possible to differentiate between waste types related to different synthesis processes and reaction steps.[158]

The classification of waste is not just important for law enforcement purposes but also for environmental analysis, particularly as the pH value, ionic load and other parameters can be important indicators of environmental harm.

Subsidies to mitigate the economic cost of clean-up operations

Cleaning up drug manufacture waste can be very expensive, not least when soil needs to be analysed and remediated. In the Kingdom of the Netherlands, there is a provincial-level subsidy scheme for the removal of drug manufacture waste to compensate those affected by the clean-up costs.[159]

Drug manufacture waste classification to support forensic and environmental analysis



Source: UNODC, based on Hauser et al., "Characterisation of aqueous waste produced during the clandestine production of amphetamine following the Leuckart Route utilising solid-phase extraction gas chromatography –mass spectrometry and capillary electrophoresis with contactless conductivity detection", *Drug Testing and Analysis*, vol. 10, No. 9 (September 2018), pp. 1368–82.

Drug waste removal subsidy scheme in the Kingdom of the Netherlands

Since 2021, there has been a provincial-level subsidy scheme in the Kingdom of the Netherlands. The scheme is set to run until the end of 2025 and is intended for individuals and companies that own or have a long-term lease on a location where drug waste has been dumped. Subsidy requests are handled on behalf of the country's 12 provinces by a central executive agency called BIJ12.

The basic principle with drug waste dumping is "the polluter pays", but if it is not possible to track the polluter down, the affected parties, who include private individuals or public organizations, are entitled to a subsidy. Reimbursements vary, with municipalities, provinces and water boards being reimbursed half of the costs, up to €50,000. Any costs exceeding this are reimbursed up to a maximum of €200,000. Private individuals are fully reimbursed for the costs, up to a maximum of €200,000.

In three exceptional cases involving substantial soil pollution and groundwater contamination in the Province of North Brabant (Brabantse Wal (Halsteren), Neerkant (Deurne) and Zundert), the costs far exceeded the ceiling established under the expanded subsidy scheme. The Ministry of Infrastructure and Water Management, in cooperation with the parties involved, is thus financing the costs incurred in these cases to enable speedier remediation. These large dumping sites were also the reason why the lower house of the parliament pressed for a new, more generous scheme.

That new scheme is currently being prepared and will cover mega-dumping sites, so that tailor-made solutions will no longer be necessary. The clean-up costs of dumping sites will also be included in the new regulation.

Source: BIJ12, through an information request; Government of the Kingdom of the Netherlands, "Meer vergoeding voor opruimkosten drugsafvaldumpingen" (21 October 2022).

The average costs of dismantling and cleaning up synthetic drug production, storage and waste dumping sites in Belgium and Netherlands (Kingdom of the) have been estimated at €13,566 and €33,372, respectively.[160] The estimates include costs associated with law enforcement, civil protection and private firms involved in the dismantling, transport, storage and destruction of materials found at production or dumping sites.

In the case of the Kingdom of the Netherlands, a more detailed analysis of the costs involved for the affected land or property owners can be made on the basis of data provided by the executive agency BIJ12. In the period 2021–2024, average clean-up project costs increased, with average costs in 2024 amounting to €27,107. The total funds awarded also increased steadily over that period, to €1,720,651 in 2024, with an average subsidy of €18,304 awarded per project that year. However, these calculations include neither any other direct or indirect costs for society, such as legal, law enforcement or health-related costs, nor any intangible costs for nature or biodiversity.

Wastewater treatment

Once drug residuals are found in wastewater, wastewater treatment is generally quite effective at removing them. However, the removal rate can differ substantially depending on the type of drug involved. For example, the removal

TABLE 7 Provincial subsidy scheme for the removal of drug manufacture waste in the Kingdom of the Netherlands, 2021–2024

Year	Number of subsidies awarded	Total funds awarded	Average per project	Average % financed per project
2021	65 out of 77 (84%)	€ 517 342	€ 7 959	65%
2022	68 out of 73 (93%)	€ 644 184	€ 9 473	65%
2023	105 out of 120 (88%)	€ 1 553 800	€ 14 798	62%
2024	94 out of 99 (95%)	€ 1 720 651	€ 18 304	58%

Source: UNODC, based on data received from the executive agency BIJ12.

TABLE 8 Total costs of clean-up projects in the Kingdom of the Netherlands, 2021–2024

Year	Average cost of rewarded projects	Cheapest project	Most expensive project
2021	€ 17 495	€ 1 249	€ 190 631
2022	€ 18 195	€ 1 761	€ 193 600
2023	€ 25 344	€ 1 921	€ 194 672
2024	€ 27 107	€ 1 176	€ 384 152

Source: UNODC, based on data received from the executive agency BIJ12.

Environmental harm compensation funds

Given the burden on local municipalities in terms of the cleaning costs related to drug laboratories and drug waste dumping sites, various authorities in Belgium have proposed the establishment of a compensation fund based on monetary penalties paid by drug traffickers and perpetrators of other drug-related offences.

Although it is not directly linked to environmental harm, Spain has a similar fund, the Seized Assets Fund, which was established in 2003 for assets seized pursuant to a final court order in cases involving drug trafficking and related crimes. In 2024, the fund distributed around €20 million, which was divided equally between demand and supply reduction projects. The activities supported include crime prevention, investigation, prosecution, drug addiction prevention and treatment and international cooperation. Eligible beneficiaries include regional and local governments, non-profit organizations, law enforcement agencies, customs and tax authorities, the Special Prosecutor's Office for Drug Trafficking, the National Drug Plan, other State agencies, international organizations and foreign Governments.

Source: Interview #9, Belgium, law enforcement expert, December 2024.

efficiency rate of methamphetamine in wastewater treatment plants in Spain varies between 44 and 99 per cent,[161] while that of amphetamine varies between 52 and 99 per cent in Spain and 87 and 99 per cent in the Kingdom of the Netherlands.[162] In the case of MDMA, however, the removal rate is considerably lower, at between 0 and 36 per cent, according to data from the Kingdom of the Netherlands combined with a global study.[163]

The removal of substances from water may create another environmental issue, as illicit drug-related substances can still be present in sludge, the residue that accumulates in treatment plants. A study in Slovakia analysed the effect of thermal treatment on sludge containing pharmaceuticals and drugs, concluding that such treatment is effective at removing those substances even at lower temperatures.[164]

The European Union has adopted a revised directive on urban wastewater treatment, Directive (EU) 2024/3019, which establishes and updates rules on urban wastewater management.[165] The directive is aimed at reducing pollution from micropollutants, for example, by setting stricter standards for wastewater treatment, such as the requirement for a fourth treatment stage to remove micropollutants, which include illicit drug remnants.[166]

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REGIONAL GROUPINGS

The World Drug Report uses a number of regional and subregional designations. These are not official designations, and are defined as follows:

AFRICA

- East Africa: Burundi, Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Mauritius, Rwanda, Seychelles, Somalia, South Sudan, Uganda, United Republic of Tanzania and Mayotte
- North Africa: Algeria, Egypt, Libya, Morocco, Sudan and Tunisia
- Southern Africa: Angola, Botswana, Eswatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia, Zimbabwe and Reunion
- West and Central Africa: Benin, Burkina Faso, Cabo Verde, Cameroon, Central African Republic, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Sao Tome and Principe, Senegal, Sierra Leone, Togo and Saint Helena

AMERICAS

- Caribbean: Antigua and Barbuda, Bahamas (The), Barbados, Cuba, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, Anguilla, Aruba, Bonaire, Netherlands (Kingdom of the), British Virgin Islands, Cayman Islands, Curaçao, Guadeloupe, Martinique, Montserrat, Puerto Rico, Saba, Netherlands (Kingdom of the), Sint Eustatius, Netherlands (Kingdom of the), Sint Maarten, Turks and Caicos Islands and United States Virgin Islands
- Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama
- North America: Canada, Mexico, United States of America, Bermuda, Greenland and Saint-Pierre and Miquelon
- South America: Argentina, Bolivia (Plurinational State of), Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela (Bolivarian Republic of) and Falkland Islands (Malvinas)

ASIA

- Central Asia and Transcaucasia: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan
- East and South-East Asia: Brunei Darussalam, Cambodia, China, Democratic People's Republic of Korea, Indonesia, Japan, Lao People's Democratic Republic, Malaysia, Mongolia, Myanmar, Philippines, Republic of Korea, Singapore, Thailand, Timor-Leste, Viet Nam, Hong Kong, China, Macao, China, and Taiwan Province of China
- Near and Middle East: Bahrain, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, United Arab Emirates, Yemen and State of Palestine
- South Asia: Bangladesh, Bhutan, India, Maldives, Nepal and Sri Lanka
- South-West Asia: Afghanistan, Iran (Islamic Republic of) and Pakistan

EUROPE

- Eastern Europe: Belarus, Republic of Moldova, Russian Federation and Ukraine
- South-Eastern Europe: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, North Macedonia, Romania, Serbia, Türkiye and Kosovo[1]
- Western and Central Europe: Andorra, Austria, Belgium, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, Netherlands (Kingdom of the), Norway, Poland, Portugal, San Marino, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom of Great Britain and Northern Ireland, Faroe Islands, Gibraltar and Holy See

OCEANIA

- Australia and New Zealand: Australia and New Zealand
- Polynesia: Cook Islands, Niue, Samoa, Tonga, Tuvalu, French Polynesia, Tokelau and Wallis and Futuna Islands
- Melanesia: Fiji, Papua New Guinea, Solomon Islands, Vanuatu and New Caledonia
- Micronesia: Kiribati, Marshall Islands, Micronesia (Federated States of), Nauru, Palau, Guam and Northern Mariana Islands

1 References to Kosovo shall be understood to be in the context of Security Council resolution 1244 (1999).

GLOSSARY

amphetamine-type stimulants — a group of substances composed of synthetic stimulants controlled under the Convention on Psychotropic Substances of 1971 and from the group of substances called amphetamines, which includes amphetamine, methamphetamine, methcathinone and the "ecstasy"-group substances (3,4-methylenedioxy-methamphetamine (MDMA) and its analogues).

amphetamines — a group of amphetamine-type stimulants that includes amphetamine and methamphetamine.

annual prevalence — the total number of people of a given age range who have used a given drug at least once in the past year, divided by the number of people of the given age range, and expressed as a percentage.

coca paste (or coca base) — an extract of the leaves of the coca bush. Purification of coca paste yields cocaine (base and hydrochloride).

"crack" cocaine — cocaine base obtained from cocaine hydrochloride through conversion processes to make it suitable for smoking.

cocaine salt — cocaine hydrochloride.

drug use — use of controlled psychoactive substances for non-medical and non-scientific purposes, unless otherwise specified.

fentanyls — fentanyl and its analogues.

new psychoactive substances — substances of abuse, either in a pure form or a preparation, that are not controlled under the Single Convention on Narcotic Drugs of 1961 or the 1971 Convention, but that may pose a public health threat. In this context, the term "new" does not necessarily refer to new inventions but to substances that have recently become available.

opiates — a subset of opioids comprising the various products derived from the opium poppy plant, including opium, morphine and heroin.

opioids — a generic term that refers both to opiates and their synthetic analogues (mainly prescription or pharmaceutical opioids) and compounds synthesized in the body.

problem drug users — people who engage in the high-risk consumption of drugs. For example, people who inject drugs, people who use drugs on a daily basis and/or people diagnosed with drug use disorders (harmful use or drug dependence), based on clinical criteria as contained in the *Diagnostic and Statistical Manual of Mental Disorders* (fifth edition) of the American Psychiatric Association, or the *International Classification of Diseases and Related Health Problems* (tenth revision) of WHO.

people who suffer from drug use disorders/people with drug use disorders — a subset of people who use drugs. Harmful use of substances and dependence are features of drug use disorders. People with drug use disorders need treatment, health and social care and rehabilitation.

harmful use of substances — defined in the *International Statistical Classification of Diseases and Related Health Problems* (tenth revision) as a pattern of use that causes damage to physical or mental health.

dependence — defined in the *International Statistical Classification of Diseases and Related Health Problems* (tenth revision) as a cluster of physiological, behavioural and cognitive phenomena that develop after repeated substance use and that typically include a strong desire to take the drug, difficulties in controlling its use, persisting in its use despite harmful consequences, a higher priority given to drug use than to other activities and obligations, increased tolerance, and sometimes a physical withdrawal state.

substance or drug use disorders — referred to in the *Diagnostic and Statistical Manual of Mental Disorders* (fifth edition) as patterns of symptoms resulting from the repeated use of a substance despite experiencing problems or impairment in daily life as a result of using substances. Depending on the number of symptoms identified, substance use disorder may be mild, moderate or severe.

prevention of drug use and treatment of drug use disorders — the aim of "prevention of drug use" is to prevent or delay the initiation of drug use, as well as the transition to drug use disorders. Once a person develops a drug use disorder, treatment, care and rehabilitation are needed.

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UNODC Research

A global reference on drug markets, trends and policy developments, the *World Drug Report* offers a wealth of data and analysis and in 2025 comprises several elements tailored to different audiences. The web-based **Drug market patterns and trends** contains the latest analysis of global, regional and subregional estimates of and trends in drug demand and supply in a user-friendly, interactive format supported by graphs, infographics and maps. **Key findings** provides an overview of selected findings from the analysis presented in **Drug market patterns and trends** and the thematic chapters of **Contemporary issues on drugs**, while **Special points of interest** offers a framework for the main takeaways and policy implications that can be drawn from those findings.

As well as providing a comprehensive overview of global drug trends, the *World Drug Report 2025* features a focused analysis of the following drug-related topics in the three thematic chapters:

» **The nexus between drugs and organized crime.** This chapter explores the relevance of drug trafficking for organized criminal groups and the different organizational structures of groups that define their strengths and weaknesses. It calls for an end to indiscriminate law enforcement operations and for investment in more effective law enforcement responses to drug trafficking that are tailored to the specific aims and structures of criminal groups.

» **The environmental consequences of illicit drug markets.** This chapter addresses not only deforestation and land degradation linked to drug crop cultivation, but also the dumping of toxic waste, water pollution and chemical contamination resulting from synthetic drug production and trafficking, with a focus on Europe.

» **The complex and layered impacts of drug use.** This chapter looks at the effects of drug use on individual health and family and community well-being, and emphasizes the importance of social and health-oriented interventions that can prevent, interrupt or mitigate pathways of harm.

The *World Drug Report 2025* is aimed not only at fostering greater international cooperation to counter the impact of the world drug problem on health, governance and security, but also at assisting Member States in anticipating and addressing threats posed by drug markets and mitigating their consequences.

The *World Drug Report 2025* is published on the UNODC website:
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