Methodology

Considerable efforts have been made over the years to improve the estimates presented in the *World Drug Report,* which rely, to a large extent, on information submitted by Member States through the Annual Report Questionnaire (ARQ). Nonetheless, challenges remain in making such estimates because of data gaps and the varying quality of the available data. One major problem is the irregularity and incompleteness in ARQ reporting by Member States. Irregular reporting may result in absence of data for some years, and may influence the reported trend in a given year. Secondly, submitted questionnaires are not always complete or comprehensive, and thirdly, much of the data collected are subject to limitations and biases. These issues affect the reliability, quality and comparability of the information received.

Sources of information

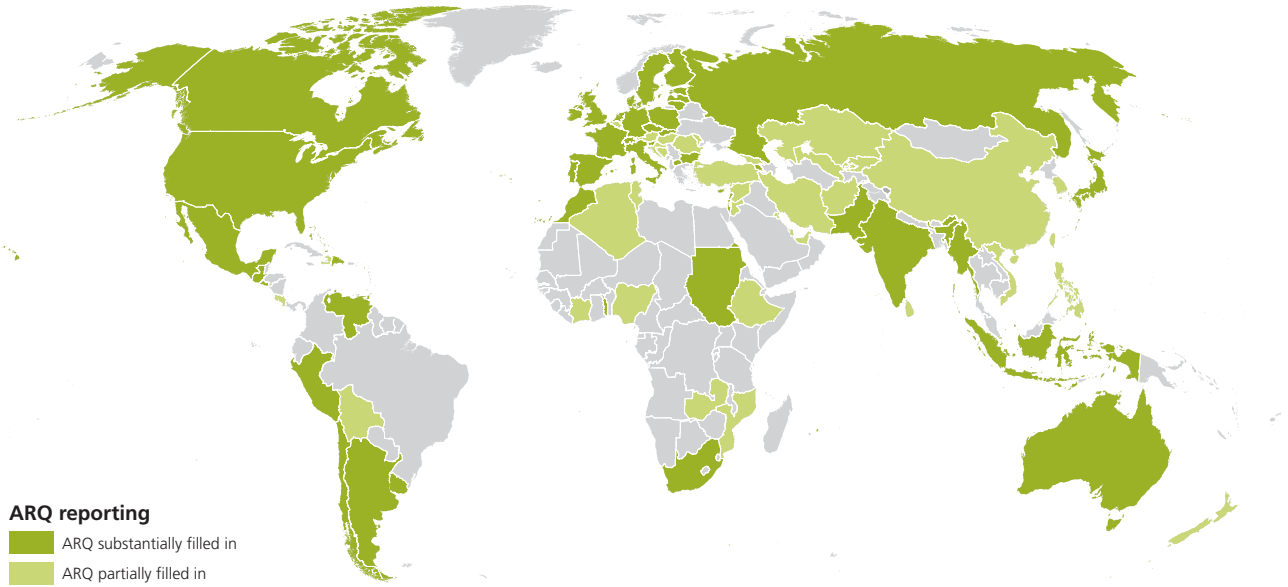
Under the International Drug Conventions, Member States are formally required to provide national drug control-related information annually to the 'Secretary-General' of the United Nations (that is, to UNODC). The Commission on Narcotic Drugs, the UNODC governing body on illicit drug issues, developed the Annual Reports Questionnaire (ARQ) to collect this information. The 2011 *World Drug Report* is based primarily on data obtained from the ARQs submitted by Governments over the period March 2010 to December 2010. The data collected during this period normally refer to the drug situation in 2009. UNODC distributed the questionnaire to 194 countries, as well as 15 territories, and received 107 replies to its questionnaire on Drug Abuse (Part II) and 106 replies to its questionnaire on Illicit Supply of Drugs (Part III). The best coverage was from countries in Europe (80% of countries filled in Part II and 88% filled in Part III), Asia (64% of countries filled in Part II and 62% Part III) and the Americas (59% of countries filled in Part II and 53% Part III). In the case of Africa, 27% of countries submitted Part II and 25% Part III, and for Oceania, 12% of countries submitted Part II and Part III.

In general, the quantity of information provided on illicit drug supply is significantly better than data provided on drug use. While 90% of the responses to Part III of the ARQ were 'substantially' completed, this was true for just 53% of the Part II. (ARQs which were more than 50% completed were classified as having been 'substantially filled in'; less than 50% completion was classified as 'partially filled in'). In order to analyse the extent to which Member States provided information, a number of key questions in the ARQs were identified:

- For Part II, Drug Abuse, the key questions referred to: trends in drug use (78% of the countries returning the ARQ), lifetime prevalence among the general population (54%), youth prevalence (54%), treatment (68%), prevalence of Hepatitis C (47%), HIV (48%) and Hepatitis B (41%) among injecting drug users, and drug-related mortality (34%).
- For Part III, the Supply of Drugs, this included the questions on: quantities of illicit drugs seized (95% of the countries returning the ARQ), trafficking (origin, routes and destination) (80%), prices and purity (85%), and drug-related arrests (91%).

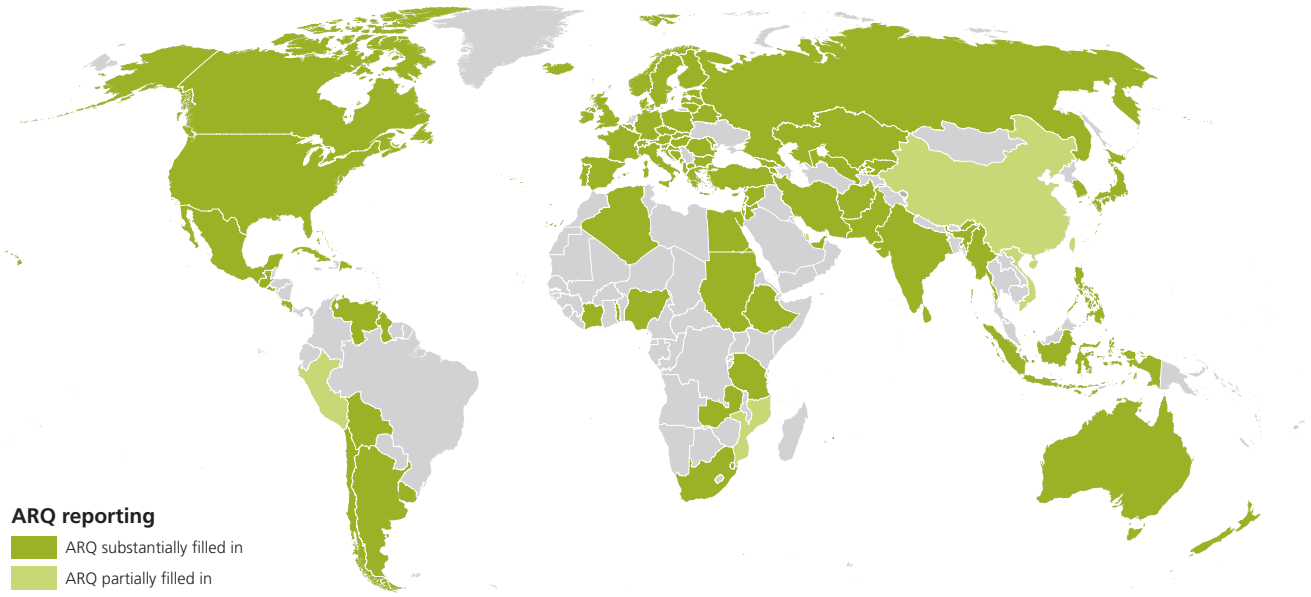
While the ARQ information forms the basis for the estimates and trend analysis provided in the *World Drug Report*, often, this is not sufficient to provide a comprehensive picture of the world's illicit drug markets. When necessary and where available, ARQ data are supplemented with data from other sources. As in previous years, seizure data was complemented primarily with data and reports from international organizations such as INTERPOL, the World Customs Organization, Europol, the Organization of American States /Inter-American Drug Abuse Control Commission (CICAD) as well as data provided by the Heads of National Law Enforcement Agencies at their regional meetings, and UNODC's 'Drug Use Information Network for Asia and the Pacific' (DAINAP). In addition, Government reports and online resources were used. Other sources included data published by the United States Department of State's Bureau for International Narcotics and Law Enforcement Affairs in its International Narcotics Control Strategy Report. Price and purity data for Europe was complemented with data from the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) and Europol, whereas precursor data are from the International Narcotics Control Board. Demand-related information was obtained through a number of additional sources, including the drug control agencies participating in the DAINAP network, as well as various national and regional epidemiological

Member states that provided annual reports questionnaire drug demand data for 2009



Note: 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 Controlin Jammu and Kashmir agreed upon by India and Pakistan.The final status of Jammu and Kashmir has not yet beenagreed upon by the parties.

Member states that provided annual reports questionnaire drug supply data for 2009



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

networks such as EMCDDA and CICAD. National government reports and scientific literature were also used.

Data on drug consumption

Overview

UNODC estimates of the extent of illicit drug use in the world have been published periodically since 1997. Assessing the extent of drug use (the number of drug users) is a particularly difficult undertaking because it involves measuring the size of a 'hidden' population. Margins of error are considerable, and tend to increase as the scale of estimation is raised, from local to national, regional and global levels. Regional and global estimates are reported as ranges to reflect the information gaps. The level of confidence expressed in the estimates varies across regions and drug types.

A global estimate of the level of use of a specific drug involves the following steps:

1. Identification and analysis of appropriate sources (starting from the ARQ);
2. Identification of key benchmark figures for the level of drug use in all countries where data are available (annual prevalence of drug use among the general population aged 15-64) which then serve as 'anchor points' for subsequent calculations;
3. 'Standardization' of existing data if reported with a different reference population than the one used for the *World Drug Report* (for example, from age group 12 and above to a standard age group of 15-64) ;
4. Adjustments of national indicators to estimate an annual prevalence rate if such a rate is not available (for example, by using the lifetime prevalence or current use rates; or lifetime or annual prevalence rates among the student population). This includes the identification of adjustment factors based on information from neighbouring countries with similar cultural, social and economic situations where applicable;
5. Imputation for countries where data is not available, based on data from countries in the same subregion. Ranges are calculated by considering the 10th and 90th percentile of the subregional distribution;
6. Extrapolation of available results for a subregion were calculated only for subregions where prevalence estimates for at least two countries covering at least 20% of the population were available. If, due to a lack of data, subregional estimates were not extrapolated, a regional calculation was extrapolated based on the 10th and 90th percentile of the distribution of the data available from countries in the region.
7. Aggregation of subregional estimates rolled-up into regional results to arrive at global estimates.

For countries that did not submit information through the ARQ, or in cases where the data were older than 10 years, other sources were identified, where available. In nearly all cases, these were government sources. Many estimates needed to be adjusted to improve comparability (see below).

In cases of estimates referring to previous years, the prevalence rates were left unchanged and applied to new population estimates for the year 2009. Currently, only two countries measure drug prevalence among the general population on an annual basis. The remaining countries that regularly measure it - typically the more economically developed - do so usually every three to five years. Therefore, caution should be used when interpreting any change in global prevalence figures, as changes may in part reflect newer reports from countries or the exclusion of older reports, rather than actual changes in use at the global level.

Detailed information is available from countries in North America, a large number of countries in Europe, a number of countries in South America, the two large countries in Oceania and a limited number of countries in Asia and Africa. One key problem in national data is the level of accuracy, which varies strongly from country to country. Not all estimates are based on sound epidemiological surveys. In some cases, the estimates simply reflect the aggregate number of drug users found in drug registries, which cover only a fraction of the total drug using population in a country. Even in cases where detailed information is available, there is often considerable divergence in definitions used, such as chronic or regular users; registry data (people in contact with the treatment system or the judicial system) versus survey data (usually extrapolation of results obtained through interviews of a selected sample); general population versus specific surveys of groups in terms of age (such as school surveys), special settings (such as hospitals or prisons), et cetera.

To reduce the error margins that arise from simply aggregating such diverse estimates, an attempt has been made to standardize - as a far as possible - the heterogeneous data set. All available estimates were transformed into one single indicator – annual prevalence among the general population aged 15 to 64 - using transformation ratios derived from analysis of the situation in neighbouring countries, and if such data were not available, using global average estimates. The basic assumption is that though the level of drug use differs between countries, there are general patterns (for example, lifetime prevalence is higher than annual prevalence; young people consume more drugs than older people; males consume more drugs than females; people in contact

with the criminal justice system show higher prevalence rates than the general population, et cetera) which apply to most countries. It is also assumed that the difference between lifetime prevalence and annual prevalence among the general population or between lifetime prevalence among young people and annual prevalence among the general population, except for emerging drug trends, do not vary greatly among countries with similar social, cultural and economic situations.

Indicators used

The most widely used indicator at the global level is the annual prevalence rate: the number of people who have consumed an illicit drug at least once in the last twelve months prior to the study. Annual prevalence has been adopted by UNODC as one of key indicators to measure the extent of drug use. It is also part of the Lisbon Consensus on core epidemiological demand indicators which has been endorsed by the Commission on Narcotic Drugs. The key indicators are:

1. Drug consumption among the general population (prevalence and incidence);
2. Drug consumption among the youth population (prevalence and incidence);
3. High-risk drug use (number of injecting drug users and the proportion engaged in high-risk behaviour, number of daily drug users);
4. Utilization of services for drug problems;
5. Drug-related morbidity (prevalence of HIV, hepatitis B virus and hepatitis C virus among illicit drug consumers);
6. Drug-related mortality (deaths directly attributable to drug consumption).

Efforts have been made to present the drug situation from countries and regions based on these key epidemiological indicators.

The use of annual prevalence is a compromise between lifetime prevalence data (drug use at least once in a lifetime) and data on current use (drug use at least once over the past month). The annual prevalence rate is usually shown as a percentage of the youth and adult population. The definitions of the age groups vary, however, from country to country. Given a highly skewed distribution of drug use among the different age cohorts in most countries, differences in the age groups can lead to substantially diverging results.

Applying different methodologies may also yield diverging results for the same country. In such cases, the sources were analysed in-depth and priority was given to the most recent data and to the methodological approaches that are considered to produce the best results. For example, it is generally accepted that nationally representative household surveys are reasonably good approaches to estimating cannabis, ATS or cocaine use among the general population, at least in countries where there are no adverse consequences for admitting illicit drug use. Thus, household survey results were usually given priority over other sources of prevalence estimates.

When it comes to heroin use (or drug injecting), or problematic use of cocaine and ATS, annual prevalence data derived from national household surveys tend to grossly under-estimate such use, because heroin or other problem drug users often belong to marginalized or less socially integrated groups, and may not be identified as living in a 'typical' household (they may be on the streets, homeless or institutionalized). Therefore, a number of 'indirect' methods have been developed to provide estimates for this group of drug users, including benchmark and multiplier methods (benchmark data may include treatment demand, police registration or arrest data, data on HIV infections, other services utilization by problem drug users or mortality data), capture-recapture methods and multivariate indicators. In countries where there was evidence that the primary 'problem drug' was opiates, and an indirect estimate existed for 'problem drug use' or injecting drug use, this was preferred over household survey estimates of heroin use.

For other drug types, priority was given to annual prevalence data found by means of household surveys. In order to generate comparable results for all countries, wherever needed, the reported data was extrapolated to annual prevalence rates and/or adjusted for the preferred age group of 15-64 for the general population.

Extrapolation methods used

Adjustment for differences in age groups

Member States are increasingly using the 15-64 age group, though other groups are used as well. Where the age groups reported by Member States did not differ significantly from 15-64, they were presented as reported, and the age group specified. Where studies were based on significantly different age groups, results were typically adjusted. A number of countries reported prevalence rates for the age groups 15+ or 18+. In these cases, it was generally assumed that there was no significant drug use above the age of 64. The number of drug users based on the population age 15+ (or age 18+) was thus shown as a proportion of the population aged 15-64.

Extrapolation of results from lifetime prevalence to annual prevalence

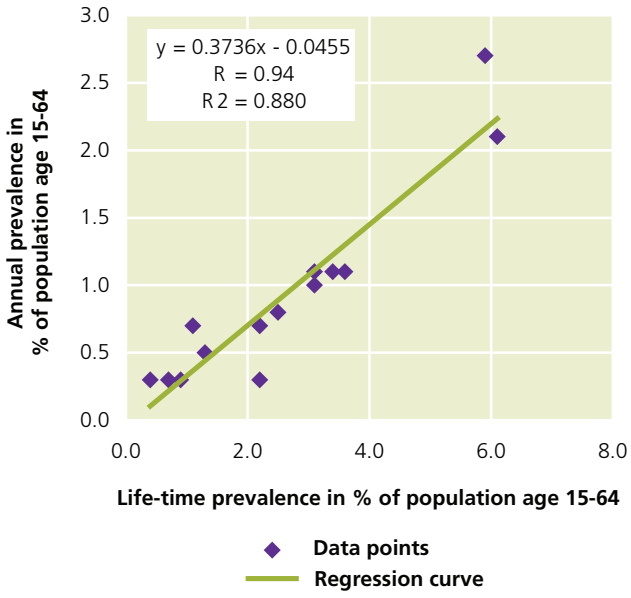
Some countries have conducted surveys in recent years without asking the question whether drug consumption

took place over the last year. In such cases, results were extrapolated to reach annual prevalence estimates. For example, country X in West and Central Europe reported a lifetime prevalence of cocaine use of 2%. Taking data for lifetime and annual prevalence of cocaine use in countries of West and Central Europe, it can be shown that there is a strong positive correlation between the two measures (correlation coefficient R = 0.94); that is, the higher the lifetime prevalence, the higher the annual prevalence and vice versa. Based on the resulting regression curve (y = annual prevalence and x = lifetime prevalence) it can be estimated that a country in West and Central European with a lifetime prevalence of 2% is likely to have an annual prevalence of around 0.7% (see figure). Almost the same result is obtained by calculating the ratio of the unweighted annual prevalence rates of the West and Central European countries and the unweighted lifetime prevalence rate (0.93/2.61 = 0.356) and multiplying this ratio with the lifetime prevalence of the country concerned (2% * 0.356 = 0.7%).

A similar approach was used to calculate the overall ratio by averaging the annual/lifetime ratios, calculated for each country. Multiplying the resulting average ratio (0.334) with the lifetime prevalence of the country concerned provides the estimate for the annual prevalence (0.387 * 2% = 0.8%). There is a close correlation observed between lifetime and annual prevalence (and an even stronger correlation between annual prevalence and monthly prevalence). Solid results (showing small potential errors) can only be expected from extrapolations done for a country in the same region. If instead of using the West and Central European average (0.387), the ratio found in the USA was used (0.17), the estimate for a country with a lifetime prevalence of cocaine use of 2% would decline to 0.3% (2% * 0.17). Such an estimate is likely to be correct for a country with a drug history similar to the USA, which has had a cocaine problem for more than two decades, as opposed to West and Central Europe, where the cocaine problem is largely a phenomenon of the last decade. Therefore, data from countries in the same subregion with similar patterns in drug use were used, wherever possible, for extrapolation purposes.

Annual and lifetime prevalence rates of cocaine use in West and Central Europe

Sources: UNODC, Annual Reports Questionnaire Data / EMCDDA, Annual Report.



Both approaches—the regression model and the ratio model—were used to determine upper and lower uncertainty range estimates calculated at a 90% confidence interval among those aged 15-64 years in the given country. The greater the range, the larger the level of uncertainty around the estimates. The range for each country is reported in the statistical annex, where available.

Extrapolations based on school surveys

Analysis of countries which have conducted both school surveys and national household surveys shows that there is, in general, a positive correlation between the two variables, particularly for cannabis, ATS and cocaine. The correlation, however, is weaker than that of lifetime and annual prevalence or current use and annual prevalence among the general population. But it is stronger than the correlation between opiate use and injecting drug use-related HIV cases, and between treatment and drug use.

These extrapolations were conducted by using the ratios between school surveys and household surveys of countries in the same region or with similar social structure where applicable. As was the case with extrapolation of results from lifetime prevalence to annual prevalence, two approaches were taken: a) the unweighted average of the ratios between school and household surveys in the comparison countries with an upper and lower uncertainty range estimate calculated at a 90% confidence interval; and b) a regression-based extrapolation, using the relationships between estimates from the other countries to predict the estimate in the country concerned, with an upper and lower uncertainty range estimate calculated at a 90% confidence interval. The final uncertainty range and best estimate are calculated using both models, where applicable.

Extrapolations based on treatment data

For a number of developing countries, the only drug use-related data available was treatment demand. In such cases, other countries in the region with a similar socio-economic structure were identified, which reported annual prevalence and treatment data. A ratio of people treated per 1,000 drug users was calculated for each country. The results from different countries were then

averaged and the resulting ratio was used to extrapolate the likely number of drug users from the number of people in treatment.

Making regional and global estimates of the number of people who use drugs and the health consequences

For this purpose, the estimated prevalence rates of countries were applied to the population aged 15-64, as provided by the United Nations Population Division for the year 2009.

Ranges have been produced to reflect the considerable uncertainty that arises when data are either extrapolated or imputed. Ranges (not absolutes) are provided for estimated numbers and prevalence rates in the Report. Larger ranges are reported for subregions and regions with less certainty about the likely levels of drug use – in other words, those regions for which fewer direct estimates are available, for a comparatively smaller proportion of the region's population.

Countries with one published estimate (typically those countries with a representative household survey, or an indirect prevalence estimate that did not report ranges) did not have uncertainty estimated. This estimate is reported as the 'best estimate'.

To account for populations in countries with no published estimate, the 10th and 90th percentile in the range of direct estimates was used to produce a lower and upper estimate. For example, there are three countries in the North Africa subregion with past year prevalence estimates for cannabis use: Algeria (a range from 5.2 – 6.4), Egypt (2.9 – 9.6) and Morocco (4.2, a point estimate). These are extrapolated to the population of the remaining three countries without prevalence data, namely the Libyan Arab Jamahiriya, Sudan and Tunisia. The 10th percentile of the lower bound of the uncertainty range (5,2, 2.9, and 4.2) is 3.2 and the 90th percentile of the upper bound (6.4, 9.6, and 4.2) is 8.9. The 3.2 and 8.9 figures are applied to the population of the remaining three countries without prevalence data for a subregional total lower and upper estimate.

In some cases, not all of a region's subregions had estimates due to a lack of country level data. For example, past year amphetamines-group prevalence was calculated for East and South-East Asia and the Near and Middle East/South West Asia, however the remaining subregions – South Asia and Central Asia – had no estimates. To calculate an overall Asia lower and upper estimate for populations in subregions with no published estimate, all of the countries throughout the region were considered using the 10th and 90th percentile of the regional distribution. These results were then combined with those subregions where an estimate was possible. One exception was South Asia's subregional opiate and cannabis estimates. In this case, India's population accounts for 85% of the six countries in the subregion, but reliable estimates of drug use for India were not available. Instead of using all prevalence estimates for Asia (that is, estimates from the Near and Middle East to East Asia) to determine India's contribution to the subregional uncertainty, it was determined that India's contribution was best reflected by its neighboring countries.

This produces conservative (wide) intervals for subregions where there is geographic variation and/or variance in existing country-level estimates; but it also reduces the likelihood that skewed estimates will have a dramatic effect on regional and global figures (since these would most likely fall outside the 10th and 90th percentile).

Estimates of the total number of people who used illicit drugs at least once in the past year

This year's Report used the same approach as last year. Two ranges were produced, and the lowest and highest estimate of each the approaches were taken to estimate the lower and upper ranges, respectively, of the total illicit drug using population. This estimate is obviously tentative given the limited number of countries upon which the data informing the two approaches were based. The two approaches were as follows:

Approach 1.

The global estimates of the number of people using each of the five drug groups in the past year were added up. Taking into account that people use more than one drug type and that these five populations overlap, the total was adjusted downward. The size of this adjustment was made based upon household surveys conducted in the USA, Canada, Australia, the United Kingdom, Italy, Brazil, Mexico, Germany, Spain, Argentina, Chile, the Plurinational State of Bolivia, Peru, Indonesia and the Philippines, which assessed all five drug types, and reported an estimate of total illicit drug use. Across these studies, the extent to which adding each population of users overestimated the total population was a median value of 126%. The summed total was therefore divided by 1.26.

Approach 2.

This approach was based on the average proportion of the total drug using population that comprises cannabis users. The average proportion was obtained from household surveys conducted in the same countries as for Approach 1 Across all of these studies, the median proportion of total drug users that comprised cannabis users was 75%. The range of cannabis users at the global level was therefore divided by 0.75.

Relative risk coefficient					
	Treatment index	IDU	Toxicity	Deaths index	Relative risk coefficient
		Index	Index		(average treatment, IDU, toxicity, death)
Opiates	100	100	100	100	100
Cocaine	85.3	47.8	88	18.5	59.9
Amphetamines	20.1	59.5	32	6.8	29.6
Ecstasy	3.8	6.1	20.7	1	7.9
Cannabis	9	0	1.5	0.6	2.8

Estimates of the number of 'problem drug users'

It is useful to make estimates of the number of drug users whose use is particularly problematic as this subgroup of drug users is most likely to come to the attention of health and law enforcement. Moreover, this subgroup's drug use has been estimated to cause the main public health and public order burden.

The number of problem drug users is typically estimated with the number of dependent drug users. Sometimes, an alternative approach is used. The EMCDDA uses 'injecting or long duration use of opioids, amphetamines or cocaine' to guide country-level indirect prevalence estimation studies of problem drug use.

In this Report, as in previous years, each of the five range estimates of the number of people using each of the five drug groups was converted into a 'heroin user equivalent'. This was calculated through the use of 'relative risk coefficients' (see table) derived from the UNODC Harm Index. This method enables the aggregation of results from different drugs into one reference drug

A lower range was calculated by summing each of the five lower range estimates; the upper end of the range was calculated by summing the upper range of the five estimates.

To obtain an estimate of the number of 'problem drug users', these totals were multiplied by the proportion of past year heroin users in the United States National Survey on Drug Use and Health (range 53-68% over the past six years of this survey). Hence, The LOW estimate of is the lower proportion (53%) multiplied by the lower estimated size of the heroin use equivalent population (28.6 million heroin user equivalents). The HIGH estimate is the higher proportion (68%) multiplied by the higher estimated size of the heroin use equivalent population (57.5 million heroin user equivalents). This gives a range of 15 to 39 million problem drug users globally.

Estimates of the prevalence of hepatitis C virus among injecting drug users

The prevalence of hepatitis C among injecting drug users is reported directly by Member States. The number of injecting drug users is obtained from the Reference Group to the UN on HIV and Injecting Drug Use[1] (preferred source), or otherwise as reported via the ARQ. To obtain an estimate of the prevalence at the regional and global level, country-level rates were weighted by the number of injecting drug users.

Estimates of the number of drug-related deaths

Drug-related deaths include those directly or indirectly caused by the intake of illicit drugs, but it may also include deaths where the use of illicit drugs was a contributory cause, including cases where drug use was involved in the circumstances of the deaths (for example, violence and traffic accidents). Member States report on drug-related deaths according to their own definitions and therefore care should be taken in making country comparisons.

The total number of drug-related deaths reported by Member States were aggregated at the regional level. To account for non-responding countries, an upper and lower estimate of the number of deaths was made using the 10th and 90th percentiles of the mortality rates for countries that did report within the same region. In North America, all countries reported and therefore, no range was given. In Oceania, only Australia reported on the number of deaths, and therefore, no variation in mortality rates across the region could be determined. Because of the lack of reported information on drug-related deaths in Africa, an alternative source was used.[2] The global estimate of the number of drug-related deaths is the sum of the regional estimates. The overall estimated number of deaths for a region was presented as a range to account for uncertainty, and also presented as a rate per 1 million population aged 15-64 to allow for some degree of comparison across regions.

1 Mathers BM, Degenhardt L, Phillips B, *et al.* (November 2008). "Global epidemiology of injecting drug use and HIV among people who inject drugs: a systematic review". *Lancet* 372 (9651): 1733–45

2 Degenhardt L, Hall W, Warner-Smith M, Lynskey M. Chapter 13: Illicit drug use. In: Ezzati M, Lopez A, Rodgers A, Murray CJL, eds. Comparative quantification of health risks: global and regional burden of disease attributable to selected major risk factors. Geneva, World Health Organization, 2003.

Drug cultivation, production and manufacture

Data on cultivation of opium poppy and coca bush and production of opium and coca leaf for the main producing countries (Afghanistan, Myanmar and the Lao People's Democratic Republic for opium and Colombia, Peru and the Plurinational State of Bolivia for coca) are mainly derived from national monitoring systems supported by UNODC in the framework of its Global Illicit Crop Monitoring Programme (ICMP). Estimates of cannabis cultivation in 2009 and 2010 in Afghanistan, as well as cannabis cultivation in 2003, 2004 and 2005 in Morocco, have also been produced by the ICMP-supported national monitoring systems. Estimates for other countries have been drawn from ARQ replies and various other sources, including reports from Governments, UNODC field offices and the United States Department of State's Bureau for International Narcotics and Law Enforcement Affairs.

A full technical description of the methods used by UNODC-supported national monitoring systems can be found in the respective national survey reports available at http://www.unodc.org/unodc/en/crop-monitoring/index.html .

Net cultivation

Not all the fields on which illicit crops are planted are actually harvested and contribute to drug production.

For Afghanistan, a system of monitoring opium poppy eradication is in place which provides all necessary information to calculate the net cultivation area. In Myanmar and the Lao People's Democratic Republic, the eradicated area of opium poppy is partly taken into account for the estimation of the net cultivation area. Not enough information is available to consider eradication carried out after the time of the annual opium survey.

A major difference between coca and other narcotic plants such as opium poppy and cannabis is that the coca bush is a perennial plant which can be harvested several times per year. This longevity of the coca plant should, in principle, make it easier to measure the area under coca cultivation. In reality, the area under coca cultivation is dynamic, changes all the time and it is difficult to determine the exact amount of land under coca cultivation at any specific point in time or within a given year. There are several reasons why coca cultivation is dynamic, including new plantation, reactivation of previously abandoned fields, abandonment, manual eradication and aerial spraying.[3]

Depending on the purpose, different concepts of area under coca cultivation can by useful, taking into account some or all of the factors described above. From a government's perspective, it may be interesting to monitor illicit cultivation attempts in a given year, by trying to capture all coca fields irrespective of whether they existed the whole year or only part of it (**gross cultivation area**). For estimating potential coca leaf and cocaine production, it would be necessary to measure the productive area and how long the fields were productive in the course of a year (**net productive area**). For other reasons, the area under cultivation at a specific cut-off date may be chosen, for example, to monitor the effect of law enforcement activities implemented in the preceding period (**area under cultivation at date x**). By definition, the net productive area and the area under cultivation at point x will be smaller than the gross cultivation area.

The area affected by coca cultivation in a given year, or **gross coca cultivation**, can be defined as the totality of all coca fields existing in that year, irrespective of whether they were newly planted, reactivated, abandoned, eradicated or sprayed during the course of that year.

For the calculation of the **net productive area**, two dimensions should be considered: the duration over which the field was in existence and productivity. The area of fields which did not exist over the full 12 months of a year should be subtracted from the gross cultivation figure, by a factor expressing their reduced productive time. In addition to the time factor, the reduced productivity of certain field types and the effects of eradication and spraying need to be taken into account.

- Young plants in new coca fields are not as productive as mature coca bushes.
- Eradicated coca fields may be replanted but have a lower yields as plants are not mature
- Coca bushes in a field sprayed with herbicide may either die (all or some) or have a reduced yield for some months.
- A reactivated field with mature coca bushes may reach full productivity faster than a newly planted field but still be less productive than a well maintained field

The effect on productivity could be added to the effect of time. For example, 20 ha which were eradicated after six months would only count as 10 productive hectares. Similarly, a factor can be introduced to reflect the reduced productivity as a result of aerial spraying. Efforts are being made to improve the estimation of the net productive area in the context of improving the accuracy of the cocaine production estimate.

In 2010, for the first time, the net productive area was estimated in addition to the net cultivation on 31 December, using information on manual eradication

3 Plant disease and pests are not considered here as their impact is likely to be captured in the coca leaf yield estimates.

Colombia, area concepts used for coca cultivation and production estimates, 2010

* All rounded and adjusted for small fields

	Net area (31 Dec 2010)*	Average area 2009/2010	Net productive area 2010
Area under coca cultivation (ha)*	62,000	67,500	77,500
Application	Used for area trend analysis	Used for coca leaf/cocaine estimate (lower bound of range)	Used for coca leaf/cocaine estimate (upper bound of range)

and spraying of coca bush and other sources to model the permanence (that is, the productive time span) of coca fields. Permanence factors for abandoned, sprayed and eradicated coca fields were established and applied. The resulting area was considerably larger than the net area on 31 December. In addition, the previous approach of using the average net area on 31 December of the two last surveys was used to calculate coca leaf production to maintain comparability with previous years. More research is needed on the permanence of coca fields and the consequences for coca leaf yield to improve the net productive area estimate.

In Colombia, an adjustment factor was introduced to include small coca fields into the area estimate, which could not be captured due to technical limitations. This was necessary as studies showed that the proportion of undetectable small fields below 0.25 ha has been increasing in recent years. The adjustment for small fields leads to a higher area estimate and is considered more accurate. Area figures for 2009 and 2010 were calculated with and without adjustment for small fields for comparability reasons. The adjustment varies from year to year, depending on the proportion of small fields present in each cultivation region, and the contribution of each region to the total in a specific year. Thus, the adjustment factor has to be calculated for each year separately. Efforts are under way to recalculate the time series for Colombia with the adjustment factor. As of now, the adjusted figures are only available for 2009 and 2010.

In the Plurinational State of Bolivia and Peru, the coca area as estimated from satellite imagery in the second half of the year was used as a proxy for the net productive area. Thus, eradication of coca bush is partly taken into account for the estimation of the net cultivation area. Not enough information is available to also consider eradication carried out after the time of the annual survey.

For countries not covered by UNODC's Illicit Crop Monitoring Programme, the reported net cultivation figure is used.

Yield[4] and production

To estimate potential production of opium, coca leaf and cannabis (herb and resin), the number of harvests per year and the total yield of primary plant material has to be established. The UNODC-supported national surveys take measurements in the field and conduct interviews with farmers, using results from both to produce the final data on yield.

Opium yield surveys are complex. Harvesting opium with the traditional lancing method can take up to two weeks as the opium latex that oozes out of the poppy capsule has to dry before harvesters can scrape it off and several lancings take place until the plant has dried. To avoid this lengthy process, yield surveyors measure the number of poppy capsules and their size in sample plots. Using a scientifically developed formula, the measured poppy capsule volume indicates how much opium gum each plant potentially yields. Thus, the per hectare opium yield can be estimated. Different formulas were developed for South-East and South-West Asia. In Afghanistan and Myanmar, yield surveys are carried out annually.

For coca bush, the number of harvests varies, as does the yield per harvest. In the Plurinational State of Bolivia and Peru, UNODC supports monitoring systems that conduct coca leaf yield surveys in several regions, by

Colombia, adjustment of coca area for small fields, 2009-2010 (ha)

	2009	2010	Change on 2009
Area without adjustment	68,000	57,000	-16%
Adjustment for small fields	5,000	5,000	0%
Area with adjustment	73,000	62,000	-15%

4 Further information on the methodology of opium and coca leaf yield surveys conducted by UNODC can be found in United Nations (2001): *Guidelines for Yield Assessment of Opium Gum and Coca Leaf from Brief Field Visits*, New York (ST/NAR/33).

harvesting sample plots of coca fields over the course of a year, at points in time indicated by the coca farmer. In Colombia, where the security situation does not allow for surveyors to return to the sample fields, only one harvest was measured, and the others were estimated based on information from the farmer. In all three coca cultivating countries, yield surveys are carried out only occasionally, due to the difficult security situation in many coca regions, and because of funding constraints.

Conversion factors

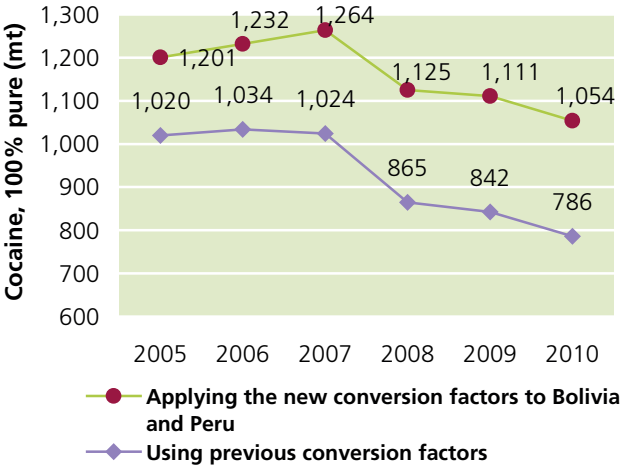
The primary plant material harvested - opium in the form of gum or latex from opium poppy, coca leaves from coca bush, and the cannabis plant - undergo a sequence of extraction and transformation processes, some of which are done by farmers onsite, others by traffickers in clandestine laboratories. Some of these processes involve precursor chemicals and may be done by different people in different places under a variety of conditions, which are not always known. In the case of opium gum, for example, traffickers extract the morphine contained in the gum in one process, transform the morphine into heroin base in a second process, and finally produce heroin hydrochloride. In the case of cocaine, coca paste is produced from either sun-dried (in the Plurinational State of Bolivia and Peru) or fresh coca leaves (in Colombia), which is later transformed into cocaine base, from where cocaine hydrochloride is produced.

The results of each step, for example, from coca leaf to coca paste, can be estimated with a conversion factor. Such conversion factors are based on interviews with the people involved in the process, such as farmers in Colombia, who report how much coca leaf they need to produce 1 kg of coca paste or cocaine base. Tests have also been conducted where so-called 'cooks' or 'chemists' demonstrate how they do the processing under local conditions. A number of studies conducted by enforcement agencies in the main drug-producing countries have provided the orders of magnitude for the transformation from the raw material to the end product. This information is usually based on just a few case studies, however, which are not necessarily representative of the entire production process. Farmer interviews are not always possible due to the sensitivity of the topic, especially if the processing is done by specialists and not by the farmers themselves. Establishing conversion ratios is complicated by the fact that traffickers may not know the quality of the raw material and chemicals they use, which may vary considerably; they may have to use a range of chemicals for the same purpose depending, on their availability and costs; and the conditions under which the processing takes place (temperature, humidity, et cetera) differ.

It is important to take into account the fact that the margins of error of these conversion ratios – used to calculate the potential cocaine production from coca leaf or the heroin production from opium - are not known. To be precise, these calculations would require detailed information on the morphine content of opium or the cocaine content of the coca leaf, as well as detailed information on the efficiency of clandestine laboratories. Such information is limited. This also applies to the question of the psychoactive content of the narcotic plants.

UNODC, in cooperation with Member States, is currently reviewing coca leaf to cocaine conversion ratios as well as coca leaf yields and net productive area estimates.[5] More research is needed to establish comparable data for all components of the cocaine production estimate.

Impact of conversion factors on global estimates of potential cocaine HCl production (mt)



Many cannabis farmers in Afghanistan and Morocco conduct the first processing steps themselves, either by removing the upper leaves and flowers of the plant to produce cannabis herb or by threshing and sieving the plant material to extract the cannabis resin. The herb and resin yield per hectare can be obtained by multiplying the plant material yield with an extraction factor. The complex area of cannabis resin yield in Afghanistan was investigated in 2009 and 2010. The yield study included observation of the actual production of resin, which is a process of threshing and sieving the dried cannabis plants. In Morocco, this factor was established by using information from farmers on the methods used and on results from scientific laboratories. Information on the yield was obtained from interviews with cannabis farmers.[6] The estimate of global cannabis herb and resin

5 More detailed information on the ongoing review of conversion factors was presented in the 2010 *World Drug Report*, p.251 ff.

6 For greater detail on studies with cannabis farmers, see: UNODC, *Enquête sur le cannabis au Maroc 2005*, Vienna, 2007.

production was not updated in 2010, given the high level of uncertainty and the continuing lack of information in many cannabis-cultivating countries.

Potential production

'Potential' heroin or cocaine production shows the total production of heroin or cocaine if all the cultivated opium or coca leaf were transformed into the end products in the respective producer country in the same year. However, part of the opium or coca leaf is directly consumed in the producing countries or in neighbouring countries, prior to the transformation into heroin or cocaine. In addition, significant quantities of the intermediate products, coca paste or morphine, are also consumed in the producing countries. Some products such as opium can be stored for extended periods of time and be converted into intermediate or final products long after the harvest year. These factors are partly taken into account: for example, consumption of coca leaf considered licit in the Plurinational State of Bolivia and Peru is not taken into account for the transformation into cocaine. Other factors, such as the actual amount of illicit coca paste or opium consumption and storage, are difficult to estimate and were not taken into account.

For cocaine, potential production of 100% pure cocaine is estimated. In reality, clandestine laboratories do not produce 100% pure cocaine but cocaine of lower purity which is often referred to as 'export quality'. For heroin, not enough information is available to estimate the production of heroin of 100% purity. Instead, potential production of export quality heroin is estimated, whose exact purity is not known and may vary.

Although it is based on current knowledge on the alkaloid content of narcotic plants and the efficiency of clandestine laboratories, 'potential production' is a hypothetical concept and is not an estimate of actual heroin or cocaine production at the country or global level. The concept of potential production is different from the theoretical maximum amount of drug that could be produced if all alkaloids were extracted from opium and coca leaf. The difference between the theoretical maximum and the potential production is expressed by the so-called laboratory efficiency, which describes which proportion of alkaloids present in plant material clandestine laboratories are actually able to extract.

Colombia

In 2010, for the first time, the net productive area was estimated, in addition to the previous approach of using the average area under coca cultivation of the reporting year and the previous year. For reasons of comparability, the latter was presented as the point estimate. A range was calculated whereby the estimate based on the previous methodology forms the lower bound, and the cocaine estimate based on the net productive area the upper bound. For years before 2010, the net productive area had not yet been calculated at the time of printing.[7]

Peru

Potential cocaine production in Peru is estimated from potential coca leaf production after deducting the amount of coca leaf estimated to be used for traditional purposes according to Government sources (9,000 mt of sun-dry coca leaf).

The Plurinational State of Bolivia

Potential cocaine production in the Plurinational State of Bolivia is estimated from potential coca leaf production after deducting the amount of coca leaf produced on 12,000 ha in the Yungas of La Paz where coca cultivation is authorized under national law.

Drug trafficking

Seizures

The analysis presented in this report is mainly derived from the ARQ responses covering the March 2010–December 2010 period. Including information from other sources, UNODC was able to obtain seizure data from 143 countries and territories for 2009. Seizures are thus the most comprehensive indicator of the drug situation and its evolution at the global level. Although seizures may not always reflect trafficking trends correctly at the national level, they tend to show reasonable representations of trends at the regional and global levels.

Countries may report seizures of drugs using a variety of units, primarily by weight (kg) but also in litres, tablets, doses, blotters, capsules, ampoules, et cetera. When reporting about individual countries in individual years UNODC endeavours to be as faithful as possible to the reports received, but often it is necessary to aggregate data of different types for the purposes of comparison. For the purposes of aggregation, conversion factors are used to convert the quantities into 'kilogram equivalents' (or 'ton equivalents').

The conversion factors affect seizure totals of amphetamine-type stimulants in particular, as a significant share of seizures of these drug types is reported in number of tablets. In previous editions of the *World Drug Report*, the factors used for ATS ranged between 30 mg and 100 mg per tablet, and were intended to reflect the amount of controlled substance in the tablet; these factors depended on the drug type but not on the reporting country.

7 More information on the results of the two approaches and the methodology used can be found in the report on coca cultivation in Colombia (UNODC/ Government of Colombia, June 2011) available on the internet at http://www.unodc.org/unodc/en/crop-monitoring/index.html.

Apart from seizures of ATS tablets, drug seizures are mainly reported to UNODC by weight. This includes seizures of ATS which are not seized in tablet form (for example, crystalline methamphetamine, ATS in powder form) as well as seizures of other drug types, such as heroin and cocaine. Moreover, ATS seizures made in tablet form are also sometimes reported by weight, and in some cases, the reported total weight possibly includes ATS seized in different forms. Reports of seizures by weight usually refer to the bulk weight of seizures, including adulterants and diluents, rather than the amount of controlled substance. Moreover, given the availability of data, accurate purity adjustments for bulk seizure totals in individual countries are feasible in a small minority of cases, as they would require information on purity on a case by case basis or statistically calibrated data, such as a weighted average or a distribution. The bulk weight of tablets is easier to obtain and less variable.

To improve the comparability of seizure totals across different years and countries, UNODC has revised the conversion factors used for ATS tablets to reflect the bulk weight of the tablets rather than the amount of controlled substance. The factors used in this edition of the *World Drug Report* are based on available forensic studies and range between 90 mg and 300 mg, depending on the region and drug type. The change has been implemented for all years up to and including 2009 (see table). The conversion factors remain subject to revision as the information available to UNODC improves.

All other conversion ratios remained unchanged from previous editions. Seizures quantified by volume (litres) are aggregated using a conversion ratio of 1 kilogram per liter, which applies to all drug types. Cannabis plants are assumed to have a weight of 100 grams.

Moreover, at various points in the analysis, purity adjustments are made where relevant and where the availability of data allows.

UNODC continues to record and report the disaggregated raw data, which are available in the seizure listings published online.[8] In these tables, seizure quantities are reproduced as reported. In the rest of the Report, seizure data are often aggregated and transformed into a unique measurement: seizures in 'kilogram equivalents'. For the purposes of the calculations a 'typical consumption unit' was assumed to be for cannabis herb, 0.5 g; for cannabis resin, 0.135 g; cocaine and morphine, 0.1 g; heroin, 0.03 g; LSD, 0.00005 g (50 micrograms); and opium, 0.3 g. For opiate seizures (unless specified differently in the text), it was assumed that 10 kg of opium were equivalent to 1 kg of morphine or heroin. Though these transformation ratios can be disputed, they provide a means of combining the different seizure reports into one comprehensive measure. The transformation ratios have been derived from those normally used by law enforcement agencies, in the scientific literature and by the International Narcotics Control Board, and were established in consultation with UNODC's Laboratory and Scientific Section.

Trafficking routes and volumes

Information of trafficking routes was mainly obtained from analyses of individual drug seizures reported to UNODC, as well as analyses of trafficking routes reported by Member States.

To calculate the volumes of drugs trafficked, the retail market size of each country was established by multiplying the number of drug users with best estimates on per capita drug consumption, derived from local studies. There is, however, still a lack of scientific studies on per

Weight of tablets in mg				
	Ecstasy (MDMA or analogue)	Amphetamine	Methamphetamine	Non-specified amphetamines
Africa	271	250	250	250
Asia (excluding Near and Middle East/ South-West Asia)	300	250	90	250
Europe	271	253	225	250
Central and South America and the Caribbean	271	250	250	250
Near and Middle East/ South-West Asia	237	170	250	250
North America	250	250	250	250
Oceania	276	250	250	250

8 See http://www.unodc.org/unodc/en/data-and-analysis/WDR.html

capita consumption and results must be treated as preliminary. Based on the estimates of the volumes consumed and knowing the main origins of the drugs and the seizures made, the volumes of the main drug flows were established

Market analysis

Drug price and purity data

Price and purity data, if properly collected and reported, can be powerful indicators of market trends. Trends in supply can change over a shorter period of time when compared with changes in demand and shifts in prices and purities are good indicators for increases or declines of market supply. Research has shown that short-term changes in the consumer markets are first reflected in purity changes while prices tend to be rather stable over longer periods of time. UNODC collects its price data from the ARQ, and supplements this data with other sources such as DAINAP, EMCDDA and Government reports. Prices are collected at farm-gate level, wholesale level ('kilogram prices') and at retail level ('gram prices'). Countries are asked to provide minimum, maximum and typical prices and purities. When countries do not provide typical prices/purities, for the purposes of certain estimates, the mid-point of these estimates is calculated as a proxy for the 'typical' prices/purities (unless scientific studies are available which provide better estimates). What is generally not known is how data were collected and how reliable it is. Although improvements have been made in some countries over the years, a number of law enforcement bodies have not yet established a regular system for collecting purity and price data.

Size and value of the market

Multiplying the volumes of drugs consumed in a country with the purity-adjusted retail prices gives the value of the market. In case no country-specific per capita use rates were available, regional estimates were used. Similarly, in case no country-specific prices were available, average subregional prices were used as a proxy. The same principle was applied to purities. Average subregional purities were used for countries that were not in a position to assess the purities of the drugs seized. Given the large number of assumptions in deriving the various country estimates from subregional or regional averages, all sizes of the market estimates must be treated with caution.