

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 (i.e. the Secretariat of UNODC). For this purpose, the Commission on Narcotic Drugs developed the Annual Report Questionnaire (ARQ) which forms the basis of information in the World Drug Report.

The World Drug Report 2012 is based primarily on data obtained from the ARQ returned by Governments to UNODC up to 31 December 2011. The data collected in the current ARQ normally refer to the drug situation in 2010. UNODC sent out the questionnaire to 192 Member States, as well as 15 territories. In response, UNODC received 91 replies to its questionnaire on the "Extent and patterns of and trends in drug use (ARQ Part III)" and 94 replies to Part IV on "Extent and patterns and trends in drug crop cultivation, manufacturing and trafficking". The best coverage was from Member States in Europe where over 80 per cent of the countries responded, in Asia more than half (60 per cent) and in the Americas more than 40 per cent of the countries filled in the ARQ. In the case of Africa, nearly 20 per cent of the Member States and in the Oceania region, only two out of the 14 countries responded to the Annual Report Questionnaire. Member States' responses to the ARQ are shown on the maps which follow.

In general, the quantity of information provided on illicit drug supply is significantly better than that of information provided on drug demand. Analysis of responses to Part IV of the ARQ revealed that 86% of them were 'substantially' completed compared to 61% of Part III. (ARQ which were more than 50% completed were classified as having been 'substantially filled in'; less than 50% completion is classified as having been 'partially filled in').

In order to analyse the extent to which Member States

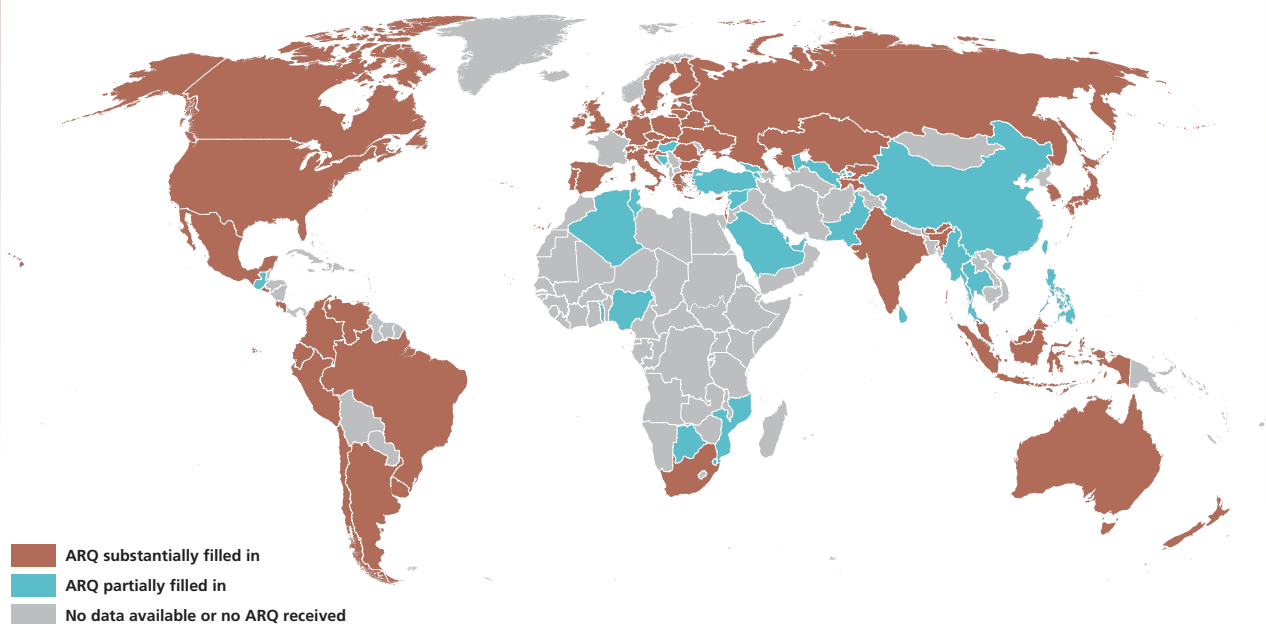
provided information, a number of key questions in the ARQ were identified:

- For Part III, on the extent and patterns and trends of drug abuse, the key questions used for the analysis referred to: trends in drug use, for which 77% of the Member States and territories returning the ARQ provided information; lifetime prevalence among the general population for which 57% of the Member States responded; for youth prevalence 60% responded; and for treatment demand 89% responded. The overall response rate of completion was 61% for the countries which submitted Part III to UNODC.
- For Part IV, on the extent and patterns and trends in drug crop cultivation, manufacturing and trafficking, the analysis included replies to the questions on: the quantities seized for which 90% of the Member States returning the ARQ provided the information; on trafficking 81% of the Member States provided responses; for prices and purity 81% of the Member States provided responses, and for drug related arrests 80% of the Member States provided responses. The overall analysis of these data revealed that 86% of the Part III responses were completed.

Information provided by Member States in the ARQ form the basis for the estimates and trend analysis provided in the World Drug Report. Often, this information and data is not sufficient to provide an accurate or comprehensive picture of the world's drug markets. When necessary and where available, the data from the ARQ are thus supplemented with data from other sources.

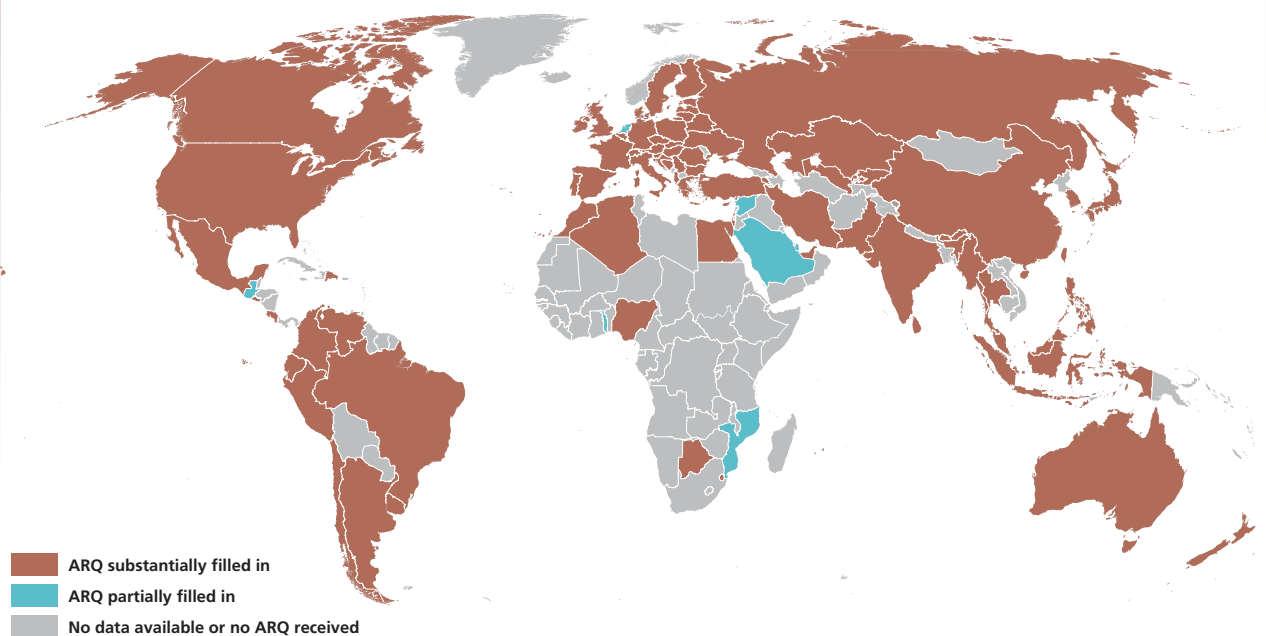
As in previous years, seizure data made available to UNODC via the ARQ was complemented primarily with data from Interpol/ICPO, and data provided to UNODC by the Heads of National Law Enforcement Agencies (HONLEA) at their regional meetings. Price data for Europe were complemented with data from Europol. Precursor data presented are mainly those collected by the International Narcotics Control Board (INCB). Demand related information was obtained through a number of additional sources, including the national assessments of the drug situation supported by UNODC, the drug control agencies participating in the UNODC's, 'Drug Abuse Information Network for Asia and the Pacific' (DAINAP), as well as various national and regional epidemiological networks such as the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) or the Inter-American Drug Abuse Control Commission (CICAD). Reports published by National governments and academic research published in the scientific literature were also used as sources of information. This type of supplementary information is useful and necessary as long as Member States lack the monitoring systems necessary to produce

Member States that provided annual reports questionnaire drug demand data for 2012



Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Dashed lines represent undetermined boundaries. 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. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.

Member States that provided annual reports questionnaire drug supply data for 2012



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reliable, comprehensive and internationally comparable data.

To this end, UNODC encourages and supports the improvement of national monitoring systems. Major progress has been made over the last few years in some of the countries that have major illicit crop cultivations. In close cooperation with UNODC and with the support of major donors – these countries have developed impressive monitoring systems designed to identify the extent of, and trends in, the cultivation of narcotic plants. These data form a fundamental basis for trend analysis presented in the World Drug Report.

There remain significant data limitations on the demand side. Despite commendable progress made in a number of Member States, in the area of prevalence estimates for example, far more remains to be done to provide a truly reliable basis for trend and policy analysis and needs assessments. The work currently being done on the World Drug Report 2012 provides yet another opportunity to emphasize the global need for improving the evidence base available to the policy makers and programme planners.

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. 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 are 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 2010. 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 far as possible - the heterogeneous data set. All available estimates were transformed into one single indicator – annual prevalence among the general popula-

tion 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, 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 relationship 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.

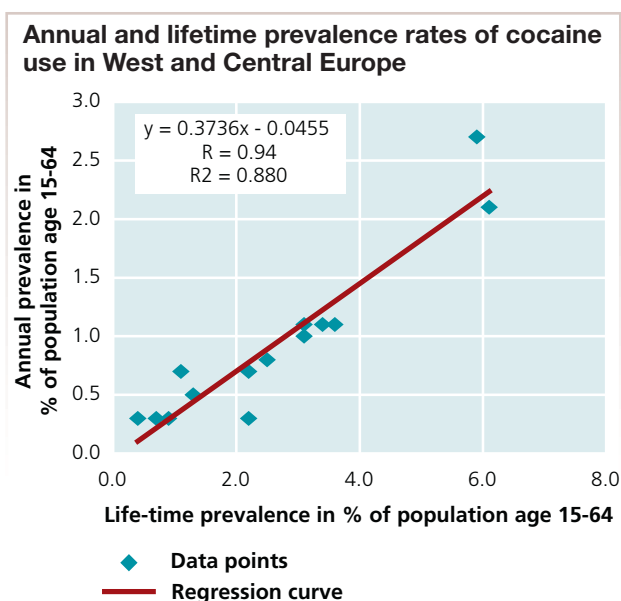
Extrapolation methods used

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



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

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 line (with annual prevalence as the dependent variable and lifetime prevalence as the independent variable) 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 average of annual prevalence rates of the West and Central European countries and the unweighted average 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.

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 pro-

vided by the United Nations Population Division for the year 2010.

Ranges have been produced to reflect the considerable uncertainty that arises when data are either extrapolated or imputed. Ranges 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 an a median of 120%. The summed total was therefore divided by 1.20.

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 77%. The range of cannabis users at the global level was therefore divided by 0.77.

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'.

Relative risk coefficient					
	Treatment index	IDU Index	Toxicity Index	Deaths index	Relative risk coefficient (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

This was calculated through the use of ‘relative risk coefficients’ (see below) 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 (29.3 million heroin user equivalents). The HIGH estimate is the higher proportion (68%) multiplied by the higher estimated size of the heroin use equivalent population (56.7 million heroin user equivalents). This gives a range of 15.5 to 38.6 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 Use¹ (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 are 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 used to determine a rate for the reporting year and this rate was used to produce an estimate of the number of drug-related deaths corresponding to the year 2010. The estimated number of drug-related deaths for 2010 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.

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, were also produced by the UNODC-supported national monitoring systems. Estimates for other countries were drawn from ARQ replies and various other sources, including reports from Governments, UNODC field offices and the United

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.

States Department of State's Bureau for International Narcotics and Law Enforcement Affairs. Opium poppy cultivation in countries which do not conduct area surveys, was estimated with an indirect method (see below).

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 which makes it 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 so dynamic, including new plantation, reactivation of previously abandoned fields, abandonment, manual eradication and aerial spraying.³

In this report, the issue of different area concepts used to monitor illicit coca bush cultivation is further investigated.⁴ For technical reasons, the initial area measurement of coca fields takes place on satellite images acquired at different dates of the year and sometimes having different technical specifications. For the Bolivian and Peruvian estimate, these difference are considered to have a limited effect only, whereas the dynamic situation in Colombia requires adjustment to maintain year-on-year comparability. In this report, an effort was made to present the area interpreted on satellite imagery, the gross area affected by coca (as a proxy of the gross coca cultivation area) and the area at 31 December to make the effect of the adjustments transparent and present estimates comparable across countries to the extent possible (see p. 36 of this report).

Indirect estimation of illicit opium poppy cultivation

Eradication and plant seizure reports indicate that illicit opium poppy cultivation exists in many countries, which do not regularly conduct illicit crop surveys. Starting 2008 a new methodology was introduced to estimate the extent of this illicit cultivation with an indirect method based on two indicators available in UNODC's databases: eradicated poppy area and opium poppy (plant, capsule) seizures reported as units or weight.

Prioritization of data sources: Whenever possible, the eradicated poppy area was used as this indicator is conceptually closest. If this indicator was not available, poppy plant seizure data was used, which requires an additional conversion of the seized amount into area eradicated. It can be assumed that plant seizures are often a different way of recording eradication. e.g. in cases where area measurements are technically difficult or because the law requires all seized material to be weighed even if the seizure consist actually of eradicating plants on a field. Large-scale or long-distance illicit trade with opium poppy plants is unlikely as the plants are bulky, perishable and of low value.

Eradication factor: Evidence from countries which provide both illicit cultivation and eradication data indicates that illicit cultivation is typically a multiple of the area eradicated. This relationship, averaged over the last five years for which information is available, was used to calculate a factor which allowed to estimate illicit cultivation in countries from eradication figures. Since 2008, this factor is based on opium poppy cultivation and eradication data from Colombia, Lao People's Republic, Mexico, Myanmar, Pakistan and Thailand. It ranged between 2.1 and 3.5 (eradicated area x factor = net cultivation area). Afghanistan was not considered for the calculation of the factor as the objective was to estimate low to mid-levels of illicit cultivation. Afghanistan, representing two thirds or more of global illicit poppy cultivation, clearly fell outside this range.

Plant seizures: seizures of poppy plant material usually happen close to the source, i.e. in vicinity of the cultivation area. The data available in UNODC's databases does not allow to determine the parts of the plant seized as only one category exists ("plant, capsules") for plant seizures. Most (roots, stem, leaves, capsules) or only some parts (poppy straw, capsules only) may be seized. While this does not influence seizure data given in plant units, it plays a role when interpreting seizure data given as weight.

Plant seizure data in units represent plant numbers, which can be converted into area (ha) using an average number of opium poppy plants per hectare. Yield measurements from Afghanistan and Myanmar, where UNODC has conducted yield surveys over several years, indicate an average figure of about 190,000 plants per hectare. Dividing poppy plant seizure numbers by this factor results in estimate of the area on which the seized material was cultivated. This

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

⁴ See *World Drug Report 2011*, p. 262.

is equivalent to eradicated area, as the seized material was taken out of the production cycle. Eradicated area multiplied with the eradication factor described above yields then cultivation area.

Plant seizure data reported as weight: In order to convert the weight of seized poppy plants into area, a typical biomass per hectare of poppy was estimated based on the evaluation of various sources. The biomass yield in oven-dry equivalent including stem, leaves, capsule and seeds reported by a commercial licit opium poppy grower in Spain⁵ was 2,800 kg/ha for rain-fed and 7,200 kg/ha for irrigated fields respectively. Information on the weight of roots was not available. Loewe⁶ found biomass yields between 3,921 kg/ha to 5,438 kg/ha in trial cultivation under green house conditions. Acock⁷ found oven-dry plant weights of about 37 grams including roots in trials under controlled conditions corresponding to a biomass yield of around 7,000 kg/ha with the assumed plant density of 190,000/ha. Among the available biomass measurements only the figures from Spain referred to poppy grown under field conditions. All other results fell into the range between the non-irrigated and irrigated biomass yields (2,800 – 7,200 kg/ha) reported. For purposes of this calculation the simple average of these two values was taken.

Two caveats have to be made: a) As the reporting format does not differentiate between capsules and plants or between the different growth stages of a poppy plant, it was assumed that the reported weight refers to whole, mature plants. This leads to a conservative estimate as many plant seizures are actually carried out on fields before the poppy plants reach maturity. b) The reference biomass measurements from scientific studies are expressed in oven-dried equivalents, whereas the reported weights could refer to fresh weight or air-dry weight; both of which are higher than the oven-dry equivalent weight equivalent. This would lead to an over-estimation of the illicit cultivation area. In the case of young plants, which are typically fresh but not yet fully grown, both errors could balance off, whereas in the case of mature or harvested plants, which tend to be drier, both errors would be smaller.

Missing values: Not all states with illicit opium poppy cultivation report eradication or plant seizures on a yearly basis. If values were missing, the value used for that specific year was the average of the last 5 years. If there are not eradication or plant seizure reports in that period, no value is calculated.

Yield⁸ 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 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 trans-

5 Personal communication, 2010, from Alcaliber company.

6 Personal communication, 2010, see also Loewe, A. (2010). Remote Sensing based Monitoring of Opium Cultivation in Afghanistan. Philosophische Fakultät. Bonn, Rheinische Friedrich-Wilhelms-Universität: 106.

7 Acock, M. C., R. C. Pausch, et al. (1997). "Growth and development of opium poppy (*Papaver Somniferum* L.) as a function of temperature." *Biotronics* 26: 47-57.

8 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).

formed into cocaine base, from where cocaine hydrochloride is produced.

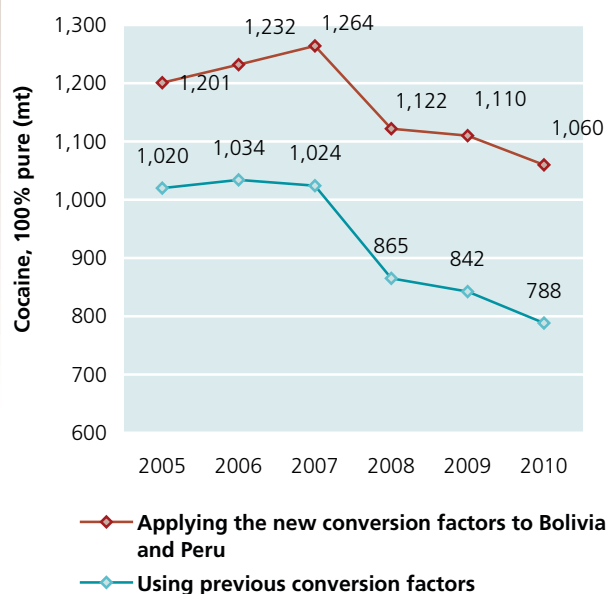
The results of each step, for example, from coca leaf to coca paste, can be estimated with a conversion factor. Such conversion factors are based on interviews with the people involved in the process, such as farmers in Colombia, who report how much coca leaf they need to produce 1 kg of coca paste or 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.⁹ More research is needed to establish comparable data for all components of the cocaine production estimate.

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, 2010 and 2011. The yield study included observation of the actual production of resin, which is a process of threshing and sieving the dried cannabis plants. In

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



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.¹⁰ The estimate of global cannabis herb and resin production was not updated in 2011, 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

⁹ More detailed information on the ongoing review of conversion factors was presented in the 2010 *World Drug Report*, p.251 ff.

¹⁰ For greater detail on studies with cannabis farmers, see: UNODC, *Enquête sur le cannabis au Maroc 2005*, Vienna, 2007.

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.¹¹

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 138 coun-

tries and territories for 2010. 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 aggregation, conversion factors are used to convert the quantities into 'kilogram equivalents' (or 'ton equivalents'). UNODC continues to record and report the disaggregated raw data, which are available in the seizure listings published at: <http://www.unodc.org/unodc/en/data-and-analysis/WDR.html> 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. Moreover, at various points in the analysis, purity adjustments are made where relevant and where the availability of data allows.

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. 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 ensure the comparability of seizure totals across different years and countries, UNODC uses conversion factors for ATS tablets intended 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 the drug type, and also apply to other units which are presumed to represent a single consumption unit (dose). The table on the next page lists the factors used for 'ecstasy', amphetamine, methamphetamine, and non-specified ATS. The

¹¹ 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>.

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)	3 00	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

conversion factors remain subject to revision as the information available to UNODC improves. UNODC is also in the process of establishing conversion factors for the drug types that were newly introduced with the recent revision of the Annual Report Questionnaire.

For the other drug types, the weight of 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. As in previous editions of the World Drug Report, seizures quantified by volume (litres) are aggregated using a conversion ratio of 1 kilogram per litre, which applies to all drug types. Cannabis plants are assumed to have a weight of 100 grams.

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 is 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 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 are 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 are available, regional estimates are used. Similarly, in case no country-specific prices are available, average subregional prices are used as a proxy. The same principle is applied to purities. Average subregional purities are 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.