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 Reports 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 in the UNODC). For this purpose, the Commission on Narcotic Drugs in 2010 endorsed the revised Annual Reports Questionnaire (ARQ) that is sent to Member States each calendar year for submission of responses and information on the drug situation.

The World Drug Report 2016 is based on data primarily obtained from the ARQ returned by Governments to UNODC up to 31 December 2015. The data collected in the current ARQ normally refer to the drug situation in 2014. UNODC sent out the questionnaire to 192 Member States, as well as 15 territories. In response, up to 31 December, 2015 UNODC had received 101 replies to its questionnaire on the "Extent and patterns of and trends in drug use (ARQ Part III)" and 104 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 85 per cent of the countries responded, in Asia 63 per cent and in the Americas 40 per cent of the countries filled in the ARQ. In the case of Africa, 25 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 73 per cent of them were 'substantially' completed compared to 67 per cent 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').

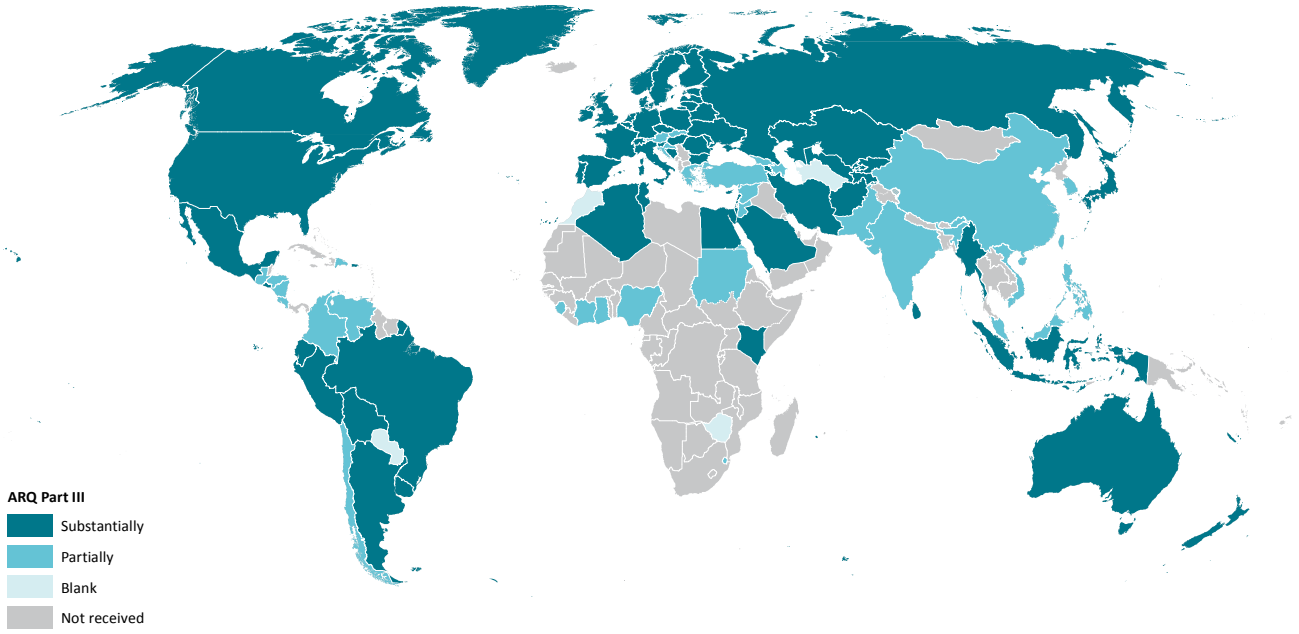
In order to analyse the extent to which Member States provided information, a number of key questions in the ARQ were identified:

- 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 86 per cent of the Member States and territories returning the ARQ provided information; prevalence of different drugs among the general population for which 65 per cent of the Member States responded; for prevalence of drug use among youth 52 per cent responded; for drug related mortality 56 percent and for treatment demand 84 per cent of the Member States responded. The overall response rate of completion was 67 per cent for the countries which submitted Part III to UNODC, however this analysis does not take into account the completeness or quality of the information provided in response to each of the areas mentioned.
- 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 96 per cent of the Member States returning the ARQ provided the information; on trafficking of illicit drugs, for which 86 per cent of the Member States provided responses; on prices and purity 80 per cent of the Member States responded, and on persons brought into formal contact with the police and/or the criminal justice system in connection with drug-related offences, which 80 per cent of the Member States provided information. The overall analysis of these data revealed that 73 per cent of the Part IV responses were "substantially" completed. However this analysis does not take into account the completeness of responses of the quality of information provided in each of sections mentioned.

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.

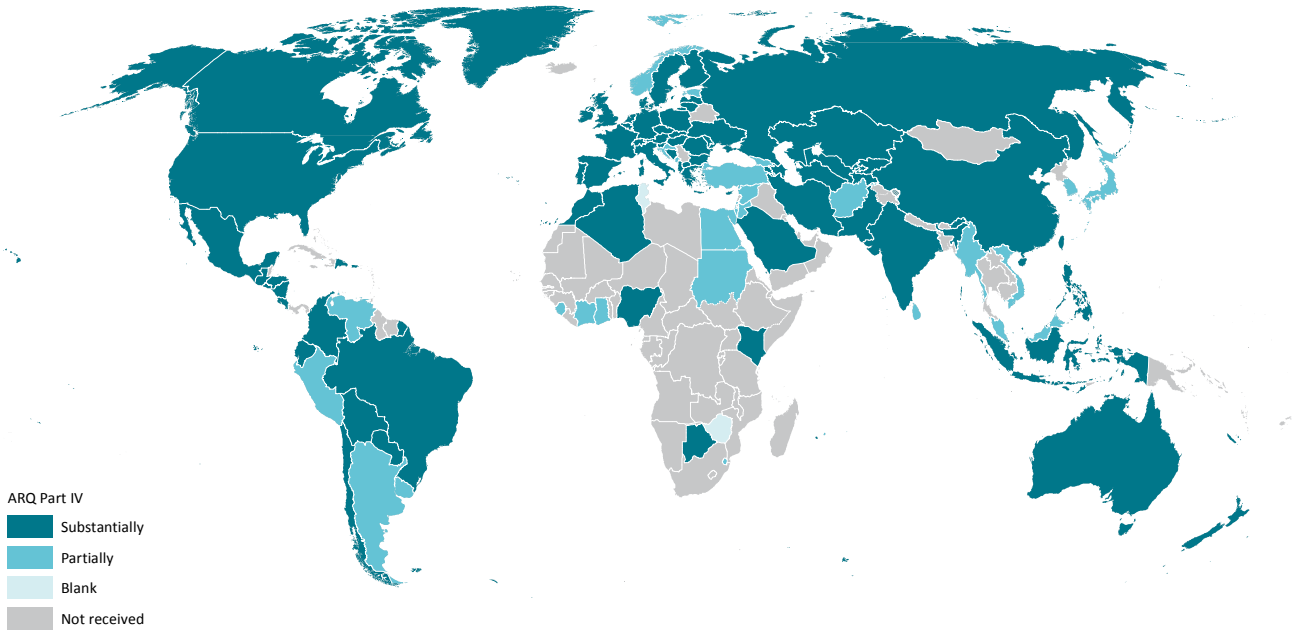
As in previous years, seizure data made available to UNODC via the ARQ was complemented primarily with data from other government sources, such as official national publications, data provided to UNODC by the Heads of National Law Enforcement Agencies (HONLEA) at their regional meetings. and data published by international and regional organisations such as Interpol/ICPO, World Customs Organization, European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) and the Inter-American Drug Abuse Control Commission (CICAD). Price data for Europe were complemented with data from Europol. Demand related information was

Member states that provided annual reports questionnaire drug demand data for 2014



Note: The boundaries shown on this map do not imply official endorsement or acceptance by the United Nations. Dashed lines represent undetermined boundaries. The 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. The final boundary between the Sudan and South Sudan has not yet been determined.
A dispute exists between the Governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

Member states that provided annual reports questionnaire drug supply data for 2014



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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 additional sources of information. This type of supplementary information is useful and necessary as long as Member States lack the monitoring systems necessary to produce reliable, comprehensive and internationally comparable data.

To this end, UNODC encourages and supports the improvement of national monitoring systems. Major progress has been made in the area of illicit crop monitoring 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 of illicit crop cultivation and drug production 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 2016 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 use and health consequences

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 prevalence and estimates of the number of drug users) is a particularly difficult undertaking because it involves in most settings measuring the size of a 'hidden' population. Regional and global estimates are reported with 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 youth population). This includes the identification of adjustment factors based on information from countries in the region 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 are needed to be adjusted to improve comparability (see below).

In cases of estimates referring to previous years, the prevalence rates are unchanged and applied to new population estimates for the year 2014. Currently, only a few countries measure prevalence of drug use 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 national, regional or even global prevalence figures, as changes may in part reflect newer reports from countries, at times with changed methodology, or the exclusion of older reports, rather than actual changes in prevalence of a drug type.

Detailed information on drug use 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. For the World Drug Report 2016 new estimates of prevalence of drug use among the general population were available from 20 counties mostly in

North America, South America and Western and Central Europe. 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), or high risk groups, 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 – in most instances using regional average estimates and using transformation ratios derived from analysis of the situation in neighbouring countries.. 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 new or emerging drug trends, do not vary greatly among countries with similar social, cultural and economic situations.

UNODC have suppressed the publication of estimates of the prevalence of drug use in countries with smaller populations (less than approximately 100,000 population aged 15-64) where the prevalence estimates were based on the results of youth or school surveys that were extrapolated to the general adult population.

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 the 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 indicators of drug use which has been endorsed by the Commission on Narcotic Drugs. The key epidemiological indicators of drug use 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 (treatment demand);
5. Drug-related morbidity (prevalence of HIV, hepatitis B virus and hepatitis C virus among drug users);
6. Drug-related mortality (deaths attributable to drug use).

Efforts have been made to present the overall 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 the use of opiates (opium, heroin, and other illicit opiates), injecting drug use, or the use of cocaine and ATS among regular or dependent users, annual prevalence data derived from national household surveys tend to grossly under-estimate such use, because heroin or other problem drug users often tend to be marginalized or less socially integrated, 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. Therefore for most of the countries, prevalence of opioid or opiates use reported refers to the extent of use of these substances measured through indirect methods.

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

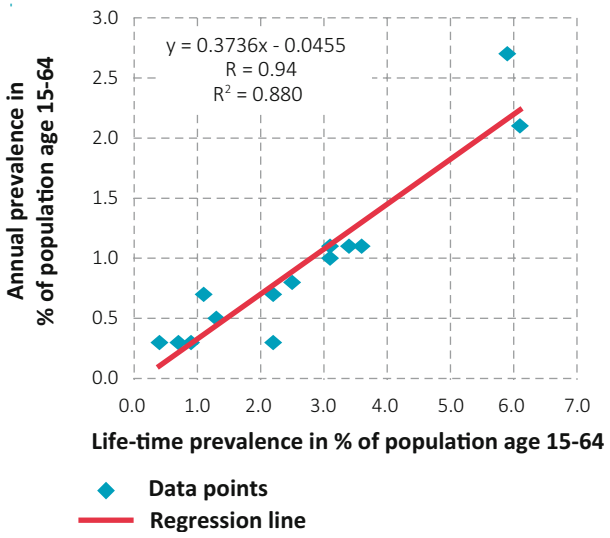
Adjustment for differences in age groups

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%. As an example, 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 Europe 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%).

Example of annual and lifetime prevalence rates of cocaine use in West and Central Europe



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

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 vari-

ables, 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 and between treatment demand and extent of drug use in the general population

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 drug users registered or 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 2014.

In the tables presented in the World Drug Report for regional and global estimates, totals may not add up due to rounding.

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 (0.52, a point estimate), Egypt (2.9 – 9.6) and Morocco (4.2, a point estimate) and Tunisia (2.60). These are extrapolated to the population of the remaining three countries without prevalence data, namely the Libyan Arab Jamahiriya, and Sudan. The 10th percentile of the lower bound of the uncertainty range (0.52, 2.9, and 4.2) is 1.0 and the 90th percentile of the upper bound (0.52, 9.6, 4.2 and 2.60) is 8.5. The 1.0 and 8.5 figures are applied to the population of the remaining three countries without prevalence data to derive a subregional total lower and upper estimate of 2.3 and 6.6 per cent respectively.

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 recent 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 neighbouring 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 in the previous years. 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 26 countries globally including countries from North America (Canada, Mexico and the United States, Europe (Germany, Spain and England and Wales), Latin America (Argentina, Brazil, Plurinational State of Bolivia, Chile, Peru and Uruguay), Asia and the Pacific (Israel, Indonesia, Philippines, and Australia) and Africa (Algeria), 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 over estimated the total population was a median factor of 1.12. The summed total was therefore divided by 1.12

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 81 per cent. The range of cannabis users at the global level was therefore divided by 0.813.

The global lower estimate was the lower of the two values obtained from the two approaches, while the upper estimates was the upper value derived from the two approaches described.

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 a proxy to those who could be diagnosed with drug use disorders, 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 burden of disease and public order.

The number of problem drug users is typically estimated with the number of people with drug use disorders. Sometimes, an alternative approach is used. The EMCDDA has been using '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 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 is the lower proportion (53%) multiplied by the lower estimated size of the heroin use equivalent population (31.5 million heroin user equivalents). The HIGH estimate is the higher proportion (68%) multiplied by the higher estimated size of the heroin use equivalent population (62.4 million heroin user equivalents). This gives a range of 16.7 to 42.4 million problem drug users globally.

Calculation of drug use perception indices

In addition to estimates on the extent of drug use, member states also provide UNODC with their perceptions of drug use trends. Such trends are typically based on a multitude of indicators, including general population prevalence data, school surveys, treatment data, emergency room visits, mortality data, reports by social workers, health care officials and law enforcement officers, arrest data, seizure data, media reports, etc. Based on this information a simple index has been created. For reports of 'large increase' 2 points were allocated, for 'some increase' 1 point; for 'stable' 0 points; for some decrease 1 point was deducted and for 'large decrease' 2 points were deducted.

On average some 89 countries per year reported drug use trends over the 1998-2014 period to UNODC. If all coun-

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

tries had reported each year 'some increase', the index would have reached 1,424 points in 2014; in case of all countries reporting 'large increases' the index would have attained 2,848 points in 2014. The cocaine use perception index, with 1998 as a base year (= 0), arrived at 237 points in 2014; the heroin use perception index reached 192 points in 2014 and the cannabis use perception index 566 points.

Calculation of cocaine consumption trends based on waste-water analysis

Cocaine use trends, as reported in household surveys, showed an overall rather stable pattern in Europe over the 2011-2014 period. These results could be corroborated by the analysis of changes in benzoylecgonine, one of the main cocaine metabolites, found in waste-water in 67 cities across Western, Central and South-Eastern Europe. (If cocaine is consumed by a person it is mainly metabolized into benzoylecgonine, i.e. the main chemical subseuqnetly found in waste-water is benzoylecgonine rather than cocaine as such).

The development of comparable analytical tools and methods for the waste-water analysis took place in recent years in Europe by waste-water research institutes under the umbrella of the COST (European Cooperation in Science and Technology) initiative, supported by the European Union under the EU Framework Programme Horizon 2020. Both EU and non-EU countries participate in this cooperation. In order to obtain – as far as possible – comparable data, waste-water in various cities has been analysed by the research institutes participating in the COST exercise over a 1 week period each year in spring. The amount of benzoylecgonine found each day in the waste-water was determined and a daily average was calculated. (This is important as cocaine use is typically more widespread during the weekend than during normal weak days). In a subsequent step the size of the population responsible for the waste-water in the respective wast-water catchment areas was determined and the results were shown in terms of average milligrams of benzoylecgonine found in waste-water per 1000 inhabitants. In order to calculate an European average, the city results were again weighted by population by the respective population living in the respective waste-water catchment areas. Two averages (with the respective 95 per cent confidence intervals) were calculated; an overall average of all cities participating each year in the study and an average of the 11 cities participating each year in the study. Both averages showed basically a stable pattern over the 2011-2014 period.

Estimates of the prevalence of injecting drug use, HIV and hepatitis (C and B virus) among people who inject drugs (PWID)

Criteria for selecting national estimates

Besides the official UNODC, UNAIDS and WHO data collection instruments, data sources considered also included: European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) country reports and the EMCDDA Statistical Bulletin; and country level estimation studies including HIV seroprevalence and behavioural surveillance.

Factors considered in selecting national data:

- Quality of methodology (i.e., classified A – D according to the table below)
- For PWID, annual prevalence in preference to lifetime injecting
- Most recent data

The study with the strongest classification of methodology was used. Where there were multiple such studies, for PWID data referring to annual prevalence was used, otherwise the most recent data was used. More recent, weaker study designs did not replace an estimate based on a superior methodology, regardless of when the study was conducted if this was within the last ten years.

Decision rules for selecting national estimates on HIV prevention, treatment and care services were based on the guidelines presented in Mathers et. al. (2010) Lancet article: "HIV prevention, treatment, and care services for people who inject drugs: a systematic review of global, regional, and national coverage", who also provide a detailed web appendix to this publication.

Data are categorized by methodology according to a slightly modified classification originally proposed in Mathers et. al. (2008) Lancet paper.[1]

Calculation of regional and global estimates

Regional and global estimates were calculated for a specific reference year. Presently this is for 2014 (as for most of the data presented in the World Drug Report 2016).

People who inject drugs (PWID):

Best estimates: Country-level best estimates of the prevalence of PWID were weighted by the population aged 15-64 years (for the reference year) to obtain a sub-regional average prevalence (where there was insufficient data within a sub-region, a regional weighted-average prevalence was calculated). Countries from within the same sub-region without a prevalence estimate were given this sub-regional average. The sub-regional estimates of the numbers of PWID were summed to produce the regional and global estimated numbers, with the corresponding rate calculated using the relevant populations aged 15-64 years.[2]

Ranges in estimates: The range in the sub-regional estimates were calculated using the 10^{th} and 90^{th} percentiles of the

1 Mathers, B., L. Degenhardt, et al. (2008). Global epidemiology of injecting drug use and HIV among people who inject drugs: a systematic review. The Lancet 372(9651): 1733-1745

2 This is the same as the methodology used by Mathers et. al. for the UN Reference Group estimates published in 2008

Classification of methodology for people who inject drugs and those among them living with HIV

Class	Data on people who inject drugs
A	Indirect prevalence estimation methods e.g., capture-recapture, network scale-up method, multiplier methods, etc
B1	Mapping/census and enumeration
B2	General population survey
C	Treatment and other national registers of drug users
D1	· Official government estimate with no methodology reported · Experts' judgment with known method of estimation (eg. an estimate obtained through a rapid assessment) · Modelling studies (e.g. Spectrum) · Delphi method or other consensus estimate
D2*	Estimate with methodology unknown

**Data graded D2 are excluded from the dataset*

Class	Data on the prevalence of HIV among people who inject drugs
A	Seroprevalence study
A1	Multi-site seroprevalence study with at least two sample types (e.g. treatment or outreach sample)
A2	Seroprevalence study from a single sample type
B	Registration or notification of cases of HIV infection (e.g. from treatment services)
C	Prevalence study using self-reported HIV
D1	· Official government estimate with no methodology reported · Modelling Studies (e.g. mode of transmission models)
D2*	Estimate with methodology unknown

**Data graded D2 are excluded from the dataset*

known country-level prevalence estimates from within the same sub-region. For countries where the best estimate was also presented with a range then these lower and upper estimates were incorporated into the 10th and 90th percentiles, respectively. The range reflects the sub-regional variability in prevalence estimates that were then applied to the population aged 15-64 from countries from within the same sub-region for which no country-level prevalence were available. By summing the upper and lower estimates for the number of PWID ranges in the regional and global estimates were calculated.

People who inject drugs living with HIV (PWID PLHIV):

Best estimates: Country-level estimates of the prevalence of PWID PLHIV were weighted by the number of PWID to obtain the sub-regional average. If the number of PWID was not known for a particular country with an PWID PLHIV estimate then the sub-regional average prevalence of PWID was used in the weighting. Countries within the same sub-region without a PWID PLHIV prevalence estimate were given the sub-regional average PWID PLHIV prevalence applied to number of PWID (known or sub-regional weighted average). The sub-regional numbers of PWID living with HIV were summed to obtain the regional and global estimates.

Range in numbers of PWID PLHIV: The range in the sub-regional estimates were calculated using the 10th and 90th percentiles of the known country-level prevalence estimates from within the same sub-region. For countries where the best estimate was also presented with a range then these lower and upper estimates were incorporated into the 10th and 90th percentiles, respectively. For each country a lower estimate of the number of PWID PLHIV was made using the lower estimate of the PWID PLHIV prevalence (either known or the sub-regional 10th percentile) and the lower estimate of the number of PWID (either known or sub-regional 10th percentile). The upper estimate was calculated in a similar manner using the upper estimate of PWID PLHIV prevalence and upper estimate of number of PWID. The estimated numbers of PWID PLHIV were summed to give regional and global lower and upper bounds to the number of PWID living with HIV.

Review of data and methodology for PWID and those among them living with HIV

In calculating the 2014 estimates, UNODC, UNAIDS, WHO and the World Bank joined forces and reached out to a broad group of experts from academia (including all former members of the Reference Group to the United Nations on HIV and Injecting Drug Use), regional, international and civil society organizations to ensure that a scientific approach to the methodology was used and to access the greatest number of data sets available worldwide

on the subject. The new estimates reflect the results of the third joint UNODC/WHO/ UNAIDS/World Bank data and methodology review.

Data quality of estimates on injecting drug use and HIV among PWID

Interpretation of regional and global estimates

The global and regional estimates of the prevalence of injecting drug use and HIV among people who inject drugs presented for 2014 in the *World Drug Report* should be viewed as an update to those presented in previous editions of the *World Drug Report* which reflects the latest data available. This year new or updated information was identified on PWID from 44 countries and on HIV among PWID from 46 countries. There is no intention to imply that there has been an actual change in the prevalence of injecting drug use or HIV among PWID at the regional or global level. The new values represent an update based on the best estimates that can currently be made using the most recent and highest quality data available to UNODC, WHO, UNAIDS, and the World Bank.

Quality of national-level data on PWID

Of the 104 countries with information on the prevalence of PWID, 67 per cent were of high methodological quality (class A, as defined in the table above) and 72 per cent related to timely data from 2010 or more recently. Nearly a half (49 per cent) of the countries have information that is from recent, methodologically high quality surveys. With a low level of coverage of the population aged 15-64 compared to other regions there is limited information on PWID for countries in Africa. It is noticeable that there are relatively few recent, methodologically high quality data from the Americas. However, for the two sub-regions with the highest prevalence of PWID (Eastern and South-Eastern Europe, and Central Asia and Transcaucasia) there is a very high percentage data coverage of the populations aged 15-64 and a high proportion of the data are both recent and of high methodological quality.

Quality of national-level data on HIV among PWID

Of the 117 countries with information on the prevalence of HIV among PWID, 65% were of high methodological quality (class A, as defined in the table above) and 62% related to timely data from 2012 or more recently. More than a third (40%) of the countries have information that is from both recent and methodologically high quality surveys. The Near and Middle East has no recent, methodologically high quality data, although the data that are available suggest a very low prevalence of injecting drug use and HIV among PWID. The two sub-regions that have by far the highest prevalence of HIV among PWID

Population coverage, timeliness and methodological quality of information from the 104 countries with data on people who inject drugs

Region	Subregion	Percent coverage of population aged 15-64	Number of countries reporting data / Total number	Of countries reporting data		
				Percent with recent data (2010 or more recent)	Percent with high methodological quality (class A)	Percent with recent and high methodological quality
Africa		**49.5**	**15 / 55**	**93**	**53**	**53**
America		86.2	14 / 50	71	29	14
	North America	100.0	3 / 3	33	33	0
	Latin America and the Caribbean	73.1	11 / 47	82	27	18
Asia		**94.3**	**32 / 49**	**63**	**66**	**47**
	Central Asia and Transcaucasia	93.6	7 / 8	57	100	57
	East and South-East Asia	95.1	13 / 19	69	54	38
	South-West Asia	100.0	3 / 3	67	67	67
	Near and Middle East	13.3	3 / 13	33	0	0
	South Asia	100.0	6 / 6	67	83	67
Europe		**99.9**	**41 / 50**	**71**	**85**	**59**
	Eastern and South-Eastern Europe	100.0	13 / 13	92	92	85
	Western and Central Europe	99.9	28 / 37	61	82	46
Oceania		**74.3**	**2 / 25**	**100**	**100**	**100**
Global		**87.7**	**104 / 229**	**72**	**67**	**49**

Sources for original estimates on PWID: UNODC annual report questionnaire, progress reports of UNAIDS on the global AIDS response (various years), the former Reference Group to the United Nations on HIV and Injecting Drug Use and national government reports.

Data coverage of HIV prevalence estimates among the estimated numbers of people who inject drugs, timeliness and methodological quality of information from the 117 countries with data on HIV among people who inject drugs.

Region	Subregion	Percent coverage of estimated number of people who inject drugs	Number of countries reporting data / Total number	Of countries reporting data		
				Percent with recent data (2012 or more recent)	Percent with high methodological quality (class A)	Percent with recent and high methodological quality
Africa		**65.9**	**21 / 55**	**57**	**76**	**43**
America		94.0	15 / 50	40	53	33
	North America	100.0	3 / 3	33	100	33
	Latin America and the Caribbean	75.5	12 / 47	42	42	33
Asia		**96.3**	**38 / 49**	**63**	**74**	**47**
	Central Asia and Transcaucasia	93.6	7 / 8	86	100	86
	East and South-East Asia	96.4	14 / 19	86	64	57
	South-West Asia	100.0	3 / 3	67	100	67
	Near and Middle East	55.6	9 / 13	22	44	0
	South Asia	99.9	5 / 6	40	100	40
Europe		**99.9**	**41 / 50**	**71**	**54**	**32**
	Eastern and South-Eastern Europe	100.0	13 / 13	77	77	62
	Western and Central Europe	99.9	28 / 37	68	43	18
Oceania		**74.3**	**2 / 25**	**100**	**100**	**100**
Global		**95.1**	**117 / 229**	**62**	**65**	**40**

Sources for original estimates on HIV among PWID: UNODC annual report questionnaire, progress reports of UNAIDS on the global AIDS response (various years), the former Reference Group to the United Nations on HIV and Injecting Drug Use and national government reports.

(South-West Asia, and Eastern and South-Eastern Europe) have prevalence estimates from all countries and from recent methodologically high quality data sources from a good percentage of those countries.

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 2014. The estimated number of drug-related deaths for 2014 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. Because of the lack of reported information on drug-related deaths in Africa, an alternative source was used.[3] The wide range in the estimates for Asia reflects the low level of reporting from countries in the region. The best estimate for Asia is placed towards the upper end of the reported range because a small number of highly populated countries reported a relatively high mortality rate, which produces a high regional average. 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.

3 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 the Global Illicit Crop Monitoring Programme (ICMP). The detailed country reports can be found on the UNODC website https://www.unodc.org/unodc/en/crop-monitoring/index.html

UNODC estimates for Afghanistan cover the period 1994-2015. UNDOC supported monitoring systems in most other countries started following UNGASS 1998, became operational over the 2000-2002 period and have reported data ever since. Opium cultivation and production estimates are available up to the year 2015. For the year 2015 UNODC also published, for the first time, the results of the opium cultivation monitoring system of Mexico, supported by UNODC. Data published for Mexico up the to year 2014 have been based on estimates provided by the US State Department in its annual International Narcotics Control Strategy Report (INCSR) and are – for methodological reasons – not directly comparable with the new estimates from the new Mexican crop monitoring system. Coca cultivation estimates in the three main Andean coca producing countries have been available – at the time of drafting the World Drug Report - up to the year 2014. Results for the year 2015 will be published on UNODC's website as soon as the new reports will have been released. Estimates of cannabis cultivation in 2009, 2010, 2011 and 2012 in Afghanistan, as well as cannabis cultivation in 2003, 2004 and 2005 in Morocco, were also produced by the UNODC-supported national monitoring systems and can be found on the UNODC website. Estimates for other countries were 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. Opium poppy cultivation in countries which do not conduct area surveys, was estimated with an indirect method (see below). Sub-regional and global totals shown for the year 2015 for opium are still preliminary. In case no new data for opium poppy cultivation and opium production for the year 2015 were available at the time of writing the report, previous year estimates for the missing countries were used to arrive at the sub-regional and global estimates. The sub-regional and global estimates for 2015 will thus be adjusted in next year's World Drug Report once actual data for the missing countries will have become available. The missing countries, however, accounted only for a very small proportion of overall opium poppy cultivation and production in 2014. Thus, only small changes in the overall totals for the year 2015 can be expected to occur.

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 https://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, only the area of opium poppy eradicated before the annual opium survey is taken into account for the estimation of the 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, abandonment, reactivation of previously abandoned fields, manual eradication and aerial spraying.[4]

The issue of different area concepts and data sources used to monitor illicit coca bush cultivation continues to be investigated by UNODC.[5] To improve the comparability of estimates between countries, since 2011 net coca cultivation area at 31 of December is presented not only for Colombia but also for Peru. 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. The Colombia coca cultivation series includes adjustments for small fields since 2009 while previous years did not require adjustment. For more details, please see the country specific reports.

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

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

5 See World Drug Report 2011, p. 262.

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 3.0 (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 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 Spain[6] 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. Loewe[7] found biomass yields between 3,921 kg/ha to 5,438 kg/ha in trial cultivation under greenhouse conditions. Acock et al.[8] 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 no eradication or plant seizure was reported in that period, no value was calculated.

Yield[9] 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

6 Personal communication, 2010, from Alcaliber company.

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

8 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.

9 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).

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, Myanmar and Lao PDR, 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 these two countries, yield surveys are carried out only occasionally, due to the difficult security situation in many coca regions and because of funding constraints. In Colombia, coca leaf yield estimates are updated yearly through a rotational monitoring system introduced in 2005 that ensures that every yield region is revisited about every three years. However, as the security situation does not allow for surveyors to return to the sample fields, only one harvest is measured, and the others are estimated based on information from the farmer. In 2013 for the first time the concept of productive area was applied to calculate the coca leaf yields in Colombia, taking into account the dynamics of the fields due to spraying and eradication for which some fields are only partly productive during the year. This new way of calculating was retroactively applied to the results of 2009-2012, giving slightly different results than published before [10]. In Peru and Bolivia the additional production of partly productive areas are not considered for the coca leaf yield estimates.[11]

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, continues to review coca leaf to cocaine conversion ratios as well as coca leaf yields and net productive area estimates.[12] More research is needed to establish comparable data for all components of the cocaine production estimate.

10 More information on the results of the methodology used can be found in the report on coca cultivation in Colombia for 2013 (UNODC/ Government of Colombia, June 2014) available on the internet at http://www.unodc.org/unodc/en/crop-monitoring/index.html.

11 In 2013 a correction factor was applied for the time that fields were productive during the year, however this approach was abolished as of 2014 due to incomplete eradication data. More information about the 2013 calculation to be found at page 73 of the Peru coca cultivation survey report for 2013 available on the internet at http://www.unodc.org/unodc/en/crop-monitoring/index.html.

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

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, 2011 and 2012. 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.[13] Given the high level of uncertainty and the continuing lack of information for the large majority of cannabis-cultivating countries, the estimates of global cannabis herb and resin production have not been calculated.

Potential production

'Potential' heroin or cocaine production refers to total production of heroin or cocaine if all the cultivated opium or coca leaf, less the opium and coca leaf consumed as such, were transformed into the end products in the respective producer country in the same year.. It should be noted though that a product such as opium can be stored for extended periods of time and be converted into intermediate or final products long after the harvest year. Thus 'actual' heroin manufacture, making use of accumulated stocks of opium from previous years, can deviate significantly from 'potential' heroin manufacture out of the opium produced in a specific year. Direct consumption of opium or the coca leaf, in contrast, is being taken into account. For example, consumption of coca leaf considered licit in the Plurinational State of Bolivia and Peru is deducted from the amounts of coca available 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. Similarly, opium consumed in Afghanistan and neighbouring countries is deducted from the amounts of opium available for heroin production. In contrast, opium stocked or opium used from stocks accumulated over previous years is not considered in the calculation of 'potential' heroin manufacture.

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, two conversion ratios are used. Apart from Afghanistan, 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. For Afghanistan, the calculations are more detailed, here the share of all opium converted to heroin is estimated and a specific conversion ratio is applied, which uses an estimated purity for heroin of export quality.

Although it is based on current knowledge on the alkaloid content of narcotic plants and the efficiency of clandestine laboratories, it should be noted that '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 also 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 2013, for the first time, and again in 2014 the yearly productive areas were estimated, instead of using the average area under coca cultivation of the reporting year and the previous year (the approach used in previous reports). In addition a different conversion factor for estimating cocaine base was applied. Both the adjustment of the productive area estimate and the estimation of the conversion factor for cocaine base were retroactively applied to the results of 2009-2012, giving slightly different results than published before.[14]

Peru

Potential cocaine production in Peru is estimated from potential coca leaf production and 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.

"Old" versus "new" conversion ratios for cocaine

In order to estimate cocaine production from the area under coca cultivation, the coca leaf yield per region is estimated based on yield studies as well as – based on experiments in the field - the coca-leaf to coca-paste conversion, the coca-paste to cocaine base conversion and the cocaine-base to cocaine hydrochloride conversion. The

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

14 More information on the results of the two approaches and the methodology used can be found in annex 3 of the report on coca cultivation in Colombia for 2013 (UNODC/ Government of Colombia, June 2014) available on the internet at http://www.unodc.org/unodc/en/crop-monitoring/index.html.

results are then adjusted to show an overall conversion ratio from coca leaf to (a potential) 100 per cent pure cocaine hydrochloride.

In this report the 'old' conversion ratios from coca leaf to cocaine hydrochloride are based on studies conducted by the United States Drug Enforcement Administration (DEA) in the Andean region in the 1990s. The ratios for Colombia – in close cooperation with the Colombian authorities - were updated in 2004 and are part of the 'old' conversion ratio series.

In subsequent years the DEA undertook new studies in Peru (2005) and in the Plurinational State of Bolivia (2007-2008), following indications that the laboratory efficiency in these countries may have improved. The 'new' conversion rates found in this report – for the years 2007-2014, however, have not been reconfirmed so far in national studies as funds for such studies have not been forthcoming. For this reason, cocaine production data are not shown separately for Peru and the Plurinational State of Bolivia; only the global total based on the 'new' conversion ratio is shown. The calculations of cocaine production based on the "new" conversion ratios refer to the "new" coca leaf to cocaine hydrochloride transformation ratios found by the DEA for Colombia, Peru and the Plurinational State of Bolivia and the updated ratios for Colombia. It should be noted that the 'new' conversion ratios are still temporary; they will be updated as soon as new data, jointly established between the respective Member States and UNODC will become available. (For more details, see *World Drug Report 2010* (United Nations publication, Sales No. E.10.XI.13, pp. 251 and 252).)

Drug trafficking

Seizures

The analysis presented in this report is mainly derived from the ARQ responses from Member States up to the 2014 reporting year. Including information from other sources, UNODC was able to obtain seizure data from 123 countries and territories for 2014. Over the 2009-2014 period seizures from in total 173 countries and territories were received. 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.

Seizures are reported in volume terms as well as in terms of the number of seizure cases. The analysis of seizure cases enables a direct comparison of data across drug categories. Reporting of seizure cases is, however, less comprehensive. A total of 64 countries and territories reported seizure cases to UNDOC in 2014, or 121 countries and territories over the 2009-2014 period.

Countries reporting seizures of drug in volume terms may report seizures 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 this unique unit of measurement. Moreover, at some 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 terms of the number of tablets. Apart from seizures of ATS tablets, drug seizures are mainly reported to UNODC by weight, and sometimes by volume This includes seizures of ATS which are not seized in tablet form (for example, ATS in powder, crystalline or liquid 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 aggregated 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 only. Moreover, given the availability of data, accurate purity adjustments for bulk seizure totals in individual countries are feasible in only a 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 below lists the factors used for 'ecstasy', amphetamine, methamphetamine, and non-specified ATS. The conversion factors remain subject to revision as the information available to UNODC improves.

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;

Weight of tablets in milligrams

	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 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

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 an average weight of 100 grams.

Trafficking routes and volumes

Information of trafficking routes was mainly obtained from analyses of reports by Member States in the annual report questionnaire and in individual drug seizures reported to UNODC, as well as analyses of trafficking routes reported by Member States.

Individual drug seizures would be the ideal data source for any in-depth analysis of drug flows. Unfortunately, reporting of individual drug seizure cases is very uneven. A total of just 34 countries reported individual drug seizures to UNODC in 2014 (101 over the 2009-2014 period). For most drug categories, reported individual drug seizures only account for a small proportion of global seizures (as reported to UNODC in the annual report questionnaire).

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 relatively 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.

Prices are collected in local currency or in the currency in which the transactions take place and are then converted by UNODC into US dollars for the purposes of comparability among countries. The conversion into US dollars is based on official UN rates of exchange for the year. If comparisons of prices, expressed in US dollars are made over different years it should be noted that changes in such prices may be also influenced by changes in the exchange rates and may not necessarily reflect changes in the local markets.

Market analysis

Calculation of interception rates

In the subchapters on the opiate market and the cocaine market interceptions rates were calculated. The interception rate is the ratio of seizures divided by production and can be used as an indicator for the efficiency of law enforcement.

For the calculation of the opiate interception rates seizure data of opium, morphine and heroin were transformed into opium equivalents. Typically, a ratio of 10 kilogram of opium for 1 kilogram of morphine or heroin is used. In order to show results as a range, calculations were based a conversion ratio of 7:1 (as the lower range of the inter-

ception rate) and a conversion of 11.6 : 1 (as the upper limit of the interception rate). The lower limit represents the conversion ratios used in the Afghan opium surveys in previous years and the upper limit represents the conversion ratios used in the Afghan opium surveys in recent years. The average opiate seizures over the 1980-1989 period, the 1990-1997 period , the 1998-2008 period and the 2009-2014 period, expressed in opium equivalents were then compared to the average global opium production estimates over the same periods. Available data – theoretically - would have also allowed to calculate the interception rate for each year; such a calculation, however, would have been – most likely – highly misleading as not all of the opium produced in a year is actually sold; some of it is stocked and, in other years, heroin is produced out of stocks accumulated over previous years. While changes in stocks are important for individual years, stocks do not change too much once an average of several years is considered. The calculation of the interception rate over a number of years is thus far more meaningful than the calculation of an interception rate for any specific year.

Cocaine production estimates are shown in equivalents of 100 per cent pure cocaine. Thus, all cocaine seizures also needed to be transformed into 100 per cent pure cocaine equivalents. The problem here is that purity data are not systematically reported by all member states. Two approaches were used here to undertake the purity adjustment. The first approach was to base all conversions on the purities as reported in a specific year. An unweighted average of the reported wholesale purities was calculated for each year and the reported seizures of each year were adjusted with the an unweighted purity ratio for the specific year. The calculation of the interception rates for cocaine was then based on the averages of the purity adjusted seizures over the periods 1980-89, 1990-97, 1998-2008 and 2009-2014 and the cocaine production estimates over the same periods. For the calculation of the average cocaine production estimates, the coca-leaf to cocaine conversions based on the 'old' conversion ratios were used for the years 1980-2006 while the 'new' conversion ratios were used for the years 2007-2014. (2007 was the first year for which the calculation based on the 'new' conversion ratios was available).

For the year 2014 calculation based on unweighted purities and based on purities weighted by seizures is shown. For the latter exercise, which is more labour and time intensive, purities reported for 2014 or the latest year available were used. Seizures were then weighted with these purities. For countries still not found to report any cocaine wholesale purities over the last decade, the unweigthed regional average was used as a proxy. The result of these calculations (showing an interception rate of more than 50 per cent) suggested that the cocaine interception rates based on unweighted purities are probably still an underestimate of the actual interception rate achieved by police forces across the world.

Calculation of amounts of opiates available for consumption, estimates of actual consumption and changes in opium inventories

In order to calculate the amounts available for consumption global seizures of opiates (opium, morphine and heroin), expressed in opium equivalents, were deducted from global opium production. For these calculations it was assumed that, on average, some 10 kilograms of opium are required for 1 kilogram of morphine or heroin.

For the estimate of actual consumption the following the number of opiate users, taken from this and past World Drug Reports, was multiplied, each year, by an average per capita consumption rate of opiate use. In order to arrive at such per capita consumption estimates, the total amount of opiates (expressed in opium equivalents) available for consumption was divided by the global number of opiate users. Such ratios fluctuated, however, strongly over the 1998-2015 period. In a subsequent step, a linear regression, based on the calculated annual per capita use levels was undertaken. The resulting model ($y = 0.846 + 244.39$) suggested a small increase in per capita use of opiates from 245 grams of opiates in opium equivalents in 1998 to 260 grams per user in 2015 (equivalent to some 26 grams of pure heroin per user, assuming a 10:1 conversion ratio for opium to heroin). These per capita consumption estimates were then multiplied with the number of opiate users. This gave an estimate of the likely demand for opiates each year. Differences to the opium available for consumption indicated in this model either a built-up or a depletion of inventories in specific years.

New Psychoactive Substances

The main data source for new psychoactive substances (NPS) in the World Drug Report is the UNODC Early Warning Advisory on New Psychoactive Substances (www.unodc.org/nps). This monitoring mechanism compiles information on the emergence of NPS by substance, year and country mainly from a network of forensic laboratories, UNODC questionnaire surveys on NPS, EMCDDA and the ARQ.

CHAPTER 2 – THE WORLD DRUG PROBLEM AND SUSTAINABLE DEVELOPMENT

Additional sources

Box: Example of development programmes that may have triggered illicit cultivation

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Methodology

Below are specifics concerning the methodology and the definitions of concepts used in the analysis.

Figure 6: Unemployment[a] among past-month drug users in the United States, by drug type, 2013

a The methodology of the United States National Survey on Drug Use and Health (NSDUH) classifies respondents into the categories "Employed full-time", "Employed part-time", "Unemployed", "Other (including not in labor force)" and "12-14–year-olds". The unemployment rate in this figure is the estimated number of "unemployed" individuals as a percentage of the estimated total of the first three categories. The NSDUH survey is undertaken independently of the Current Population Survey, conducted monthly by the United States Bureau of Labor Statistics (BLS), the main source for unemployment statistics. For 2013, the United States Bureau of Labor Statistics provides an estimate of 7.4 per cent for the unemployment rate, among a civilian labour force of 155 million, drawn out of a civilian non-institutional population of 246 million. For the purposes of comparison, the NSDUH survey data yield a rate of 7.9 per cent among a population of 169 million (corresponding to the total of the three categories "Employed full-time", "Employed part-time" and "Unemployed") drawn from a population of 262 million individuals aged 12 or older.

The label 'Cocaine but not "crack" ' refers to the population of individuals who used cocaine, but not "crack" cocaine during the previous month. This may be smaller than the entire population of individuals who used some form of cocaine other than "crack" cocaine during the previous month, as it excludes individuals who may have used "crack" as well as another form of cocaine.

Figure 7: Increased likelihood of being a past-month drug user among the unemployed population, compared with the population in full-time employment in the United States, by drug type, 2013

a The label 'Cocaine but not "crack" ' refers to the use of cocaine during the previous month, without using "crack" cocaine during the same period. This does not coincide with the use of a form of cocaine other than "crack" during the previous month (independently of whether "crack" cocaine was used).

Footnote 214

The "non-agricultural alternative development" category has been defined in the OECD Creditor Reporting System purpose codes (valid for reporting up to and including 2014 flows; available at www.oecd.org), to be applied for "projects to reduce illicit drug cultivation through, for example, non-agricultural income opportunities, social and physical infrastructure".

Footnote 215

The figures for the category "narcotics control" include "development-related" anti-narcotics activities such as educational programmes and awareness-raising campaigns to restrict distribution of illicit drugs, as well as training of police and customs officers. Not included here are donor activities to destroy crops, interdict drug supplies or train and finance military personnel in anti-narcotics activities (see the purpose codes of the OECD Creditor Reporting System Aid Activities database (valid for reporting up to and including 2014 flows), available at www.oecd.org).

Footnote 216

See *Official Records of the Economic and Social Council, 2009, Supplement No. 8* (E/2009/28), chap. I, sect. C.

Footnote 217

The fractions mentioned in this paragraph express the commitments explicitly labelled in the OECD Creditor Reporting System as intended for countries in the beneficiary region, as a proportion of the total commitments, which include funds labelled with unspecified beneficiary countries or broad regions. If it were possible for the funds to be labelled with unspecified beneficiaries assigned to their ultimate beneficiary countries, the proportions could potentially be higher.