4. Methodology

Considerable efforts have been made over the last few years to improve the estimates presented in this report. Nonetheless, the data must still be interpreted with caution because of the clandestine nature of drug production, trafficking and abuse. Apart from the 'hidden' nature of the phenomenon being measured, the main problems with regard to data relate to the irregularity and incompleteness in reporting. This affects the quantity, quality and comparability of information received. First, the irregular intervals at which some Governments report may result in absence of data in some years but availability in others. The lack of regular data, for which UNODC tries to compensate by reference to other sources, can influence trend patterns. Secondly, submitted questionnaires are not always complete or sufficiently comprehensive. All figures should thus be seen as likely orders of magnitude of the drug problem, but not as precise results. It should be also noted that all figures provided, particularly those of more recent years, are subject to updating.

Sources of information

Under the International Drug Conventions, Member States are formally required to provide drug related information annually, as detailed by the Commission on Narcotic Drugs, to the 'Secretary General' of the United Nations (i.e. the Secretariat of UNODC). The Commission on Narcotic Drugs developed the Annual Reports Questionnaire (ARQ) to collect these data.

The World Drug Report 2007 is based primarily on data obtained from the ARQs returned by Governments to UNODC over the June 2006 to May 2007 period. The data collected during this period normally refer to the drug situation in 2005. UNODC sent out the questionnaire to 192 countries. Some of them were forwarded on to autonomous territories, thus bringing the total to 198. UNODC received 104 replies to its questionnaire on Drug Abuse (Part II) and 120 replies to its questionnaire on Illicit Supply of Drugs (Part III). The best coverage was from countries in Europe (89% of all countries in Europe filled in both Part II and Part III of the ARQ), followed by the Americas (66% of the countries filling in the Supply and 42% the Demand ARQ) and Asia (63% Supply / 58% Demand ARQ). In the case of Africa, 40% of countries replied to the Supply ARQ and 35% to the Demand ARQ. In the Oceania region, the two largest countries supplied information, equivalent to 13% of the countries in the region. Member states' responses to the ARQs are shown on the subsequent maps.

In general, the ability of Member States to provide information on illicit drug supply is significantly better than their ability to provide demand related information. The analysis of the 'Supply ARQs' revealed, that 77% of them were 'substantially' completed compared to just 54% of the 'Demand ARQs'. (ARQs which were more than 50% completed were classified as having been 'substantially filled in'; the rest were classified as having been only partially filled in.)

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

- For the 'Supply ARQs', this included replies to the questions on 'seizures', i.e. on the quantities seized (replied by 97% of the countries returning the ARQ), the number of seizure cases (75%), 'trafficking' (origin of drugs (69%) and destination (62%)), 'drug prices' (90%), 'drug related arrests'(87%) and 'convictions' (41%). The overall analysis of these data revealed – as mentioned before - that 'Supply ARQs' were 77% completed.
- For the Demand ARQs, the key questions used for the analysis referred to 'trends in drug abuse' (replied by 92% of the Member States), 'ranking of drugs in terms of their prevalence among the general population' (89%), 'prevalence estimates' (general population (35%), students (42%); problem drug use (30%)), 'drug related deaths' (35%), and 'treatment' (53%). The overall response rate of completion was 54% for the countries which returned a 'Demand ARQ' to UNODC.

Information provided by Member States in ARQs 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 nec-

essary and where available, the data from the ARQs are thus supplemented with data from other sources.

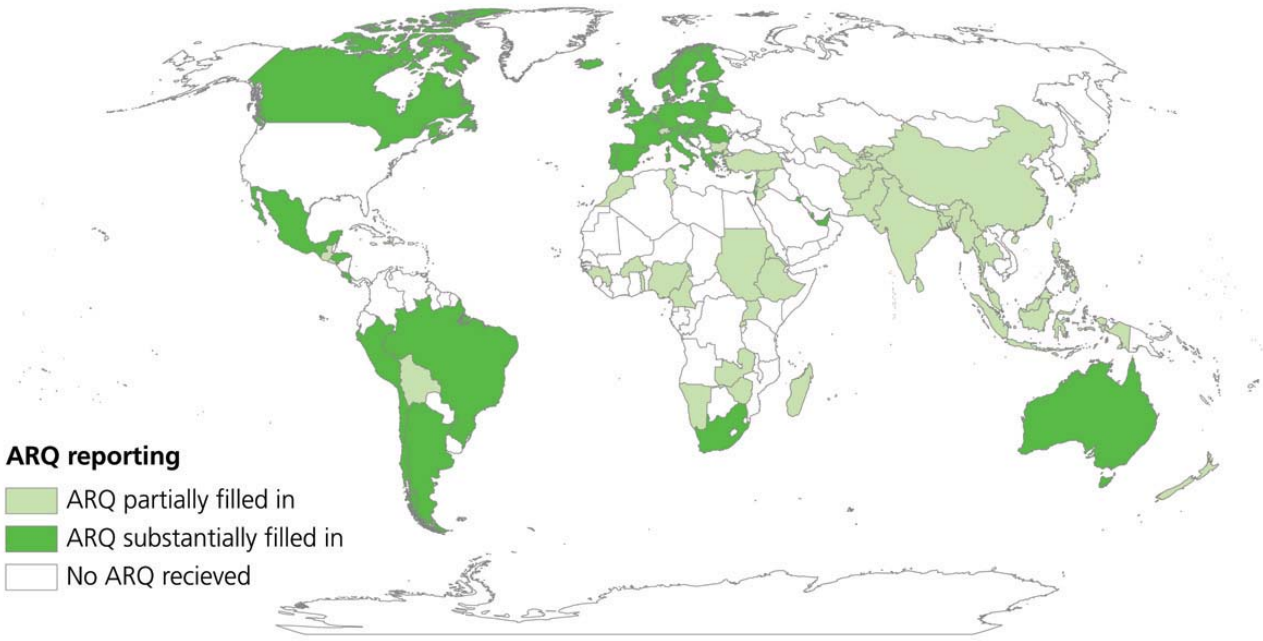
As in previous years, seizure data made available to UNODC via the ARQs was complemented primarily with data from Interpol/ICPO, data provided to UNODC by the Heads of National Law Enforcement Agencies (HONLEA) at their regional meetings, data provided through UNODC's 'Data for Africa' project, and UNODC's, 'Drug Abuse Information Network for Asia and the Pacific' (DAINAP). In addition, Government reports have been used, wherever available. Other sources considered, included data published by the United States Department of State's Bureau for International Narcotics and Law Enforcement Affairs in its International Narcotics Control Strategy Report.

Price data for Europe was complemented with data from Europol. Precursor data presented are basically those collected by the International Narcotics Control Board (INCB). Demand related information was obtained through a number of additional channels, including UNODC's Global Assessment Program (GAP), the drug control agencies participating in 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). National government reports published in the scientific literature were also used as sources of information. This type of supplementary information is useful and necessary as long as Member States lack the monitoring systems necessary to produce reliable, comprehensive and internationally comparable data.

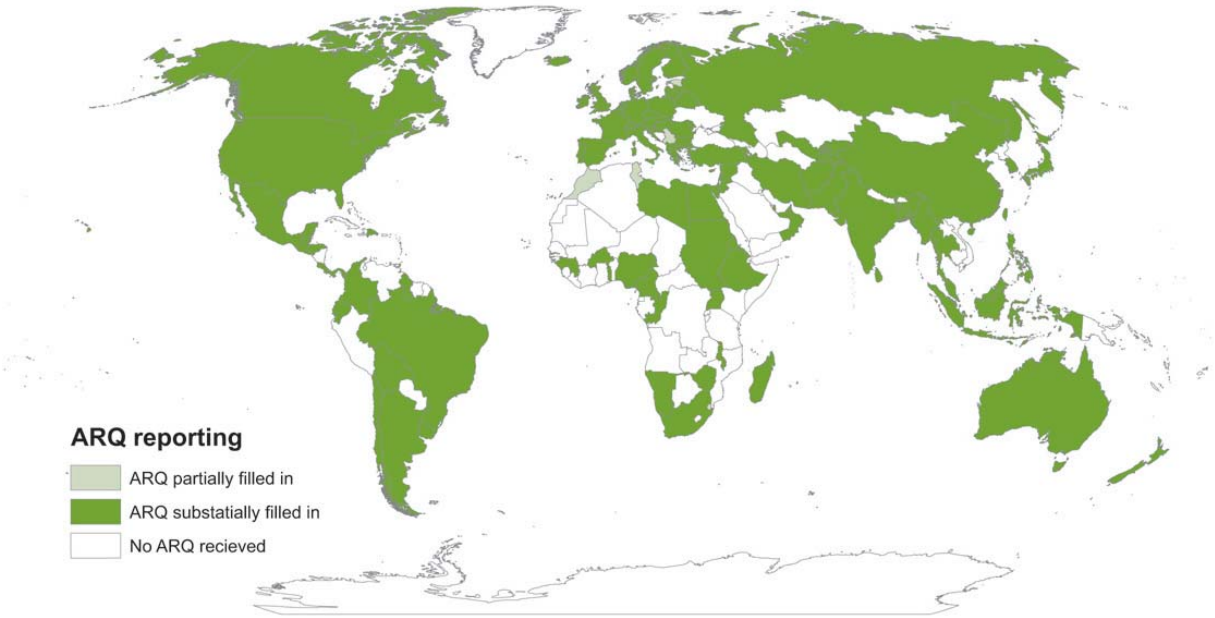
To this end, UNODC encourages and supports the improvement of national monitoring systems. Major progress has been made over the last few years in some of the main drug producer countries. In close cooperation with UNODC's Illicit Crop Monitoring Program (ICMP) and with the support of major donors – these countries have developed impressive monitoring systems designed to identify extent of and trends in the cultivation of narcotic plants. These data form another fundamental basis for the trend analysis presented in the World Drug Report.

There remain significant data limitations on the demand side. Despite commendable progress made in a number of Member States, in the area of prevalence estimates for example, far more remains to be done to provide a truly reliable basis for trend and policy analysis and needs assessments. The work being done on the World Drug Report 2007 provides yet another opportunity to emphasise the global need for improving data collection and monitoring to improve the evidence base for effective policy.

Reporting of Annual Report Questionnaires (ARQ) Part II, Drug Abuse, for the year 2005



Reporting of Annual Report Questionnaires (ARQ) Part III, Ilicit supply of drugs, for the year 2005



Sources and limitations of data on the supply side

Cultivation, production and manufacture

Global estimates are, in general, more robust on the production side, notably data for plant based drugs, than on the demand side. In line with decisions of the Member States (1998 UNGASS and subsequent Commission on Narcotic Drugs resolutions), UNODC launched an Illicit Crop Monitoring Programme (ICMP) in 1999. The objective of the programme is to assist Member States in establishing national systems to monitor the extent and evolution of the illicit cultivation of narcotics crops on their territories. The results are compiled by UNODC to present global estimates on an annual basis. Data on cultivation of opium poppy and coca bush and production of opium and coca leaf, presented in this report for the main producing countries (Afghanistan, Myanmar and Laos for opium and Colombia, Peru and Bolivia for coca) have been derived from these national monitoring systems operating in the countries of illicit production, covering the period up to, and including 2006. The Government of Morocco, in cooperation with UNODC, also conducted surveys on illicit cannabis cultivation and cannabis resin production in 2003, 2004 and 2005. Estimates for other countries presented in this report have been drawn from replies to UNODC's Annual Reports Questionnaire, from 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.

The key indicator for measuring progress made towards the supply reduction goals set out in the UNGASS Political Declaration of June 1998 is the area under cultivation of narcotic crops. Since 1999, UNODC has been supporting the establishment of national monitoring systems in the main narcotics production countries. These monitoring systems are tailored to national specificities. The direct participation of UNODC ensures the transparency of the survey activities. Through its network of monitoring experts at headquarters and in the field, UNODC ensures the conformity of the national systems so that they meet international methodological standards and the information requirements of the international community. Most of these monitoring systems rely on remote sensing technology (i.e. analysis of satellite imagery) in combination with extensive field visits which is made possible through UNODC's field presence in all of the main narcotics producing countries. Satellite images, in combination with ground information, offer a reliable and objective way of estimating illicit crops. Depending on the local conditions, the surveys are conducted either on a census approach (coca cultivation in Colombia, Peru and Bolivia, cannabis cultivation in Morocco) or a sample approach

(opium poppy cultivation in Afghanistan, Myanmar and Laos). The accuracy assessment of the individual estimates differs, but is often close to 90%, i.e. 'ground truthing' shows that about 90% of the areas analysed from satellite photos were correctly identified as poppy fields or coca fields. In the case of sampling, the potential error depends on the number of villages investigated and/or on the number of satellite photos taken which form the basis for subsequent extrapolations to the agricultural land. In the case of Afghanistan, for instance, the estimated area under poppy cultivation in the 2006 opium poppy survey ranged, within the confidence interval (α= 0.1) between 150,000 and 180,000 hectares, or +/-9 percent of the calculated value of 165,000 hectares.

In addition, ground surveys, assist UNODC to obtain information on yields, drug prices and various other socio-economic data that is useful for alternative development interventions. Detailed discussion of the methodological approaches can be found in the methodology section of each survey. (http://www.unodc.org/unodc/en/crop_monitoring.html)

UNODC has also started to conduct yield surveys in some countries, measuring the yield of test fields, and to develop methodologies to extrapolate the yields from proxy variables, such as the volume of poppy capsules or the number of plants per plot. This approach is used in South-East Asia as well as in Afghanistan. All of this is intended to improve yield estimates, aiming at information that is independent from farmers' reports. The accuracy of the calculated yields depends on a number of factors, including the number of sites investigated. In the case of Afghanistan the confidence interval for the mean yield results in the 2006 survey was, for instance, +/- 3% of the mean value (α= 0.1).

In areas in which UNODC has not, as yet, undertaken yield surveys, results from other surveys conducted at the national level are used instead. This is currently still the case for some parts of Bolivia (Chapare) while in other parts of the country (Yungas) as well as in Colombia and in Peru UNODC has already conducted yield surveys in cooperation with the local authorities. The disadvantage of having to take recourse to yield data from other sources is that the sampling strategies does not necessarily fit UNODC's definition of an area under cultivation, and that year on year variations due to weather conditions or due to the introduction of improved seeds, fertilizers and pesticides, are not properly reflected in the end results. The new surveys found higher yields than previous estimates had suggested. As a consequence, a number of figures had to be retroactively adjusted and the global cocaine estimates are now slightly higher than those published in previous World Drug Reports.

The transformation ratios used to calculate the potential cocaine production from coca leaf or the heroin production from opium are even more problematic. In order to be precise, these calculations would require detailed information at the local level on the morphine content in opium or the cocaine content in the coca leaf, as well as detailed information on the clandestine laboratory efficiency, which in turn is a function of know-how, equipment and precursor chemicals. This information is not available. A number of studies conducted by enforcement agencies in the main drug producing countries have provided some orders of magnitude for the transformation from the raw material to the end product. The problem is that this information is usually based on just a few case studies which are not necessarily typical for the production process in general. Potential margins of error in this rapidly changing environment, with new laboratories coming on stream while others are being dismantled, are thus, substantial. This also applies to the question of the psychoactive content of the narcotic plants. One study conducted in Afghanistan by UNODC over a couple of years, indicated, for instance, that the morphine content of Afghan opium was significantly higher than had been thought earlier. Based on this study, in combination with information on the price structure (which suggested that at a 10:1 conversion ratio of opium to heroin laboratory owners would lose money), it became clear that this conversion ratio had to be changed. In 2005, the transformation ratio was finally changed to 7:1, following, additional information obtained from interviews with morphine/heroin producers in Afghanistan. This ratio remained unchanged for 2006 as well.[a]

For cocaine, a number of studies have been conducted in the Andean region over the last decade investigating the transformation ratios of coca leaf to cocaine base and cocaine HCL - which also form the basis for UNODC's estimates. However, some of the conversion ratios are not in line with reported price patterns of these substances, raising some questions as to their appropriateness and indicating a need to revisit them. At the same time, it is obviously impossible for UNODC to set up clandestine laboratories and hire 'cooks' in order to improve its statistical basis. All of this underlines the ongoing difficulties to accurately assess global heroin and cocaine production, despite the progress made in assessing the area under cultivation and other aspects of cultivation and production.

[a] Details are summarised in UNODC, Afghanistan Opium Survey 2006, pp. 122-124.

'Potential' heroin or cocaine production shows the level of production of heroin or cocaine if the opium or coca leaf were transformed into the end products in the respective producer country. Part of the opium or the coca leaf is directly consumed in the producing countries or in neighbouring countries, prior to the transformation into heroin or cocaine. In addition, significant quantities of the intermediate products, coca paste or morphine, are also consumed in the producing countries. These factors are partly taken into account. Coca leaf considered licit in Bolivia and Peru is not taken into account for the transformation into cocaine. Similarly, opium consumed in Afghanistan, Iran and Pakistan is not considered to be available for heroin production. As a result, global estimates of 'potential' production should be rather close to 'actual' production. Moreover, as the transformation ratios used are rather conservative, total 'potential' production may well be close to 'actual' production of the end products if one takes the de-facto lower amounts available for starting the transformation process into account.

The use of the concept of 'potential production' at the country level also means that 'actual' heroin or cocaine production is under-estimated in some countries, and over-estimated in others while the estimate for the global level should be only slightly affected by this. The calculation of 'potential' cocaine production estimates for Peru, for instance, exceeds actual local cocaine production as some of the coca paste or coca base produced in Peru is exported to neighbouring Colombia and other countries for further processing into cocaine. Based on the same reasoning, potential cocaine production estimates for Colombia under-estimate actual cocaine production in the country. Actual cocaine manufacture in Colombia takes place from locally produced coca leaf as well as from coca base imported from Peru.

Despite all of these difficulties, the overall accuracy of the global heroin and cocaine estimates has certainly improved over the last few years and can be considered to be reasonably good.

The situation is less satisfactory when it comes to cannabis. In the case of cannabis herb, the globally most dispersed illegal drug, all available production estimates were aggregated. In most cases, these estimates are, however, not based on scientific studies (often reflecting potential yields of eradicated areas rather than actual production) and often refer to different years (as only a limited number of countries provide such estimates in their annual reports questionnaires). A significant number of countries do not provide any estimates. Therefore, a systematic review was undertaken, once again, of all those countries which over the last decade were identified by other countries as a significant cannabis source countries or which reported the seizures of whole cannabis plants (which is indicative of domestic cultivation). For those countries, production was estimated to cover domestic demand, multiplying the number of estimated cannabis users by the average global cannabis herb consumption rate, derived from previous calculations. For countries that were identified as cannabis producing countries but were not identified as major cannabis exporting countries, a certain percentage of domestic demand was used to estimate local production. The percentages chosen depended on quantitative and qualitative information available for different regions. Clearly, this is not an ideal estimation technique but the best that is currently available.

In the case of cannabis resin, scientific information on the – most likely - largest cannabis resin producing country is available which, in combination with seizure statistics, forms a basis for extrapolations to the global level. Another estimate was based on global cannabis herb production estimates and the proportion of resin to herb seizures, assuming that cannabis resin and cannabis herb have the same likelihood to be seized. The average of these two estimates forms UNODC's cannabis resin estimate.

The approach taken to come up with ATS production estimates is one of triangulation, estimating production based on reported seizures of the end products in combination with some assumptions of law enforcement effectiveness, seizure data of precursor chemicals and estimates based on the number of consumers and their likely levels of per capita consumption. The average of these three estimates is then used to arrive at UNODC's global estimates for amphetamine, methamphetamine and ecstasy production. The estimation procedure remained largely unchanged from the one used since the 2004 World Drug Report, which was based on the methodology developed for UNODC's *Study on Ecstasy and Amphetamines, Global Survey 2003*.

Trafficking

The information on trafficking, as presented in this report, is mainly drawn from the Annual Reports Questionnaires (ARQ), submitted by Governments to UNODC in 2006 and early 2007 and refers to the year 2005 (and previous years). Additional sources, such as other Government reports, Interpol, the World Customs Organization (WCO), reports by the Heads of National Law Enforcement Agency (HONLEA), data provided via UNODC's 'Data for Africa' project, data provided via UNODC's, 'Drug Abuse Information Network for Asia and the Pacific' (DAINAP), and UNODC's field offices, were used to supplement the

information. Priority was, however, given to officially transmitted data in the Annual Reports Questionnaire. The analysis of quantities seized, shown in this report, was based on ARQ's returned by 120 countries over the June 2006–May 2007 period, of which 118 countries provided seizure information. Including information from other sources, UNODC has in its data base (DELTA) seizure data from 165 countries for the year 2005, up from 156 countries in 2004. Seizures are thus the most comprehensive indicator of the drug situation and its evolution at the global level. Although they may not always reflect trafficking trends correctly at the national level, they tend to show good representations of trafficking trends at the regional and global levels.

There are some technical problems as – depending on the drugs - some countries report seizures in weight terms (kg), in volume terms (litres) while other countries report seizures in 'unit terms'. In the online interactive seizure report (http://www.unodc.org/ unodc/en/ world_drug_report.html), seizures are shown as reported. In the World Drug Report, seizure data have been aggregated and transformed into a unique measurement: seizures in 'kilogram equivalents'. For the purposes of the calculations a 'typical consumption unit' (at street purity) was assumed to be: cannabis herb: 0.5 grams, cannabis resin: 0.135 grams; cocaine and ecstasy: 0.1 grams, heroin and amphetamines: 0.03 grams, LSD: 0.00005 grams (50 micrograms). A litre of seizures was assumed to be equivalent to a kilogram. 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 all of these transformation ratios can be disputed, they at least provide a possibility of combining all the different seizure reports into one comprehensive measure. The transformation ratios have been derived from those used by law enforcement agencies, in the scientific literature, by the International Narcotics Control Board, and were established in consultation with UNODC's Laboratory and Scientific Section. No changes in the transformation ratios used in last year's World Drug Report were made.

Seizures are used as an indicator for trends and patterns in trafficking. In combination with changes in drug prices or drug purities, changes in seizures can indicate whether trafficking has increased or declined. Increases in seizures in combination with stable or falling drug prices is a strong indication of rising trafficking activities. Increasing seizures and rising drug prices, in contrast, may be a reflection of improved enforcement effectiveness. Changes in trafficking can also serve as an indirect indicator for global production and abuse of drugs. Seizures are, of course, only an indirect indicator for trafficking activities, influenced by a number of additional factors, such as variations in law enforcement practices and changes in reporting modalities. Thus, the extent to which seizure statistics from some countries constitute all reported national cases, regardless of the final destination of the illicit drug, can vary and makes it sometimes difficult to assess actual trafficking activities. The problem is exacerbated by increasing amounts of drugs being seized in countries along the main transit routes, the increasing use of 'controlled deliveries', in which countries forego the possibility of seizing drugs immediately in order to identify whole trafficking networks operating across countries, and 'upstream disruptions', making use of intelligence information to inform partner countries and enable them to seize such deliveries prior to entering the country of final destination. Some of the increase of cocaine seizures in the Andean region in recent years, for instance, may have been linked to such upstream market disruptions.

However, over longer periods of time and over larger geographical entities, seizures have proven to be a good indicator to reveal underlying trafficking trends. While seizures at the national level may be influenced by large quantities of drugs in transit or by shifts in law enforcement priorities, it is not very likely that the same is true at the regional or at the global level. If a large drug shipment, while in transit, is taken out of the market in one country, fewer drugs will be probably seized in the neighbouring countries. Similarly, if enforcement efforts and thus seizures decline in one country, the neighbouring countries are likely to suffer from intensified trafficking activities, resulting in rising levels of seizures. The net results, emerging from changes of enforcement priorities of an individual country, are thus, in general, not significant at the regional or at the global level. Actual changes in trafficking can thus be considered to be among the main reasons for changes in seizures at the regional level or the global level. Indeed, comparisons, on a time-series basis, of different indicators with statistical dependence have shown strong correlations (e.g. global opium production estimates and global seizures of opiates, or global coca leaf production and global cocaine seizures), supporting the statistical worth of seizure statistics at regional and global levels. At the same time, data also show that interception rates have gradually increased over the last decade, reflecting improved law enforcement effectiveness at the global level.

Price and purity data

UNODC also collects and publishes price and purity data. Price and purity data, if properly collected, can be very powerful indicators for the identification of market trends. As supply changes in the short-run are usually stronger than changes on the demand side (which tend

to take place over longer time periods), shifts in prices and purities are a good indicator for actual increases or declines of market supply. Research has also shown that short-term changes in the consumer markets are – first of all - reflected in purity changes while prices tend to be rather stable over longer periods as traffickers and drug consumers at the retail level prefer 'round' prices. UNODC collects its price data from the Annual Reports Questionnaire, and supplements this data set by other sources, such as price data collected by Europol and other organisations. Prices are collected for the farm-gate level, the wholesale level ('kilogram prices') and for the retail level ('gram prices'). Countries are asked to provide minimum, maximum and typical prices and purities. In case no typical prices/purities are provided, UNODC calculates the mid-point of these estimates as a proxy for the 'typical' prices/purities (unless scientific studies are available which provide better estimates). What is not known, in general, is the manner in which the data were collected and their actual statistical representativeness. While some improvements have been made in some countries over the last few years, a number of law enforcement bodies in several countries have not, as yet, discovered the powerful strategic value of such data, once collected in a systematic way, at regular intervals, so that it can be used for statistical analysis, drug market analysis and as an early warning system.

Sources and limitations of data on consumption

Extent of drug abuse

a. Overview

UNODC estimates of the extent of illicit drug use in the world have been published periodically since 1997 (see *World Drug Reports 1997, 2000, 2004, 2005, 2006* and *Global Illicit Drug Trends 2002 and 2003*). The seventh round of estimates, presented in this report, is based on information received until May 2007.

Assessing the extent of drug use (the number of drug users) is a particularly difficult undertaking because it involves measuring the size of a hidden population. Margins of error are considerable, and tend to multiply as the scale of estimation is raised, from local to national, regional and global levels. Despite some improvements in recent years, estimates provided by Member States to UNODC are still very heterogeneous in terms of quality and reliability. These estimates cannot simply be aggregated globally to arrive at the total number of drug users in the world. Yet it is both desirable and possible to establish basic orders of magnitude - which are obviously subject to revision as new and better information is generated.

A global estimate of the level of abuse of specific drugs involves the following steps:

1. Identification and analysis of appropriate sources;
2. Identification of key benchmark figures for the level of drug abuse in selected countries (annual prevalence of drug abuse among the general population age 15-64) which then serve as 'anchor points' for subsequent calculations;
3. 'Standardization' of existing data (e.g. from age group 12 and above to a standard age group of 15-64);
4. Extrapolation of existing results based on information from neighbouring countries with similar cultural, social and economic situations (e.g. lifetime prevalence or current use to annual prevalence, or school survey results to annual prevalence among the general population);
5. Extrapolation of available results from countries in a region to the region as a whole, using all available quantitative and qualitative information;
6. Aggregation of regional results to arrive at global results.

The approach taken to arrive at the global estimates has remained essentially the same since the first attempt was made in 1997.

Estimates of illicit consumption for a large number of countries have been received by UNODC over the years (in the form of Annual Reports Questionnaires (ARQ) submitted by Governments), and have been identified from additional sources, such as other governmental reports and research results from scientific literature. Officially transmitted information in any specific year, however, would not suffice to establish global estimates. Over the period June 2006 to May 2007, for instance, 104 countries provided UNODC with responses to the ARQ on Drug Abuse (Part II), but only 24 countries provided new quantitative estimates of their drug situation for the year 2005, including 14 countries providing estimates of the prevalence of drug consumption among the general population and 16 countries providing estimates of prevalence of drug use among their student populations. With the inclusion of estimates referring to previous years, UNODC has obtained over the years quantitative estimates of the drug situation from 109 countries, including 87 countries providing drug use estimates among the general population and 95 countries providing student population estimates. In cases of estimates referring to previous years, the prevalence rates were left unchanged and applied to new population estimates for the year 2005. For countries that

did not submit information, other sources, where available, were identified. Other sources were also looked for when the officially transmitted prevalence rates in the ARQ were already old. In addition, a number of estimates needed to be 'adjusted' (see below). Using all of these sources, estimates were established for 145 countries, territories and areas. Results from these countries were extrapolated to the sub-regional level and then aggregated into the global estimate.

Detailed information is available from countries in North America, a large number of countries in Europe, a number of countries in South America, a few countries in Oceania (though including the two largest countries) and a limited number of countries in Asia and in Africa. For other countries, available qualitative information on the drug use situation only allows for some 'guess estimates'. In the case of complete data gaps for individual countries, it was assumed that drug use was likely to be close to the respective sub-regional average, unless other available indicators suggested that they were likely to be above or below such an average.

One key problem in currently available prevalence estimates from countries is still the level of accuracy, which varies strongly from country to country. While a number of estimates are based on sound epidemiological surveys, some are obviously the result of guesswork. In other cases, the estimates simply reflect the aggregate number of drug addicts found in drug registries which probably cover only a small fraction of the total drug abusing population in a country.

Even in cases where detailed information is available, there is often considerable divergence in definitions used - 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 (e.g. school surveys), special settings (such as hospitals or prisons), life-time, annual, or monthly prevalence, etc.

In order to reduce the error from simply aggregating such diverse estimates, an attempt was made to standardize - as a far as possible - the very heterogeneous data set. Thus, all available estimates were transformed into one single indicator – annual prevalence among the general population age 15 to 64 and above - using transformation ratios derived from analysis of the situation in neighbouring countries, and if such data were not available, on estimates from the USA, the most studied country worldwide with regard to drug use.

The basic assumption is that the level of drug use differs between countries, but that there are general patterns (e.g. lifetime time prevalence is higher than annual prevalence; young people consume more drugs than older people) which apply universally. It is also assumed that the ratio between lifetime prevalence and annual prevalence among the general population or between lifetime prevalence among young people and annual prevalence among the general population, do not vary too much among countries with similar social, cultural and economic situation. Various calculations of long-term data from a number of countries seem to confirm these assumptions.

In order to minimize the potential error from the use of different methodological approaches, all available estimates for the same country - after transformation - were taken into consideration and - unless methodological considerations suggested a clear superiority of one method over another - the mean of the various estimates was calculated and used as UNODC's country estimate.

b. Indicators used

The most widely used indicator at the global level is the annual prevalence rate: the number of people who have consumed an illicit drug at least once in the last twelve months prior to the survey. As "annual prevalence" is the most commonly used indicator to measure prevalence, it has been adopted by UNODC as the key indicator to measure the extent of drug use. It is also part of the Lisbon Consensus[b] (20-21 January 2000) on core epidemiological demand indicators (CN.7/2000/CRP.3). The use of "annual prevalence" is a compromise between "life-time prevalence" data (drug use at least once in a life-time) and data on current use (drug use at least once over the last month). Lifetime prevalence data are, in general, easier to generate but are not very illustrative. Data on current use are of more value. However,

[b] The basic indicators to monitor drug abuse, agreed by all participating organizations that formed part of the Lisbon Consensus in 2000, are:

- Drug consumption among the general population (estimates of prevalence and incidence);
- Drug consumption among the youth population (estimates of prevalence and incidence);
- High-risk drug abuse (estimates of the number of injecting drug users and the proportion engaged in high-risk behaviour, estimates of the number of daily drug users);
- Utilization of services for drug problems (number of individuals seeking help for drug problems);
- Drug-related morbidity (prevalence of HIV, hepatitis B virus and hepatitis C virus among illicit drug consumers);
- Drug-related mortality (deaths directly attributable to drug consumption).

While in the analysis of the drug abuse situation and drug abuse trends all these indicators were considered, when it came to provide a global com parison a choice was made to rely on the one key indicator that is most available and provides an idea of the magnitude for the drug abuse situation: annual prevalence among the population aged 15 to 64.

they often require larger samples in order to obtain meaningful results, and are thus more costly to generate, notably if it comes to other drugs than cannabis which is widespread.

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 (youth and young adults tend to have substantially higher prevalence rates than older adults or retired persons), differences in the age groups can lead to substantially diverging results. Typical age groups used by UNODC Member States are: 12+; 14+: 15+; 18+; 12-60; 16-59; 18-60; 15-45; 15-75; and increasingly age 15-64. The revised version of the Annual Reports Questionnaire (ARQ), adopted by Member States, which since 2001/02 has replaced the previous ARQ, stipulates the age group 15-64 as the key population group for which drug use to be measured against. Prevalence data in this report are thus reported for the age group 15-64. In case the age groups reported by Member States did not differ significantly from this age group, they were presented as reported and the age group was explicitly added. In cases where studies were based on significantly different age groups, results were adjusted to the age group of 15-64. (See below).

The methods used for collecting data on illicit activities vary from country to country. This reduces comparability. Possibilities to reduce differences – ex post – arising due to different methodological approaches are limited. UNODC thus welcomes efforts at the regional level to arrive at more comparable data (as is currently the case in Europe under the auspices of EMCDDA and in the Americas under the auspices of CICAD).

In a number of cases, diverging results are also obtained for the same country, applying differing methodological approaches. In such cases, the sources were analysed in-depth and priority was given to the methodological approaches that are usually also used in other countries. For example, it is generally accepted that household surveys are reasonably good instruments to estimate cannabis, ATS or cocaine use among the general population. Thus household survey results were usually given priority over other sources of prevalence estimates, such as reported registry data from the police or from treatment providers.

However, when it comes to heroin abuse (or drug injecting), there seems to be a general agreement that annual prevalence data derived from national household surveys tend to grossly under-estimate such abuse because severe heroin addicts often do not live in households.[c] They may be homeless, in hospitals or in prisons. Moreover, heroin abuse is highly stigmatized so that the willingness to openly report a heroin abuse problem is limited. However, a number of indirect methods have been developed over the last two decades to provide estimates for this group of problem drug users. They include various multiplier methods (e.g. treatment multipliers, police data multipliers, HIV/AIDS multipliers or mortality multipliers), capture-recapture methods, and multivariate indicators.

Whenever such indirect estimates for problem drug use were available, they were given priority over household survey results. Most of the estimates for problem drug use were obtained from European countries. Unless there was evidence that a significant proportion of problem drug use was related to the use of other drugs, it was assumed that the problem drug use concerned opiates. In the case of some of the Nordic countries, where amphetamine use is known to account for a significant proportion of overall problem drug use, the data of reported problem drug users were corrected by applying the proportion of opiate consumers in treatment in order to arrive at estimates for opiate abuse. This also applied to estimates for Spain, where cocaine has gained a significant proportion among problem drug users.

For other drugs, priority was given to annual prevalence data found by means of household surveys. A number of countries, however, did not report annual prevalence data, but lifetime or current use of drug consumption, or they provided annual prevalence data but for a different age group. In order to arrive at basically comparable results, it was thus necessary to extrapolate from reported current use or lifetime prevalence data to annual prevalence rates and/or to adjust results for differences in age groups.

[c] The problem of under-estimation is more widespread for heroin, but it is not excluded for other drugs such as cocaine or methamphetamine.

Indirect methods to measure problem drug use

Treatment multiplier: If a survey among heroin addicts reveals, for instance, that one quarter of them was in treatment in the last year, the multiplication of the registered treatment population with a multiplier of four provides an estimate of the likely total number of problem heroin users in a country.

Police data multiplier: Similarly, if a survey among heroin addicts reveals that one out of five addicts was arrested in the previous year, a multiplication of the persons arrested for heroin possession by the multiplier (five) provides another estimate for the number of heroin users. Establishing various multipliers and applying them to the registered drug using population, provides a range of likely estimates of the heroin abuse population in a country. Either the mid-point of the range, the median or the mean of these estimates can be subsequently used to arrive at a national estimate.

Capture-recapture models are another method based on probability considerations, which can be undertaken without additional field research.[d] If in one register (e.g. arrest register) 5000 persons are found (for possession of heroin) and in a second register (e.g. treatment register) 2000 persons are found (for treatment of heroin abuse), and there are 400 persons who appear in both registries, it can be assumed that 20% (400/2000) of the drug addicts have been arrested, so that the total heroin addict population could be around 25,000 (5000/20%), five times larger than the total number of arrested heroin users.[e] Results can usually be improved if data from more than two registers are analysed (e.g. data from arrest register, treatment register, ambulance register, mortality register, substitution treatment register, HIV register etc). More sophisticated capture-recapture models exist, and are used by some advanced countries, in order to make calculations based on more than two registries. However, in order to arrive at reasonable orders of magnitude of the heroin problem in a particular country it is probably sufficient to calculate the various combinations shown above and subsequently report the mid-point, the median or the mean of the resulting estimates.

Another interesting approach is the use of multivariate indicators. For this approach, a number of local/regional studies are conducted, using various multiplier and/or capture-recapture methods. Such local studies are usually far cheaper than comprehensive national studies. They serve as anchor points for the subsequent estimation procedures. The subsequent assumption is that drug abuse at the local level correlates with other data that are readily available. For instance, heroin arrest data, heroin treatment data, IDU related HIV data, etc. are likely to be higher in communities where heroin abuse is high and lower in communities where heroin abuse is low. In addition, heroin abuse may correlate with some readily available social indicators (higher levels in deprived areas than in affluent areas; higher levels in urban than in rural areas etc). Taking all of this additional information into account, results from the local studies are then extrapolated to the national level.

c. Extrapolation methods used

The methods used for these adjustments and extrapolations are best explained by providing a number of concrete examples:

Adjustment for differences in the age groups:

New Zealand, for instance, carried out a household survey in 2001, covering the population age 15-45. According to this survey, annual prevalence of ecstasy use was found to affect 3.4% of the population 15-45, equivalent to about 56,000 people. Given the strong association between ecstasy use and younger age groups it can be assumed that there is little ecstasy use in the 45+ age group. Thus, dividing the ecstasy using population established above by the age group 15-64 gives an estimated prevalence rate of 2.2%.

The situation is slightly more complex when it comes to cocaine. The same approach for New Zealand would lower the annual cocaine prevalence rate from 0.6% of the population age 15-45 to 0.4% of the population age 15-64. In this case, however, it must be assumed that there are still some people above the age of 45 consuming cocaine. A rate of 0.4% is thus a minimum estimate. An alternative estimation approach is indicated. Thus, the relationship between cocaine consumption among the group of those age 15-45 and those age 15-64 in

[d] Such methods were originally developed to estimate the size of animal population. If, for instance, 200 fish are caught (' capture'), marked, and released back into the lake, and then the next day 100 fish are caught, of which 10 were already marked ('re-captured'), probability considerations suggest that the number of fish captured the first day were a 10% sample of the total population. Thus the total population of the lake can be estimated at around 2000 fish.

[e] The advantage of this method is that no additional field research is necessary. There are, however, problems as the two ' sampling processes' for the registries in practice are not independent from each other so that some of the underlying assumptions of the model may be violated (e.g. the ratio could be higher as some of the people arrested are likely to be transferred to a treatment facility; thus the ratio does not correspond any longer to the true proportion of people arrested among the addicts population, and may lead to an under-estimation of the total heroin addict population).

other countries was investigated. The finding was that the prevalence rate of cocaine use among those age 15-64 tends to be around 75% of the prevalence rate of those age 15-45. Instead of 0.4%, the cocaine prevalence rate in New Zealand has thus been estimated to affect 0.45% of the population age 15-64.

Similar considerations were also used for the age-group adjustment of data from other countries. 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 65. The number of drug users based on the population age 15+ (or age 18+) was thus simply shown as a proportion of the population age 15-64.

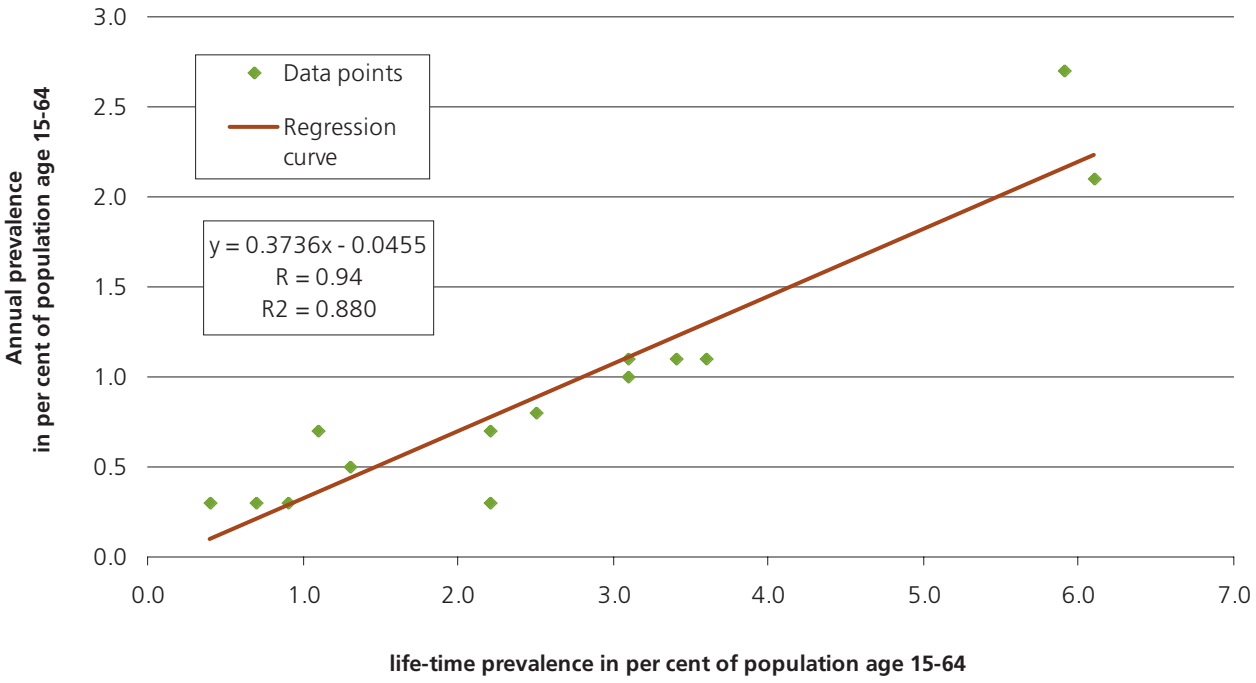
Extrapolation of results from lifetime prevalence to annual prevalence

Some countries have conducted surveys in recent years, but did not ask the question whether drug consumption took place over the last year. In such cases, results can be still extrapolated to arrive at annual prevalence estimates and reasonably good estimates can be expected. Taking data for life-time and annual prevalence of cocaine use in countries of Western Europe, for instance, it can be shown that there is a rather strong positive correlation between the two measures (correlation coefficient R = 0.94); i.e. the higher the life-time prevalence, the higher is, in general, annual prevalence and vice versa. Based on the resulting regression curve (y = 0.3736 * x - 0.0455 with y = annual prevalence and x = life-time prevalence) it can be estimated that a West European country with a life-time prevalence of 2% is likely to have an annual prevalence of around 0.7% (also see figure).

Almost the same result is obtained by calculating the ratio of the unweighted annual prevalence rates of the West European countries and the unweighted life-time prevalence rate (0.93/2.61 = 0.356) and multiplying this ratio with the life-time prevalence of the country concerned (2% * 0.356 = 0.7%).

A similar approach was used to calculate the overall ratio by averaging the annual/life-time ratios, calculated for each country.[f] Multiplying the resulting average ratio (0.387) with the lifetime prevalence of the country concerned provides the estimate for the annual prevalence (0.387 * 2% = 0.8%). This approach also enables the calculation of a confidence interval for the estimate.

Annual and lifetime prevalence rates of cocaine use in Western Europe



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

[f] For each country the ratio between annual prevalence and lifetime prevalence is calculated. The results are than averaged: In our example: (0.64 + 0.32 + 0.43 + 0.14 + 0.32 + 0.38 + 0.35 + 0.32 + 0.75 + 0.31 + 0.32 + 0.33 + 0.46+ 0.34) : 14 = 0.387

With a 95% probability the likely annual prevalence estimate for the country concerned falls within a range of 0.6% to 1%.[g] Given this close relationship between life-time and annual prevalence (and an even stronger correlation between annual prevalence and monthly prevalence), extrapolations from life-time or current use data to annual prevalence data was usually given preference to other kinds of possible extrapolations.

But, good estimation results (showing only a small potential error) can only be expected from extrapolations done for a country located within the same region. If instead of using the West 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 United States. The USA has had a cocaine problem for more than two decades and is thus confronted with very high lifetime prevalence rates while it made considerable progress in reducing cocaine consumption as compared to the mid 1980s. All of this leads to a small proportion of annual prevalence to lifetime prevalence. In Western Europe, by contrast, the cocaine problem is a phenomenon of the last decade and still growing.

Against this background, data from countries in the same region were used, wherever possible, for extrapolation purposes. Thus, data from Central and Eastern Europe were used to extrapolate results for other countries in the region which did not collect annual prevalence rates. Most of these countries had very low drug abuse levels during the cold war, which, however, grew rapidly in the 1990s.

Extrapolations based on treatment data

For a number of developing countries, the only drug related data available on the demand side was treatment demand. In such cases, the approach taken was to look for other countries in the region with a similar socio-economic structure, which reported annual prevalence data and treatment data. As a next step, the ratio of people treated per 1000 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.

Extrapolations based on school surveys

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

Extrapolation to regional and global level

The next step, after having filled, as far as possible, the data gaps, was to calculate the average prevalence for each sub-region. For this purpose the reported/estimated prevalence rates of countries were applied to the population aged 15-64, as provided by the United Nations Population Division for the year 2005. For the remaining countries, for which no estimate could be made, the average prevalence rate of the respective sub-region was applied, unless some additional information suggested that the sub-regional average would be too high or too low for the countries concerned. All of these 'adjustments', based on qualitative information, affected the overall estimate only slightly.

Following the detailed calculation of all of the sub-regional estimates, the individual sub-regional estimates ('number of drug users') were aggregated to form a regional estimate, and the regional estimates were then aggregated to arrive at the global estimates.

d. Concluding remarks

It goes without saying that each method of extrapolating results from other countries is not without problems and despite of efforts made, results of these estimations for individual countries must be still interpreted with caution. However, this should not influence the overall results as some under-estimates are, most probably,

[g] The calculation of the confidence interval can be done as follows:

1).Determination of alpha (usually 0.05);

2).Determination of the number of observations (14 in this case) and 3. Calculation of the standard deviation (0.1502 in this example). This allows to calculate the standard error (standard deviation : (square root of n), i.e. (0.1502 : (square root of 14)) = 0.040)). The z value for alpha equalling 0.05 is 1.96. Multiplying the standard error with the z-value (0.040*1.96) would give the confidence interval (+/- 0.078). But, given the low number of observations (where n< 30), the use of t-statistics is indicated instead. In this case, the standard error must be multiplied with the appropriate t-value (2.145 for n-1 degrees of freedom (14-1) and alpha equalling 0.05 for two-sided t-statistics as can be found in t-value statistics). The result is a confidence interval of +/- 0.0858 (=0.040 * 2.145). Several spreadsheet programs provide such statistics automatically. In Excel, for instance, the 'descriptive statistics' in tool menu under 'data analysis' calculates the confidence interval automatically and uses the t-statistics, wherever appropriate. Applying the +/-0.086 confidence interval to the average ratio calculated above to the mean ratio of 0.387 gives a range of ratios of 0.301 to 0.473. Using the two ratios one arrives at a minimum estimate of the annual prevalence rate of 0.6% (2% * 0.301) and a maximum estimate of the annual prevalence rate of 0.95% (2% * 0.473).

offset by over-estimates, and vice-versa, and every attempt has been made to avoid any systematic bias in the estimation process. Moreover, in order to reduce the risk of any systematic bias, estimations were based, as far as possible, on the data from neighbouring countries in the region.

It is, however, recognized that the currently provided estimations can change considerably once survey data becomes available. UNODC's methodology to arrive at global estimates by extrapolating results from a sample of countries (for which data is available) to a sub-region, also means that methodological changes can have a significant impact on the final estimates. In many cases though, actual survey data received from Member States turned out to be rather close to UNODC's estimates.

The global estimates presented in this report must, nonetheless, be treated with caution. They provide likely orders of magnitude, as opposed to precise statistics on the prevalence and evolution of global drug abuse. Further changes can be still expected as countries provide more robust estimates based on rigorous scientific methods. Nonetheless, in the absence of global studies on drug abuse, the estimations and the estimation procedures provided in this report guarantee the best picture that is currently obtainable.

Trends in drug use

a. Overview

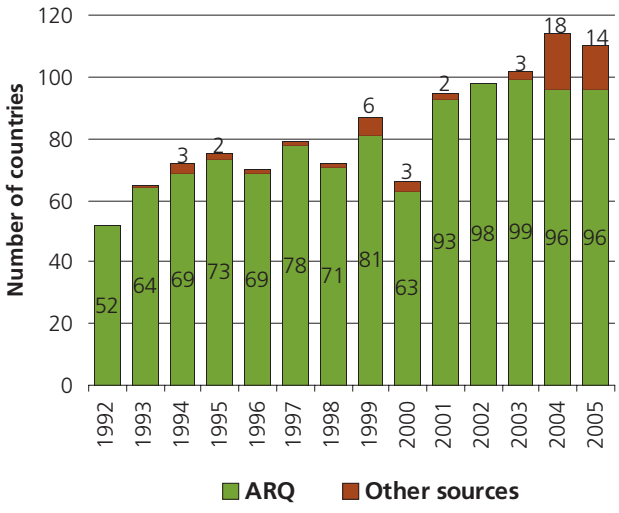
Ideally, global trends in drug use should be monitored by comparing estimates of drug use in one year with those found in a subsequent year. In practice, however, this approach does not always work as some changes in the global estimates are always due to methodological improvements and not due to underlying changes in drug use. Moreover, general population surveys are very expensive to conduct and only a few countries have an ongoing monitoring system based on these instruments.

Many countries collect, however, routine data such as the number of persons arrested for drug abuse, urine testing of arrestees, number of persons undergoing drug treatment, drug hotlines, drug related emergency department visits, drug related interventions by ambulances, or they monitor drug use based on school surveys. In addition, drug experts dealing on a regular basis with drug issues – even without having precise data at hand – often have a good feeling about whether use of certain drugs is increasing, stabilizing or declining in their constituency.

This knowledge base is regularly tapped by UNODC. Member States usually pass the Annual Reports Questionnaire to drug experts in their country (often in the ministry of health) who provide UNODC with their perception, on a five-point scale, of whether there has been a 'large increase', ' some increase', ' no great change', some decrease' or a 'large decrease' in the use of the various drugs over the past year. The perceptions may be influenced by a number of factors and partial information, including police reports on seizures and arrests, reports from drug treatment centres, reports from social workers, press reports, personal impressions, etc. Any of these influencing factors could contain a reporting bias which has the potential to skew the data towards a misleading increase or decrease. Prioritization of the drug issue is another factor which influences reporting. It can probably be assumed that the countries which reply regularly to the ARQ are those which take the drug problem more seriously. In a number of cases this is a consequence of rising levels of drug use and thus increased public awareness of the problem. All of this suggests that the sample of countries replying to the ARQs may be slightly biased towards countries faced with a deteriorating drug problem. Results based on trend data must thus be treated with caution and should not be over-interpreted.

Despite these caveats, trend data provide interesting insights into the growth patterns of individual drugs as well as into regional and global growth patterns. They represent the most comprehensive data set of expert opinion available on the development of the drug abuse problem at the global level, provided in a consistent manner over more than a decade.

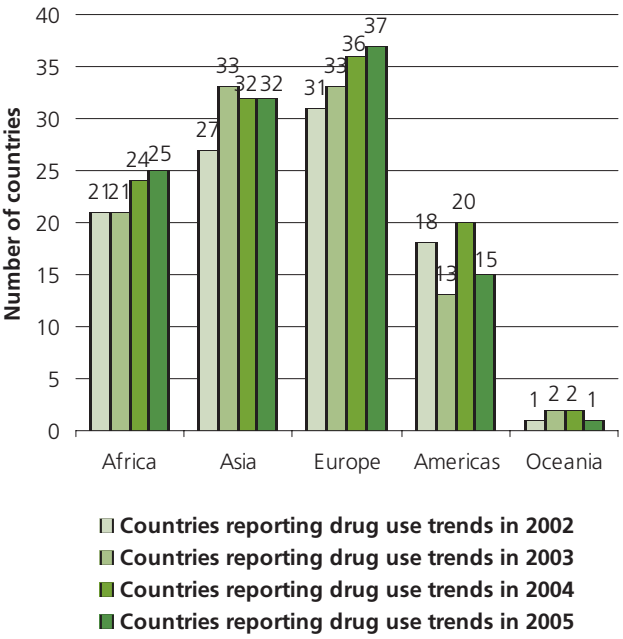
Number of countries & territories reporting drug use trends to UNODC



Sources: UNODC, Annual Reports Questionnaire Data; UNODC Field Office, UNODC, 'Data for Africa project', UNODC, DAINAP, UNODC, GAP, EMCDDA, CICAD, HONLEA reports.

Replies to the Annual Report Questionnaire (ARQ) on trends in drug use are far more comprehensive than on estimating the number of drug users. The analysis on drug use trends for the year 2005 was based on the replies of 96 countries and areas, about the same number as a year earlier, up from 52 countries and areas in 1992. Including information gathered from other sources (Government reports, UNODC Field Offices, UNODC's Data for Africa Project, UNODC's Drug Abuse Information Network for Asia and the Pacific (DAINAP), EMCDDA, CICAD, HONLEA reports and local studies) trend data from 110 countries and territories formed the basis for the subsequent analysis. The distribution of countries reporting in 2005 was roughly the same as in previous years and provides a reasonably good coverage across all regions.

Regional distribution of reports received on drug use trends for the years 2002-2005



Source: UNODC, Annual Reports Questionnaire Data.

b. Aggregating trend data

Various methods have been developed and have been used in this report for the trend aggregation. The 'traditional' method consists of simply counting the number of countries reporting increasing, stable and declining levels of drug abuse. Changes in the net results, i.e. number of respondents reporting increases less those reporting declines, have proven to be a good and useful indicator for showing overall changes in the trend. This is in line with business cycle trend analysis where enterprises are asked on a routine basis about their perceptions of whether production is expected to increase, remain stable, or fall over the new few months, and where the net results (number of increasing trends less number of falling trends) are recorded and presented in order to identify changes in trends. For the purpose of calculating this indicator, the categories 'strong increase' and 'some increase' are aggregated into a new category 'INCREASE'. Similarly, the categories 'strong decline' and 'some decline' are aggregated into a new category 'DECLINE'. 'INCREASE' less 'DECLINE' gives the 'net change'.

The advantage of this method for describing drug trends at the global level is that a large number of actors, independent of each other, express their views on the trends in their countries. Though some experts may well report wrong trend data, it is unlikely that mistakes all go in the same direction. The disadvantage of this approach is that it gives equal weight to the reports of small and big countries, which can be potentially misleading if global trends are to be identified.

Drug Use Trends as perceived by experts

Another analytical tool, referred to in this report as Drug Use Trends as perceived by experts, has been designed by UNODC to allow for a different presentation of regional and global trends in drug use, reported by Member States to UNODC. The Drug Use Trend as perceived by experts builds on previous work of UNODC which resulted in the concept of a Weighted Analysis on Drug Abuse Trends (WADAT) in 2004.

The trend is constructed as follows: each degree of trend estimation is given a numerical value ranging from –2 to +2 (–2 representing a 'large decrease'; –1, 'some decrease'; 0, 'no great change'; +1, 'some increase'; and +2, 'a large increase'). Estimates for each drug type are then multiplied by the proportion of the drug using population of the country in relation to the drug using population at the global level. The national estimates are subsequently added to represent a global trend estimate for each drug type. The results are shown as a cumulative trend curve.[h]

In the 2004 World Drug Report, the trends provided by Member States had been weighted by the size of a country's population, in line with the original WADAT concept. Using the population as the weighting instrument

[h] If country X, which has 2% of the world cocaine population, reports a 'strong increase' in cocaine use, the calculation is as follows:

2 * 0.02 = 0.04. If country Y, which has 3% of the world population reports 'some decline', the calculation is: -1*0.03 = -0.03. The values of all other countries are then calculated the same way and aggregated. For 2005, the net result for cocaine was -0.19. This number is then added to last year's number: 103.41 + (-0.19) = 103.22.

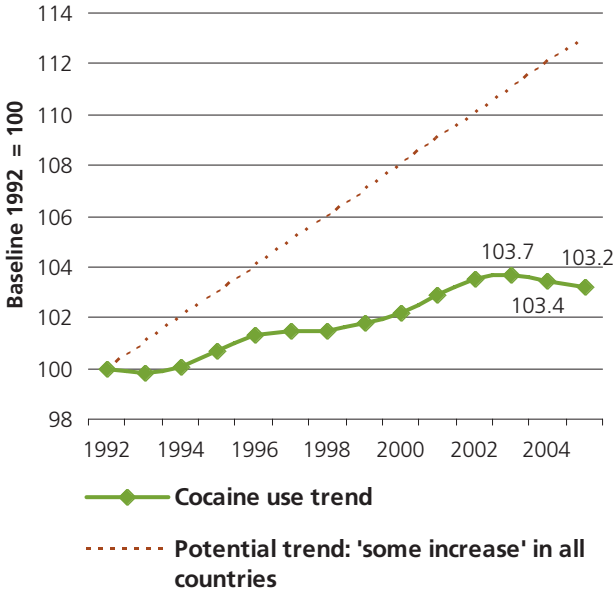
shows, in general, reasonable results at the regional level when drug prevalence rates do not differ drastically among countries. It creates, however, a serious problem once an attempt is made to apply the concept to the global level, notably for drugs which have distinct regional distribution patterns. For instance, cocaine use is concentrated in the Americas and in Western Europe while consumption levels in Asia are still minimal. If a highly populated country in Asia, like India, reports a rise in cocaine use, this rise is typically from very low levels. It must not be ignored, but it has, for the time being, not much impact on global cocaine consumption. Weighting the trend data with population data would, however, raise the global trend for cocaine consumption sharply. Such results could be potentially misleading.

Thus, an alternative solution was sought to overcome this problems. The option chosen was to use for cocaine, for instance, UNODC's estimates on the number of cocaine users per country as the weighting factor. For countries, for which no prevalence estimates exist, the average prevalence rate of the respective sub-region is taken as a proxy for the unknown actual prevalence rate. Based on this approach, prevalence estimates become available for all countries of the world. Of course, for some countries the 'weight' given to their trend data may be slightly too small and for others slightly too big, but the potential error resulting from this procedure is less than the potential error from weighting the trend with the general population.

The following graph shows the results for cocaine, starting with 1992 as a baseline (=100). The graph shows an upward trend over the 1992-2003 period, followed by a moderate downward trend over the 2003-2005 period. This suggests that after an increase over the 1992-2003 period cocaine use has declined slightly at the global level over the subsequent two years. The fact that the trend line is now at 103.2, and thus above 100, indicates that there was a net-increase in cocaine consumption over the 1992-2005 period. But, how important was the increase? If all countries had reported a 'strong' increase every year from 1992 to 2005, the composite perception trend would have reached a level of 126 (2 points per year); if all countries had reported 'some increase' every year, the trend would be now at 113 (1 point per year); if countries had considered the trend to have been stable, the line would have remained stable at 100. If countries had reported every year 'some decline', the trend would be at 87, and in case of a 'strong decline' at 74.

One advantage of this tool is that it takes the trends reported by Member States and the size of their drug using population into account. In other words, the trend gives more weight to the results reported from countries with a large cocaine using population than to those with small numbers of cocaine users. This is in line with the observation that the impact of a rise in drug consumption in a country with large numbers of drug users has a greater impact on global drug consumption than the rise in some other countries where drug use has just started. Another advantage is that the trend takes into account the degree of change in drug use levels, thus making better use of all information made available to UNODC by Member States.

Cocaine use trends* as perceived by experts: 1992-2005



Sources: UNODC, Annual Reports Questionnaire Data, UNODC Field Offices, UNODC's Drug Abuse Information Network for Asia and the Pacific (DAINAP), UNODC, Global Assessment Programme on Drug Abuse (GAP), Govt. reports, EMCDDA, CICAD, HONLEA reports and local studies.

There are, of course, also limitations that need to be taken into account when interpreting the results. The information provided remains, in most cases, an expert opinion and is not necessarily based on scientific evidence. While this tool assists in the analysis of trends, the quality of these perceptions remains the key issue. A mistake made by an expert in a country with a large drug using population can seriously distort the global trend estimates. There is also a danger that some experts may have a political agenda. Thus, this tool cannot be seen as substitute for serious scientific studies on the prevalence of drug consumption in a country. Moreover, it cannot be taken for granted that the differences between various degrees of drug use trends ("some decrease" and "large decrease") are interpreted the same way across countries, or even in the same country in different reporting years.

Reporting trends in the use of a drug type may be also biased by opposing trends for the individual substances (cocaine HCL, coca paste/base, crack-cocaine). For the

purpose of this report, not just the drug group but each individual drug has been taken into consideration. The unweighted average of all reported trends within a drug group are calculated. While for some countries, the detailed profile of substance use is known (which could give more accurate results), this is not the case for many others. Thus the general rule of averaging all drugs within one category has been applied.

It should also be noted that the Drug Use Trend as perceived by experts is limited in that it only provides general directions with regard to the main drug types reported by Member States, inevitably leading to very broad generalization. Thus, there remains a need for more drug-specific trend analysis to support the conclusions.

Development of other innovative methods to measure the extent and trends in drug consumption: the analysis of waste-water

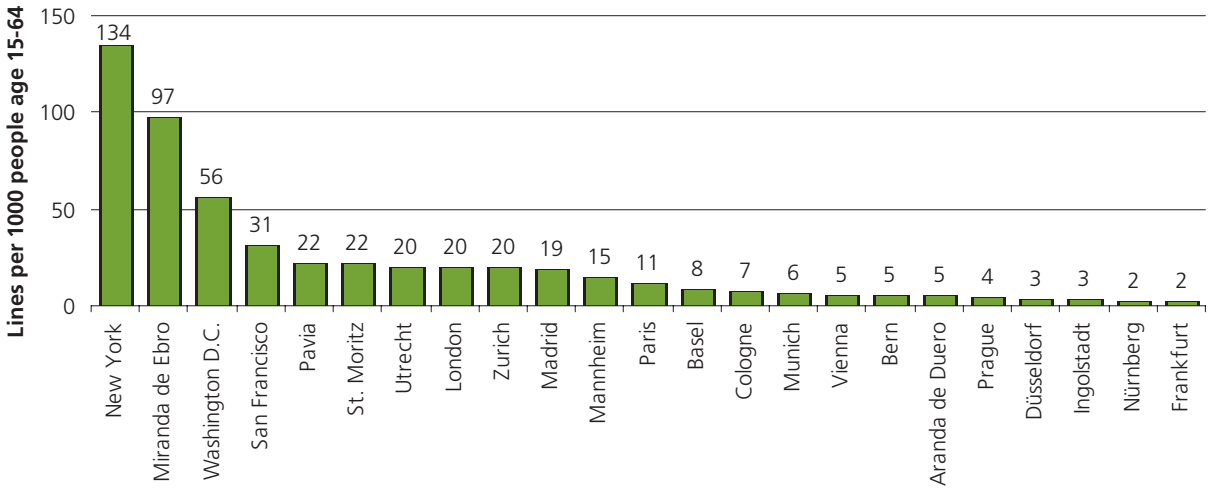
Given the difficulties to measure drug consumption based on self-reports (house-hold surveys) and to identify trends based on various indirect indicators (treatment demand, arrests etc.), scientists have also started to explore the possibility to develop alternative approaches to measure the extent of drug consumption. UNODC has not been involved in this exercise but it considers such attempts to be potentially interesting avenues.

Starting in Italy in 2005,[i] and later in the UK and in Germany,[j] several groups of scientists have started to experiment with the analysis of residuals in waste-water, in order to calculate backwards the amounts of cocaine consumed. The assumption is that cocaine that has been consumed is eventually leaving the human body and - in developed areas - most of this will land in waste-water systems in the form of benzoylecgonine, a breakdown product from cocaine after it had been processed by the human liver. The analysis is thus based on the identification of benzoylecgonine in waste water. This is an interesting marker as it – apparently - does not come from any other source than the organic processing of cocaine.

There can be no doubt that this is a highly innovative approach, making use of the capabilities of modern science. First publications provide reasonable orders of magnitude of the problem as will be shown below.

The studies suggest, for instance, that the Hudson River carries the waste of some 16 tons of cocaine consumed per year in New York. The Rhine in Germany carries the waste of some 9 tons of cocaine consumed along its

Estimated cocaine consumption based on waste-water analysis, 2005/06 (expressed as cocaine lines* per day per 1000 inhabitants, age 15-64)



* 1 line was here assumed to be equivalent to 100 milligram of cocaine.

Source: Institute for Biomedical and pharmaceutical Research, *Fist ever comparative multi-country study of cocaine use by a new measurement technique,* Nürnberg, November 2006.

[i] In the first Italian tests, 500 ml samples of waste water were collected every 40 minutes on 4 days from the Po at Mezzano, Pavia. The analysis found 25 nanograms of benzoylegonine (BE) per litre waste-water as well as 1.2 nanograms of cocaine per litre. The flow rate of the Po was found to be 1 m3 per sec-1; The BE/cocaine molecular mass ratio is 0.954; 45% of a cocaine dose is typically being excreted as BE. Based on this information the cocaine load of the Po could be calculated to amount to 3.8 kg per day or 1387 kg per year (based on the assumption in these four days was typical for the consumption during the year). Ettore Zuccato Mario Negri Institute for Pharmacological Research, Chiara Chiabrando, Sara Castiglioni , Davide Calamari, Renzo Bagnati, Silvia Schiarea and Roberto Fanelli, "Cocaine in surface waters: a new evidence-based tool to monitor community drug abuse" in Environmental Health: August 2005 (http://www.ehjournal.net/content/4/1/14)

[j] Institute for Biomedical and pharmaceutical Research, *Fist ever comparative multi-country study of cocaine use by a new measurement technique,* Nürnberg, November 2006.

[k] But, even this would be surprising as Frankfurt airport constitutes one of the main supply routes of cocaine into Germany.

banks. The Potamic River in Washington carries the waste of some 7 tons of cocaine consumed, etc. If measured against the size of the population, data show very high levels of cocaine consumption in New York (134 lines of cocaine per day per 1000 inhabitants age 15-64) and in Washington D.C. (56) while consumption appears to be still non-existent in some parts of Romania (Arges river), and at relatively low levels in Prague (4 lines per 1000 inhabitants). This is again plausible as methamphetamine is the drug of choice in this city and cocaine is mostly consumed by foreign tourists. High levels of cocaine use in Europe were found along the Ebro (Spain), along the Po (Italy) and along the Thames (UK). The studies in Italy found high levels of cocaine waste along the Po in northern Italy, but low levels along rivers in Sardinia and southern Italy, which is very much in line with all existing epidemiological information. But, there were also some surprising results, such as the very low values found for Frankfurt (2 lines per 1000 inhabitants age 15-64). Existing epidemiological data would have predicted higher figures. There could have been a temporary shortage on the market when the analysis took place,[k] or some other reasons to explain this potential anomaly.

The overall highest levels of cocaine consumption were found in the United States, followed by Spain, Italy and the UK. All of this is basically in line with other information, suggesting that the measurement techniques used for these studies are, in general, precise enough to generate reasonably accurate data to differentiate between locations.

Cocaine use in selected sites - results from waste-water studies, 2005-2006

Country	Town	River	Estimated cocaine per year (tons)	Number of lines (100 mg) per day	Lines per 1000 inhabitants per day
USA	New York	Hudson River	16.400	449,814	90
	Washington	Potomac river	7.360	201,725	38
	San Francisco	Bay	6.070	166,179	21
	unweighted average			272,573	50
Spain	Miranda de Ebro	Ebro	0.532	14,576	65
	Madrid	Manzanares	1.420	38,937	13
	Aranda de Duero	Duero	0.015	417	3
	unweighted average			17,977	27
Italy	Pavia	Po	2.850	78,187	14
United Kingdom	London	Thames	0.975	26,709	13
Netherlands	Utrecht	Vecht	0.145	3,981	13
Switzerland	St. Moritz	Inn	0.029	795	15
	Zurich	Limmat	0.103	2,814	13
	Basel	Rhie	0.944	25,864	5
	Bern	Aare	0.025	687	3
	unweighted average			7,540	9
France	Paris	Seine	1.760	48,353	7
Germany	Mannheim	Rhine	9.400	257,599	10
	Cologne	Rhine	9.050	248,004	5
	Munich	Isar	0.283	7,767	4
	Düsseldorf	Rhine	4.450	121,912	2
	Ingolstadt	Danube	0.129	3,532	2
	Nürnberg	Pegnitz	0.070	1,926	1
	Frankfurt	Main	0.372	10,205	1
	unweighted average			92,992	4
Austria	Vienna	Danube	1.010	27,536	3
Czech Republic	Prague	Moldau	0.132	3,611	3
Romania	-	Arges*	-	-	-
Unweighted average of all sites in Europe				**43,972**	**9**
Weighted* average of Europe				**50,222**	**11**
Unweighted average of all sites - global				**72,547**	**14**

Source: Institute for Biomedical and Pharmaceutical Research, *Fist ever comparative multi-country study of cocaine use by a new measurement technique,* Nürnberg, November 2006.

While UNODC is not in a position to verify the accuracy of all individual city results, there are still possibilities to undertake some broad plausibility checks, cross-checking the waste-water results with information from other sources.

If the average per capita values for each country are taken and multiplied with the population of the country, data suggest that cocaine consumption in the ten European countries, where such analyses took place, could be close to 140 metric tons. Extrapolated to the whole of West and Central Europe (based on a calculated weighted average of 11 lines of cocaine per day per 1000 inhabitants), one could reckon with a market of some 190 metric tons. As the selection of the cities has not been representative for each country but biased toward location with higher levels of cocaine consumption - which is particularly obvious in cases where only one location per country was tested (such as London or Paris) - total European consumption can be expected to be still smaller. In order to account for this about a quarter could be probably subtracted, leaving a net consumption of some 140 metric tons of cocaine.[1] In fact, this estimate turns out to be very similar to the estimate of Europol that some 250 metric tons of cocaine are being shipped to Europe. Deducting seizures made by the European law enforcement agencies, leaves some 140 metric tons for domestic consumption.

A calculation for the US market, based on the average of the three selected cities of New York, Washington and San Francisco (50 lines per day per 1000 inhabitants) would result in an over-estimate, reflecting the fact that in many parts of the US cocaine consumption is known to be substantially lower than in New York. Disregarding the high results from New York and extrapolating from data from Washington D.C. (38 lines per 1000 inhabitants per day) and San Franciso (21 lines per day per 1000 inhabitants), the average US estimate could be around 270 metric tons. This would be a reasonable estimate for the size of the US market, in line with previously reported estimates on the size of the US market.

Though it is clear that currently available waste-water studies are not, as yet, sufficient in terms of number of studies to come up with reliable national, regional or global estimates, data published so-far show that the results are largely in line with what one could expect, thus lending an additional element of credibility to these results.

In some of the studies, attempts have also been made to estimate the number of cocaine users, based on the amounts consumed. This would work fine if the average per capita consumption levels of cocaine were known. For most cities, this is not the case. With regard to these final back-calculations, from the quantities consumed to the number of users, views between UNODC and the authors of some of the studies differ. Information available to UNODC suggests that the 'average user' consumes far higher quantities of cocaine than it is assumed in these studies. This has important implications. The number of cocaine users, deduced from the amounts consumed, tends to be very high in some of these studies which may not reflect reality. UNODC is currently involved in a multi-city study in Europe to find out more detailed information on the amounts of drugs (including cocaine) consumed, on average, by a drug user, which should assist, inter alia, such studies to work with assumptions that are closer to reality.

In conclusion, UNODC is carefully monitoring the development of new approaches to come up with more reliable data on drug consumption. A first round of waste-water studies in Europe and North America has already provided promising results, which are probably not too far off reality. Most assumptions used in these studies, derived from scientific literature, seem to be reasonable, except for the very last element, the back-calculation from the amounts used to the number of potential drug users. But this is, in fact, an issue which has been long neglected and still needs more research at the local, national and international levels. The approach to identify the amounts consumed seems to work fine whenever a specific marker can be identified for a drug (such as benzoylecgonine for cocaine) and as long as a city or a region has a functioning waste water system, where the water eventually ends up in a river. For the time being, this seems to be a promising new approach for developed countries, less so for developing countries where the basic infrastructure is often not available.

[1] There is also another alternative calculation which leads to similar results. If t the selected sites in each country were those with the highest level of cocaine consumption, one can calculate – for the countries for which info is available - the ratio between the average and the highest cocaine use figure. The average of the averages shows a ratio of 0.5, which means that the highest value is, on average, about twice as high as the national average. Correcting the data for the countries where only one site was investigated, would reduce the figure for the selected 10 countries to 96 tons, which - extrapolated to West and Central Europe as a whole – would result in an estimate of 132 metric tons.