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PREFACE

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Evolution of international drug control, 1945-1995

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ABSTRACT

The international drug control system had its origins in Shanghai in 1909 and, a mere three years later, the first International Opium Convention was adopted, establishing, in rudimentary form, the present narcotics control regime. During the existence of the League of Nations, the Permanent Central Board was created; this was the predecessor of the International Narcotics Control Board and it effectively put an end to the large-scale diversion of manufactured narcotic drugs from the legal trade into illicit channels. A burgeoning international drugs trade led to an expansion in the number of conventions, protocols and agreements attempting to control it. The Single Convention on Narcotic Drugs was therefore introduced in 1961, to integrate the measures of previous instruments and to extend the scope of international control to other drugs, such as cannabis and coca leaf. The rapid expansion of the pharmaceutical industry and the large number of manufactured psychotropic drugs led to the adoption of the 1971 Convention on Psychotropic Substances which controls the products of the licit industry as well as "street drugs" that are not used in medical practice. However, the illicit drug trade continued to exploit all of the opportunities offered by globalization during the past two decades and it was recognized that new measures were required to counteract them. The 1988 Convention broke new ground by introducing measures to counteract money-laundering, to deprive those engaged in illicit traffic of the proceeds of their criminal activity and to prevent international traffic in substances frequently used in the illicit manufacture of drugs. In the present paper we have analysed some of the historic events in the evolution of the drug abuse problem and the international responses to them.

Introduction

The development of the international drug control system has been and is a continuous and incremental process and there are no demarcation lines between three historical periods, namely, prior to the First World War (1909-1914); the

period of existence of the League of Nations (1920-1940); and the first 50 years of the United Nations (1945-1995).

During the period 1909-1995, important and significant changes took place in respect of the drugs involved, as well as the form and extent of their abuse, but it was realized from the very beginning that national efforts aimed at restricting the availability of drugs of abuse to medical and scientific purposes must be supported by international action (see table). This remained the guiding principle of the international community in developing the international drug control system. International drug treaties constitute the backbone of this system.

Chronology of the development of the international drug control system

	Year
I. Control of plants	
Opium poppy	1953
Coca bush	1953
Cannabis plant	1961
II. Control of drugs	
A. Plant materials	
Prepared opium	1925 (some measures in 1912)
Medicinal opium	1931 (some measures in 1925)
Raw opium	1931 (some measures in 1925)
Coca leaf	1953 (some measures in 1925)
Cannabis	1961 (some measures in 1925)
Cannabis resin	1961 (some measures in 1925)
Poppy straw	(Some measures in 1961)
B. Natural (and semi-synthetic) compounds	
Morphine and other opiates	1912
Cocaine	1912
Analogues of narcotic drugs	1931
C. Synthetic compounds	
Synthetic opioids	1948
Some synthetic stimulants	1971
Some synthetic sedatives	1971
Some hallucinogens	1971
III. Control of substances used in the manufacture of drugs	
A. Precursor compounds	
Cocaine precursors (ecgonine and its derivatives	1925
Precursors of other narcotic drugs (e.g. opiates)	1931 (some measures in 1925)
Some precursors of psychotropic substances	1988
B. Chemicals and solvents	
Some chemicals and solvents	1988

Genesis

The first international narcotics conference was held at Shanghai, China, in 1909 when, upon the initiative of Bishop Charles H. Brent and the President of the United States of America, Theodore Roosevelt, 13 countries participated in the International Opium Commission. The delegates had no power to sign a diplomatic act but agreed unanimously on nine resolutions. Some of these resolutions were addressed to Governments which had, as a consequence of the Opium Wars, concession territories in China, requesting them to regulate the trade, distribution and consumption of opium in conformity with Chinese national legislation. The other resolutions, concerning the desirability of the gradual suppression of opium smoking, restriction of the use of morphine to medical purposes and national control of morphine and other derivatives of opium, can be considered the first universal appeal to fight drug abuse and the first declaration of the principles of a future international narcotics control system.

The most important consequence of the International Opium Commission was the organization at The Hague of the conference which led to the adoption of the first International Opium Convention in 1912; several years later, an agreement was signed at Geneva concerning suppression of the manufacture of, internal trade in and use of prepared opium. The significance of this Convention is twofold: *(a)* it established narcotics control as an institution of international law on a multilateral basis; and *(b)* it established, in rudimentary form, the present national narcotics control regime.

In the Hague Convention, the gradual suppression of opium smoking was agreed upon, the use of morphine, other opiates and cocaine was limited to medical and legitimate purposes, and their manufacture, trade and use were made subject to a system of permits and recording.

In 1912, there were 46 nominally sovereign States; the conference was attended by representatives of 12 countries; and 34 countries were absent or not invited. Through diplomatic channels and the convening of two further international conferences, it was possible to attain the signatures of all countries, except five. It was therefore decided on 25 June 1914 that the Convention would come into force by the end of that year. Three days later, on 28 June, the Austrian Archduke Francis Ferdinand was assassinated at Sarajevo.

Universal ratification of the Convention finally came about as the result of the treaties of Versailles, since every peace treaty (in 1919, with Germany, Austria and Bulgaria; in 1920, with Hungary and Turkey) contained provisions about the obligation of the High Contracting Parties to ratify and apply the 1912 Convention.

League of Nations

A year after the convening of the Versailles conference, on 15 December 1920, the first Assembly of the League of Nations set up the Advisory Committee on the Traffic in Opium and Other Dangerous Drugs, the predecessor of the Commission

on Narcotic Drugs, established within the framework of the United Nations. This decision was based on article 23 of the Covenant, which entrusted the League with general supervision over the execution of agreements with regard to the traffic in opium and other dangerous drugs. The Advisory Committee held its first meeting from 2 to 5 May 1921 and continued its activities until 1940.

There is no space here to describe the creation and evolution of the international drug control system during the existence of the League of Nations and the brief summary below is limited to the major achievements of the League, so as to allow an understanding of the *status quo ante* the Second World War.

As reflected in the resolutions of the 1909 International Opium Commission and in the 1912 Convention, the drug problem was at first perceived as the smoking of prepared opium, and abuse of morphine and other opiates (including heroin) and of cocaine in the Far East. Opium smokers and opiate and cocaine abusers were supplied by the unlimited production of opium in Asia and by the unlimited manufacture of opiates and cocaine (manufactured drugs) in Europe. The efforts of the League were consequently focused on the reduction of availability of prepared opium and manufactured drugs in the Far East. The suppression of opium smoking remained the aim of the conventions and agreements concluded during the existence of the League of Nations. It became evident, however, that this aim could not be achieved without international monitoring, and one of the greatest achievements of the League was the creation, pursuant to the International Opium Convention of 1925, of the Permanent Central Board (first known as the Permanent Central Opium Board, and subsequently as the Permanent Central Narcotics Board), the predecessor of the International Narcotics Control Board. This put an end to the large-scale diversion of manufactured narcotic drugs from the legal trade into illicit channels.

The 1925 Convention came into force only in 1928, and the Permanent Central Board started its work in 1929. There is documented evidence that, in the intervening period between 1925 and 1929, at least 100 tonnes of manufactured alkaloids (opiates and cocaine) passed into illicit traffic. Owing, however, to the new export-import authorization system and its supervision by the Board, the diversion of opiates became very difficult and some unscrupulous manufacturers started to market and export new morphine derivatives. Benzyl-morphine is the best example and can be regarded as the first designer drug, because it is an analogue and substitute for morphine. But it is also a precursor because morphine can easily be recovered from it. In this context, it should be noted that the control of codeine (methyl-morphine) was motivated more by its convertibility into morphine than by its actual abuse or potential for abuse. Thus, although it is often stated that control of precursors was introduced by the 1988 Convention, in reality precursors of opiates (including thebaine) have been under international control since 1931, and ecgonine and all of its derivatives (e.g. all of the cocaine precursors) were put under international control in 1925.

The 1925 Convention contained provisions for the control of coca leaf exports from producing countries to countries in which the manufacture of cocaine took place. The same controls were applied to crude cocaine (e.g. extracts) and to ecgonine and its derivatives which had also been used since 1885 for cocaine manufacture in Europe.

The 1925 Convention also contained the first provisions related to cannabis prohibiting the export of cannabis resin to countries that prohibited its use, and preventing illicit international trade in Indian hemp, especially in resin. During the League of Nations period, however, no international attempts were made to control the traditional use of cannabis, coca leaf chewing or opium eating.

The provisions of the 1925 Convention instituted the international system of supervision of international trade by the Permanent Central Board, but it was realized that with no limitation placed on the supply of raw materials for the manufacture of opiates and cocaine and the supply of opium and manufactured alkaloids to consumer countries, it would be impossible to reduce their use to that required for medical purposes.

The 1931 Convention can be considered a response to this situation and it is justified to call it the "Limitation Convention" because of the introduction of the system of estimates. Each Government was obliged to furnish annual estimates of its need for narcotic drugs for medical and scientific purposes. These estimates were examined by the Drug Supervisory Body which drew up an annual statement of the estimated world requirements. Compliance with the estimates was under the control of the Permanent Central Board which was authorized to intervene in any case in which the limits were not respected.

The suppression of opium smoking remained one of the main aims of the conventions and agreements concluded during the existence of the League of Nations, including the Agreement concerning the Control of Opium Smoking, signed at Bangkok in 1931. The League was, however, no longer functioning when prohibition was introduced by the colonial powers in their territories in the Far East.

Illicit traffic during this period was considerably facilitated by the lack of cooperation among national authorities and by the differences between national criminal jurisdiction systems. The first international provisions intended for the prosecution and extradition of traffickers and for direct police cooperation appeared in the 1936 Convention, which was initiated by the International Criminal Police Organization (Interpol) because there was no platform for the establishment of closer cooperation among national police authorities in respect of drug offences. The Convention followed, to a large extent, the International Convention for the Suppression of Counterfeiting Currency of 1929, and although its provisions were never properly implemented, its principles were used for the development of the 1961, 1971 and 1988 Conventions.

United Nations

A. Mandates and structures

The transfer of powers and functions from the League of Nations to the United Nations was achieved by a number of legal and administrative arrangements. In the field of narcotic drugs, the 1946 Protocol served this purpose and subsequently served as a model for similar legal documents in other technical fields.

The primary responsibility for the general supervision of narcotic matters was assigned to the Economic and Social Council which, at its first meeting, created the Commission on Narcotic Drugs to continue the work of the Advisory Committee, which had ceased to exist when the League of Nations was dissolved. The Commission was given the following terms of reference:

(a) To assist the Council in exercising such powers of supervision over the application of international conventions and agreements dealing with narcotic drugs as may be assumed by or conferred on the Council;

(b) To carry out such functions entrusted to the League of Nations Advisory Committee on Traffic in Opium and Other Dangerous Drugs by the international conventions on narcotic drugs as the Council may find necessary to assume and continue;

(c) To advise the Council on all matters pertaining to the control of narcotic drugs, and prepare such draft international conventions as may be necessary;

(d) To consider what changes may be required in the existing machinery for the international control of narcotic drugs and submit proposals thereon to the Council;

(e) To perform such other functions relating to narcotic drugs as the Council may direct.

Within the United Nations Secretariat, the Division of Narcotic Drugs was set up and entrusted with the monitoring of the implementation of decisions made at policy level for the control of narcotic drugs. The Division was subsequently integrated into the United Nations International Drug Control Programme.

Since the Permanent Central Board and the Drug Supervisory Body were created by treaties and not by the League of Nations, there was no need for the establishment of new bodies to ensure continuity; in accordance with the 1961 Convention, the two bodies were merged to form the International Narcotics Control Board.

The important tasks performed by the Health Committee of the League of Nations and by the Office international d'hygiène publique were continued by the World Health Organization (WHO). The responsibility of WHO in the field of narcotic drugs was substantially increased by the 1948 Protocol.

B. Treaties

1. Protocol amending the Agreements, Conventions and Protocols on Narcotic Drugs, 1946

The Protocol summarized the six existing international treaties together with the necessary corrections (e.g. transfer of responsibilities of the bodies of the League of Nations to the new United Nations bodies), without the addition of new provisions.

2. Protocol bringing under International Control Drugs Outside of the Scope of the 1931 Convention for Limiting the Manufacture and Regulating the Distribution of Narcotic Drugs, 1948

The 1931 Convention had placed under international control compounds derived from natural raw materials, for example, natural alkaloids, such as morphine or cocaine, and semi-synthetic derivatives of opium alkaloids, such as heroin. Completely synthetic dependence-producing narcotic analgesics were marketed after the adoption of the 1931 Convention and, in the aftermath of the Second World War, it became evident that the problems connected with the use of these synthetic drugs (pethidine, methadone etc.) were identical with the consumption of natural opiates.

The 1948 Protocol was therefore intended to bring synthetic narcotic drugs under international control, but the extension of the scope of control was not limited to synthetic compounds. The Protocol applies to all drugs liable to the same kind of abuse and productive of the same kind of harmful effects as the drugs specified in article I, paragraph 2 of the 1931 Convention. This provision makes it possible to place under international control not only new synthetic drugs but also any addiction-forming drug, whether already discovered or to be discovered in the future. This provision can be considered as the birth of the similarity concept. It must be emphasized that prevention of the uncontrolled marketing (and eventual abuse) of new drugs constituted the basic philosophy of the Convention. This is reflected in two provisions.

In accordance with the Protocol, every State party to the Protocol is obligated to inform the Secretary-General of any drug used or capable of being used for medical or scientific purposes (and not falling within the scope of the 1931 Convention) which that party considers capable of abuse and of producing harmful effects. Second, the Protocol authorized the Commission on Narcotic Drugs to place such a drug under provisional control. The provisional control measures might be altered in the light of the conclusions and decisions of WHO (and subsequently in the light of experience).

The need for prompt action by the Commission, which resulted in the adoption of the 1948 Protocol, was confirmed by the Permanent Central Opium Board in 1951. In its report, the Board pointed out that the licit consumption of pethidine quantitatively exceeded morphine consumption; some national authorities reported that pethidine was abused in 28 per cent of addiction cases and that most morphine abusers had switched to methadone.

3. Protocol for Limiting and Regulating the Cultivation of the Poppy Plant, the Production of, International and Wholesale Trade in, and Use of Opium, 1953

The principle of limiting the manufacture and use of natural and semi-synthetic opium alkaloids was adopted and applied in the 1931 Convention, and extended to the synthetic narcotic analgesics by the 1948 Protocol, but there were no international agreements limiting the production and non-medical use of opium (except for the prohibition of opium smoking). The limitation of the production of raw materials had been considered by the League of Nations but follow up to the project was cut

short by the war. The 1953 Protocol therefore specifically prohibited the non-medical use of opium, and it required each producing country to establish a monopoly to control the cultivation of the opium poppy and the production of opium. The Protocol enumerated, by name, seven countries authorized to produce opium for export (Bulgaria, Greece, India, Iran, Turkey, the Union of Soviet Socialist Republics and Yugoslavia).

The practical merits of the 1953 Protocol cannot be evaluated on the basis of the treaty itself because it never became a vital international instrument. Rather, it must be considered as a forerunner of the provisions of the Single Convention on Narcotic Drugs dealing with the control of cultivation of "narcotic plants" and production of natural materials. The drafting and the adoption of the Single Convention on Narcotic Drugs was facilitated by the existence of the 1953 Protocol because some of the latter's provisions could be incorporated into the text of the Single Convention, and it was possible to avoid reopening discussions on such overambitious and unrealistic proposals as the establishment of an international opium monopoly or an international inspection system which were debated for several years during the development of the 1953 Protocol.

4. Single Convention on Narcotic Drugs, 1961

The extreme complexity of the provisions of the conventions, agreements and protocols on narcotic drugs was realized as early as 1948, when the Economic and Social Council invited the Secretary-General to prepare a single draft convention integrating the control systems of previous treaties. With the adoption of the 1953 Protocol, the number of treaties was increased to nine.

Furthermore, in the 1950s, there was an important change in the philosophy of the international community. Prior to the Second World War, opium smoking and the abuse of heroin, morphine and cocaine in the Far East were considered the main drug problems in the world, while problems connected with the abuse of cannabis resin were studied by the League of Nations. It was only after the War that discussions started on the possibilities of suppressing the traditional opium eating habit[1] and cannabis consumption in Asia, and the coca chewing habit in South America. From a historical perspective, therefore, it can be concluded that in the 1950s no distinction was made between traditional use and abuse. This is reflected in the report of the Permanent Central Opium Board for 1955 on coca chewing, which states that, in 1954 a long-standing controversy had been brought to an end when it was agreed between the Governments concerned, WHO and the Commission on Narcotic Drugs that the habit constituted a form of drug addiction, even though it did not possess all of the characteristics of addiction, and that it should be suppressed.[2]

The new philosophy was translated into the respective provisions of the 1961 Convention, which led to the suppression of the opium eating habit and cannabis

[1]There was a difference of opinion between the United States and other countries. The United States' position that the use of opium products for other than medical and scientific purposes was abuse and not licit had been clearly stated in a memorandum in 1925.

[2]The decision was based on the expert opinion of the World Health Organization.

consumption in some Asian countries and, to some extent, a reduction in coca chewing in South America.

The Single Convention was not simply a synthesis of previous international instruments. It also extended the scope of control to other drugs (e.g. cannabis and coca leaf) and introduced a number of new control measures. Its main provisions are as follows:

(a) It prohibits the production, trade and use for non-medical purposes of all narcotic drugs;

(b) It extends the scope of control to cannabis and coca leaf;

(c) It limits possession of narcotic drugs to medical and scientific purposes and to persons authorized to possess them;

(d) It makes obligatory, for manufactured drugs, the limitation based on estimates introduced by the 1931 Convention (narcotic raw materials were excluded);

(e) It incorporates the basic provisions of the 1953 Protocol (national opium monopoly, licensing of farmers etc.) and extends these provisions also to cannabis and coca leaf;

(f) It extends the system of import certificates and export authorizations, introduced by the 1925 Convention, to poppy straw;

(g) It completes the international system of statistical control by extending it over the entire range of transactions concerning all drugs covered by the Convention.

In addition, the Single Convention introduced new obligations for dealing with the medical treatment and rehabilitation of addicts and it divided drugs into four schedules so that greater or lesser degrees of control could be exercised in respect of the various substances and compounds.

Under the 1961 Convention, the Permanent Central Board and the Drug Supervisory Body were merged into one single body, the International Narcotics Control Board, and the tasks of the Board were substantially increased, mainly because the estimates and the statistical return systems were extended to all narcotic drugs.

The responsibility of WHO was also increased: scheduling decisions of the Commission were to be based on the recommendations of WHO which set up an expert committee[3] for the study of the scientific and medical aspects connected with the use and abuse of new drugs.

The functioning and the provisions of the 1961 Convention (and of the other drug control treaties) were analysed by the International Narcotics Control Board and the United Nations International Drug Control Programme in reports submitted to the Commission on Narcotic Drugs which was requested by the General Assembly in 1994 to evaluate the functioning of the international drug control system. Without entering into the content of the reports on cannabis, coca leaf etc., it is

[3]There have been several changes to the name of the committee, which is currently known as the Expert Committee on Drug Dependence.

necessary to draw attention to their main finding that the 1961 Convention had been successful in preventing the diversion of narcotic drugs from legal sources toward illicit channels so that black markets were no longer supplied by legally manufactured narcotic drugs. It should be emphasized that the provisions of the 1961 Convention were intended to prevent diversion but were not aimed at combating illicit traffic in clandestinely produced or manufactured drugs, which became a large-scale organized criminal activity after the adoption of the Convention.

5. *Convention on Psychotropic Substances, 1971*

The international control of synthetic opioids, introduced in 1948, was followed by the extension of the scope of control to other synthetic drugs only in 1971. The hesitation of some industrialized countries to acknowledge the necessity for control over the international trade in amphetamines and barbiturates contributed to the delay and to the adoption of inadequate control measures.

The scope of international control was substantially increased by the Convention on Psychotropic Substances, with its extension to three drug classes: sedatives (at that time mainly barbiturates); amphetamine-type stimulants; and LSD-type hallucinogens.

For several decades, most Governments were of the opinion that national controls were sufficient for the prevention of the public health and social consequences of the abuse of barbiturates and amphetamines. Following reports on the increase in the non-medical use of both drug classes and the appearance of new forms of abuse (e.g. the intravenous administration of amphetamines in excessive doses assumed epidemic proportions in some countries), it was realized that national control measures must be complemented by international action.

In addition, the abuse of LSD and some other hallucinogens suddenly emerged as a new problem; the rapid spread of the abuse of such new drugs, their clandestine manufacture and the increase in their illicit trafficking warranted immediate international intervention.

In theory, international control of those substances could have been solved through the amendment of the 1961 Convention but such proposals were constantly rejected by the majority of the members of the Commission on Narcotic Drugs because of their fear of the dilution of the narcotic control system by extending it to cover a huge number of pharmaceutical preparations. It must be noted that, in many countries, thousands of products were marketed which contained barbiturates in combination with other pharmaceuticals (including amphetamines)[4] as compared to the current situation where most such combination products have disappeared from the market. Similarly, in 1971, in many countries, the number of pharmaceutical preparations containing amphetamines was substantial, in contrast to the

[4]The situation can be illustrated by the example of a country where, after the entry into force of the Convention, 1,724 combination products containing small amounts of phenobarbital were exempted from some control measures.

present, when in most countries most of the amphetamines (and practically all of their combination products) have been withdrawn from the market.

It can be seen that the 1971 Convention is the combination of two completely different control regimes: one for the LSD-type hallucinogenic drugs (e.g. "street drugs" which are not used in medicine and are manufactured in clandestine laboratories) in Schedule I, and another for stimulants, hypnotics, sedatives and anxiolytics, which are products of the licit pharmaceutical industry, in Schedules II, III and IV. It must be noted that, owing to the spectacular decrease in the prescription and licit manufacture of amphetamine and methamphetamine, the black market in these drugs is today mainly supplied by clandestine laboratories.

The control regime for substances in Schedule I is stricter than that provided by the 1961 Convention for narcotic drugs, whereas the provisions for psychotropic substances in the other three Schedules of the 1971 Convention are mainly national control measures. Most of the international obligations (estimates, export-import authorizations etc.) were omitted from the new treaty.

The 1971 Convention was drawn up in conformity with the intentions of several industrialized countries which also wanted to limit the number of substances in Schedules II, III and IV. Unfortunately, this intention led to the elimination of some substantial elements of the preventive structure of the international drug treaty system:

(a) In order to avoid the control of all barbiturates, the "similarity concept" of previous treaties was replaced by new scheduling criteria. In consequence, it is impossible to put under control similar substances containing the same basic chemical structure (this possibility had existed since 1925). Thus, every new drug, including designer drugs, must be evaluated individually by a complicated and time-consuming process;

(b) In order to limit the number of drugs in the Schedules, the possibility of the control of precursors (which existed in previous treaties since 1925) was also excluded. The consequence was a 17-year delay in the introduction of the international control of LSD and amphetamine precursors, through the adoption of a new treaty.

A few years after the entry into force of the 1971 Convention, it became apparent that its provisions were insufficient to prevent the diversion of substances in Schedules II, III and IV. The provision for the prohibition or restriction of importation of specified psychotropic substances on an individual basis was not a substitute for monitoring. The Commission and the Economic and Social Council reacted to that situation by requesting parties to apply additional control measures on a voluntary basis. The adequacy of this action has been confirmed by the compliance of most countries with the requests.

Despite some major weaknesses and deficiencies, the 1971 Convention constitutes an important step in the development of the international drug control system. One of its merits is the inclusion of demand reduction provisions, which means that the prevention of drug abuse through early identification, treatment, education, aftercare, rehabilitation and social reintegration etc. has become an obligation of Governments.

6. *Protocol Amending the Single Convention on Narcotic Drugs, 1972*

The 1972 Protocol amending the 1961 Convention can be considered the first response to the increased illicit cultivation of the opium poppy and the cannabis plant, the increased illicit production of cannabis, cannabis resin and opium, the increased illicit manufacture of heroin, and the increased illicit traffic in all of those drugs. It was expected that strengthening the respective obligations of parties and expanding the role of the Board would lead to a greater efficacy of national efforts in the suppression of such illicit activities and to better cooperation among national authorities, with the assistance of the Board in preventing the international expansion in trafficking. The provisions of the Protocol were, however, unable to counteract the further increase in the illicit cultivation, production and manufacturing trends. It was only in 1988 that the international community realized the necessity of undertaking more concentrated action and the importance of developing new methods of combating the activities of organized criminal cartels.

There are two other elements in the 1972 Protocol which should be mentioned:

(a) The 1961 Convention was amended by demand reduction provisions which were patterned after the respective provisions of the 1971 Convention;

(b) The provisions of the 1961 Convention, intended to limit the availability of narcotic drugs to medical and scientific purposes, were supplemented by the obligation of parties to ensure the availability of those drugs for such purposes.

Both amendments are very important. First, because they reflect the realization that without the reduction of illicit demand, supply reduction measures will bring temporary results only, and, second, one of the basic principles of international drug control is that reduction in the availability of drugs for non-medical purposes should not affect and limit their therapeutic use.

7. *United Nations Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances, 1988*

After the adoption of the 1961 Convention and the emergence of cannabis abuse in industrialized countries, it became evident that the provisions of that Convention, intended to eliminate the traditional use of cannabis, were inadequate to prevent the large-scale illicit traffic in cannabis which was a consequence of the increase in its new illicit demand. There are no reliable statistics on the number of new cannabis abusers in Western countries but the explosion in demand can be illustrated by the example of the United States where, prior to the decriminalization of the possession of marijuana for personal use, one million persons were arrested between 1970 and 1973 for marijuana-related crimes. The propagation of the modern (e.g. non-traditional, non-medical, non-ceremonial) form of cannabis smoking in Western European countries in the 1970s created further large markets for illicit traffic in cannabis and cannabis resin.

The establishment of the international drug control system contributed to a large extent to the elimination of the world's greatest addiction epidemics, which were created in the nineteenth century and at the beginning of the twentieth century

by the legalization of the opium trade and opium smoking and the free sale of morphine and heroin, and also to the prevention of new epidemics.

In 1969, when the number of heroin addicts in the world was very low,[5] the death of 224 American teenagers due to heroin overdose can be regarded as the first sign of the beginning of a new wave of heroin abuse. The interaction between the spread of heroin abuse and the propagation of new clandestine heroin laboratories led to the problem becoming global and the adoption of the 1972 Protocol amending the 1961 Convention could not stop the flow of illicit opium to clandestine laboratories and the increasing availability of illicit heroin.

The international community was not prepared for the explosion in cocaine abuse in the 1980s, which was accompanied by the large-scale illicit manufacture of cocaine in some Latin American countries. The dramatic increase in cocaine abuse is illustrated by two reports submitted by the United States to the Secretary-General of the United Nations: in 1970, no cocaine abuse was reported, while in 1988, the number of cocaine abusers was estimated at 12,200,000, among them 1,242,000 daily abusers, and 1,696 cocaine-related deaths were registered.

It was, therefore, realized that the control methods of the existing international treaties, which had been successful against the diversion of narcotic drugs from legal sources to illicit channels, must be complemented by concentrated and coordinated international action and new, more efficient methods of combating organized illicit drug traffic. The adoption of the 1988 Convention should be considered a response to this new situation.

The International Conference on Drug Abuse and Illicit Traffic, held in 1987, was the prelude to the 1988 Convention, with a consensus on the following issues relating to illicit traffic:

(a) The time when the world was divided into producing countries and consuming countries was over. Drug abuse had become a global phenomenon and illicit cultivation, production and manufacture were no longer limited to a small number of countries;

(b) Illicit traffic had become an international criminal activity and there were close links between illicit drug traffic and other organized criminal activities;

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[5] In 1970, the following number of heroin abusers were reported to the United Nations:

United States of America	65,915
Hong Kong	12,982
Thailand	2,780
Canada	2,714
United Kingdom of Great Britain and Northern Ireland	1,417
France	107
Republic of Korea	56
Australia	7
Federal Republic of Germany	6
Belgium	1
Total	85,985

(c) Illicit traffic generated large financial profits, thus enabling criminal organizations to penetrate and corrupt the structures of Governments, societies and legitimate commercial and financial business.

All of the above phenomena were drastically manifested in the South American countries that initiated the 1988 Convention, which introduced a number of new methods against illicit traffic, including, *inter alia*:

(a) Measures that enabled Governments to deprive persons engaged in illicit traffic of the proceeds of their criminal activities;

(b) A comprehensive legal framework for close collaboration;

(c) Monitoring of substances (including some precursors of some psychotropic substances), chemicals and solvents frequently used by clandestine drug laboratories.

At the same time, implementation of the provisions of the 1961 and 1971 Conventions became a treaty obligation of parties to the 1988 Convention.

The provisions of the 1988 Convention contain practically all of the elements necessary to overcome constitutional and other obstacles hindering cooperation among national authorities with different legal and criminal jurisdiction systems. The possibilities for international police cooperation were widened by the Convention, including authorization of controlled delivery techniques. The success of the 1988 Convention now depends upon the determination of Governments to implement the complex and comprehensive provisions of this new international instrument.

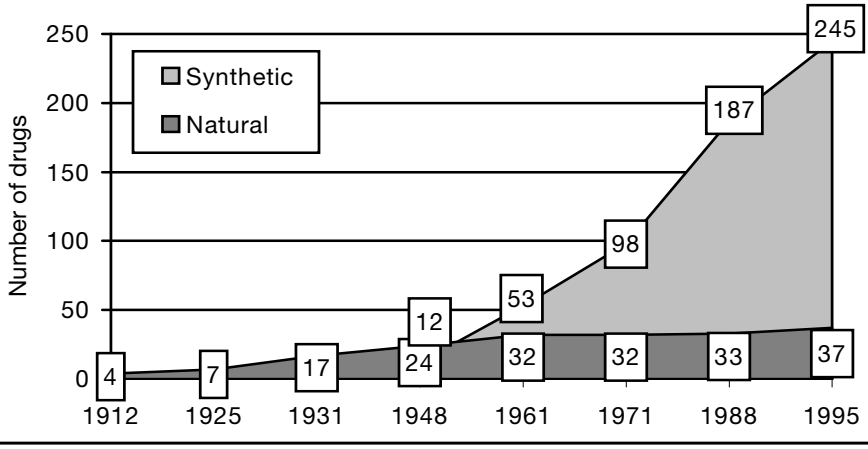
The future

The explosion in the abuse of cannabis (in the 1960s), heroin (in the 1970s) and cocaine (in the 1980s) has changed the world; countries in the western hemisphere became the major consumers of drugs, leading to the development of an international illicit supply network, while in many developing countries, the traditional use of some narcotic drugs has been replaced by "Western" types of drug abuse. The shift from opium to heroin and from eating or smoking to injection of drugs are examples of that frightening trend.

Figure 1 demonstrates that the increase in the number of natural drugs (including their semi-synthetic derivatives) under international control is negligible. Huge amounts of natural drugs are seized throughout the world but their number remains limited to cannabis and cocaine products and heroin. Figure 1 also demonstrates the steady increase in the number of synthetic compounds under international control over time. Owing to the unlimited possibilities offered by chemical synthesis, it is obvious that more and more synthetic drugs will be added to the schedules of the conventions. This process will be speeded up by a recent phenomenon that can best be described as illicit research. In the past, all new drugs were

the result of pharmaceutical research, and the use of these drugs for non-medical purposes began after their marketing as pharmaceutical products. Now parallel research activity is undertaken to develop new drugs for non-medical purposes only. As a result of this illicit research, it can be foreseen that hundreds of new designer drugs (e.g. fentanyl derivatives, ecstasy-type compounds and others) will be developed and manufactured in clandestine laboratories. It is highly probable that all natural drugs will gradually be replaced by similar synthetic compounds. Such a development will lead to drastic changes in the cultivation, production and manufacture of illicit drugs and the international community should be prepared to adapt the treaty system to these new situations.

Figure 1. Increase in the number of drugs and substances under international control (1912-1995)

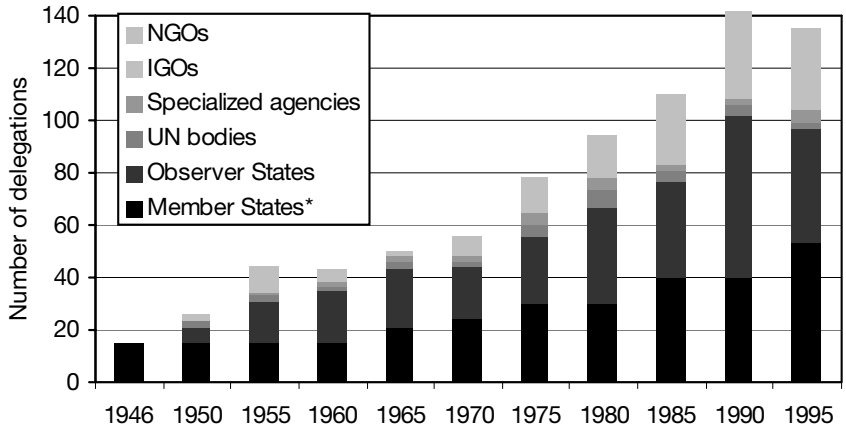


In this situation, it must be realized that there are no substitutes for international drug control treaties, and conventions will continue to form the backbone of the international drug control system. The updating of that system remains one of the principal responsibilities of the Commission on Narcotic Drugs. It is expected that the increased size of the Commission and the large number of participants in its sessions (see figure 2), as well as the activity of delegations, will strengthen and not weaken the operational functioning of the treaty system.

At the request of the General Assembly, the shortcomings of the treaty system were evaluated by the International Narcotics Control Board and the United Nations International Drug Control Programme which submitted concrete proposals to the Commission. There is a need to accelerate the functioning of the international drug control system. This aim cannot be achieved without the elimination of loopholes in the preventive network of that control system. It is the duty of the Commission to consider amending the existing drug control treaties (first of all the scheduling

provisions of the 1971 Convention) and/or simplifying the procedures for the review and evaluation of emerging drugs of abuse, otherwise the gap between the official detection of the appearance of a new drug of abuse on the illicit market and its scheduling (currently, usually, a four-year process) will be further widened.

Figure 2. Attendance at sessions of the Commission on Narcotic Drugs



*The membership of the Commission on Narcotic Drugs was increased from 15 States in 1946, to 21 in 1961, to 24 in 1966, to 30 in 1972, to 40 in 1983 and to 53 in 1991.

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Alternative development: the modern thrust of supply-side policy*

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ABSTRACT

Alternative development is closely associated with reductions in drug crop cultivation at the local level. At present, local successes in such reductions cannot be directly attributed to alternative development interventions because the motivations and circumstances that determine household drug crop cultivation remain largely unexplored. Research has tended to focus on aggregate trends in drug crop cultivation at the national, regional and village levels. The specific socio-economic, cultural and environmental circumstances that influence household production are consequently overlooked in project design. Rather, alternative development initiatives have adopted a uniform approach where emphasis is placed on the high economic returns that the opium poppy and the coca bush are reported to accrue per unit of land.

The present article rejects such a uni-causal explanation of drug crop cultivation, founded as it is on the assumption that drug crop producers are a homogenous group. Instead, an insight is offered into the diverse factors influencing household drug crop cultivation that are currently neglected, including returns on labour, access to credit and land, and the effect of law enforcement and conditionality. The article indicates that the failure to recognize the dynamics of household decision-making has implications for the cost-effectiveness of the current strategy and raises questions concerning the unintended consequences of alternative development. Its impact on the poor and the process of relocation is a particular focus. In addition, the article illustrates that greater attention needs to be given to the timing and interface between law enforcement initiatives and alternative development interventions.

The paper concludes that a greater understanding of the multi-functional role which drug crops play in the socio-economy of the household would assist in determining more effective and sustainable initiatives aimed at reducing both existing and potential drug crop cultivation. It is suggested that the overall success of supply-side interventions will be contingent on reductions in demand both internationally and, increasingly, in source countries.

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The opium poppy and the coca bush: their cultivation and characteristics

The opium poppy and the coca bush represent efficient cash crops that are well suited to the harsh conditions of source areas. Opium poppies will grow with little difficulty in conditions unsuitable for most other crops, cultivated on either irrigated or unirrigated land and at altitudes of up to 3,000 metres. Households are also able to choose from a variety of climates that are available to them in the mountainous areas of opium poppy cultivation. Consequently, planting dates and the altitude of cultivation vary in response to changing weather conditions, methods adopted to reduce risk[1] and techniques used to obtain higher yields.

The coca bush also shows resilience in a marginal environment. It is able to grow in a variety of altitudinal, climatic and soil conditions. It can tolerate acidic soils and shows a resistance to pests and diseases. The use of pesticides and fertilizers is therefore limited, making the coca bush a popular crop in the economically and environmentally fragile areas of the Andes.[2] It is a perennial that matures in only 18 months and can be harvested 4-6 times per annum for up to 40 years, although productivity begins to dwindle after 15 years. The labour-intensive nature of harvesting means that coca bush not only provides a livelihood for the producer but has also given those on the altiplano a consistent source of employment [3].

Both the opium poppy and the coca bush are low-capital input, high-yield crops that produce non-perishable, high value-to-weight products. The durability of the opium poppy means that households can choose to speculate if market prices are deemed too low. The opium poppy also produces a number of by-products with both a high use and exchange value. With many areas of cultivation lacking adequate infrastructure, the high value-to-weight ratio of coca leaves and opium makes the transportation of relatively small amounts either on foot or by mule a profitable endeavour. Most importantly, growers have almost guaranteed markets and access to credit and seeds from some traders. As Brailsford [4] points out, cultivation of the opium poppy would be an ideal solution in, for example, Badakhshan Province, in Afghanistan, were it not for the undesirability of the end product. Furthermore, aid agencies would probably be promoting its cultivation and introducing improved methods of production.

The extent of opium poppy and coca bush cultivation informs policy makers of resource priorities and the effectiveness of current supply-side strategies [5]. However, reliable estimates of illicit drug production have been difficult to obtain owing

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[1]There are several risks associated with cultivating opium poppy. Apart from the threat of eradication by law enforcement agencies, the opium poppy is vulnerable to natural threats during the first two months of growth, including inadequate sunshine, excessive rainfall, insects, worms, hailstorms, early frost and trampling by animals. During the harvest, rain and high winds will reduce yields. The harvesting of the opium poppy requires skill and experience: a significant proportion of the potential yield may be lost as a result of untimely, or improper, lancing [1]. The outbreak of *fusarium oxysporum* in the Upper Huallaga Valley in Peru illustrates the risk to coca leaf production from natural agents. Moreover, coca bush requires three days to dry after being harvested. In the tropical zones of the Andes, where coca bush is generally grown, excessive rainfall is typical. The timing of the harvest is critical if the leaves are not to blacken and be wasted [2].

[2]The ecological range of coca bush is not limited to South America. At the turn of the nineteenth century, it was cultivated on the island of Java in Indonesia.

to the political and geographical inaccessibility of source areas. Inadequate data on the levels of opium poppy and coca bush cultivation, yields, alkaloid content, harvesting efficiency and conversion factors have resulted in a wide disparity in the measurement of cocaine and heroin manufacture worldwide. For instance, opium production figures recorded in the "Afghanistan opium poppy survey" undertaken by the United Nations International Drug Control Programme [1], have consistently differed from estimates issued by the Government of the United States of America, sometimes by as much as 100 per cent.

It is important to recognize that, even with consensus on the extent of drug crop cultivation in any given source country, there is a need to develop a greater understanding of the complexity of implementing alternative development interventions in source areas, and what such interventions can realistically hope to achieve, given the growing demand for illicit drugs and the continuing prevalence of rural underdevelopment.

Alternative development

The concept

Alternative development has sought to create the economic and social environment in which households can attain an acceptable standard of living, without the need for drug crop cultivation. The approach has varied greatly between regions and donors. One of the main protagonists of alternative development has been the Government of Bolivia, which has sought to capitalize on the image of drug crop cultivation as a source of development in order to negotiate greater overseas assistance [6]. The semantics of alternative development has also proved popular with some donors who have justified the contravention of conventional development criteria and best practice under the guise of alternative development initiatives.[3]

The concept of alternative development emerged from the failure of the crop substitution initiatives of the 1970s and the integrated rural development approach of the 1980s. In the 1970s, crop substitution projects successfully identified alternative crops but failed to alter the market and infrastructural constraints that households faced in traditional areas of drug crop cultivation. The broader, integrated rural development approach of the 1980s sought to redress the emphasis on replacing income by promoting the integration of traditional areas of cultivation into the economic and social mainstream. The approach consolidated crop-substitution initiatives with food-for-work schemes, income-generation opportunities, infrastructural projects to improve access to markets and social development initiatives aimed at improving education, health and access to safe drinking water and sanitation.

[3]See Mansfield and Sage [7] and Dudley [8], who argue that alternative development initiatives, in particular those implemented by the Government of the United States, often do not comply with conventional development criteria and best practice, as they largely ignore cross-cutting issues such as poverty-targeting, participation, gender and environmental sustainability.

In the late 1980s, however, the relocation of drug crop production from traditional areas to new areas of cultivation prompted a further reappraisal of drug control. The result was a broader strategy of alternative development that has sought to integrate regional development assistance with law enforcement initiatives [6, 9, 10]. At the core of alternative development is a recognition that drug crop cultivation is interwoven with numerous other issues which go well beyond the microeconomics and agronomy of coca bush and opium poppy cultivation.[4]

More recently, a wide range of initiatives has been adopted in an attempt to integrate drug control into national development plans [11]. The broader strategy has sought to revive and expand the legal sectors of the economy and provide a framework for sound economic policies to generate demand for diversified economic growth and job creation nationwide [12]. In 1991, the United States Agency for International Development allocated a significant proportion of project resources to the highland valleys in Bolivia, in an attempt to generate alternative sources of income and employment and deter migration to the Chapare,[5] as well as significant monetary aid in the form of economic support funds to assist the Government of Bolivia in its programme of economic reform.[6]

Some analysts have suggested that there is a fundamental contradiction between microlevel initiatives, which aim to integrate source areas into the State through crop substitution, law enforcement and infrastructural efforts, and macroeconomic policies that seek to create sound economic policies through reducing government expenditure and removing market imperfections [13]. It seems counterintuitive to suggest that the removal of agricultural subsidies and the imposition of severe budget constraints, under the auspices of the structural adjustment policies of the International Monetary Fund and the World Bank, have assisted Governments of source nations in their efforts to increase agricultural incomes and improve the socio-economic, political and legal environment in which licit income-earning opportunities might flourish. In response to such criticism, the Government of the United States and the European Union have offered trade preferences, debt relief and financial assistance to source countries in an attempt to create diversified and sustainable economies with viable alternatives to drug crop cultivation and processing. In the current lexicon of the Government of the United States, all such initiatives qualify as "alternative development" interventions.

The context

In practice, alternative development initiatives have worked on the assumption that reductions in opium poppy and coca bush cultivation are conditional on the

[4]At the international level, only two alternative development projects have been attempted in areas of cannabis cultivation: in the Bekaa Valley in Lebanon, which also produces the opium poppy, and the Rif region in Morocco.

[5]One third of the Cochabamba Regional Development Project budget of $38 million was spent on the highland valleys between 1983 and 1992 [10].

[6]Despite the assertion that the economic support funds were to assist the Government of Bolivia in its programme of economic reform, payments were closely tied to the achievement of eradication targets. Consequently, some commentators suggested that such funds were used to finance the compensation payments given to those coca bush farmers who agreed to eradicate their coca bush [2].

general social and economic development of source areas and the integration of such areas into the State [14, 15, 16, 17]. As such, the elimination of drug crop cultivation is often a positive externality of the process of enhancing food security, increasing household incomes and improving the quality of life [16].

Evidence suggests that coca leaf and opium production are a function of marginal socio-economic and ecological conditions [18, 19, 20, 21, 22, 23]. Hurd and Masty's study of Nangarhar, in Afghanistan, indicated that opium production tended to concentrate in the poorest areas [20]. The size of landholding, access to irrigation and population density were seen as important determinants in the extent of opium poppy cultivation. Potulski's research supports that claim, suggesting that source areas in south, south-east Asia and Latin America typically suffer from a lack of land, reliable water supply and food, making them some of the most agriculturally underdeveloped areas of the world [19, 24].

Project baseline studies also indicate that source areas are characteristically poor. In both Buner and the eastern Dir Valley, in Pakistan, for example, the average per capita income was half the national average prior to project implementation [25, 26, 27, 28]. Infrastructure, access to safe drinking water and the provision of government health and social services are often limited or non-existent. Indicators of malnutrition, infant mortality and illiteracy have proved to be consistently and substantially higher than national averages [16, 29, 30, 31]. In the Dir region, in Pakistan, for example, 25 per cent of men and 2 per cent of women were considered literate. Another example is that of Xieng Khouang, in the Lao People's Democratic Republic, where infant and child mortality is thought to range from 50 per cent to 75 per cent [15, 17].

Typically, over 90 per cent of households in source areas have been found to be entirely dependent on agriculture for their livelihood; off-farm income opportunities are very limited [29]. The farming sector itself has proved structurally weak, however, with poor marketing, small landholdings, an absence of credit facilities and a lack of irrigation. Environmental degradation, low-quality inputs and poor agronomic practices have led to extremely low yields, resulting in food deficits of between two and seven months [4, 16, 23, 29, 32, 33, 34, 35]. Such a loss of direct entitlement has led to a greater reliance on opium poppy and coca bush crops as a means of securing subsistence [32, 36, 37]. For many households in source areas, drug crops generate the greatest proportion of household annual income, a significant proportion of which is used to purchase food for consumption [19, 38, 39, 40]. As suggested by Dalibor [41], most inhabitants are destitute farmers who practise shifting cultivation and rely on opium poppy cultivation as a means of supplementing meagre incomes to cope with chronic food deficits in food production. In addition, Dalibor claims that there is no evidence that farmers are earning more than basic subsistence incomes even with their returns from growing opium poppy. As a result, households are trapped permanently in debt.

Despite the rhetoric, there is little evidence that the so-called lucrative trade in drug crops has led to economic and social development in source areas. In this context, drug crop cultivation can be seen as part of a wider survival strategy aimed at guaranteeing food security. As such, a minimum level of coca bush and opium poppy cultivation is integral to the livelihood strategies of poor households, allowing

them a guaranteed level of cash income to satisfy basic needs [21, 40]. Consequently, many commentators have suggested that development assistance is justified for such areas, simply on the basis of the prevailing level of poverty and the incidence of food insecurity [23].

The results

Alternative development through the introduction of substitute crops and diversified cropping patterns has disproved the myth that coca bush and opium poppy crops offer the highest returns to small farmers [19, 24, 39, 42, 43]. Substitution efforts in northern Thailand have illustrated that annual profits per square metre can be increased by over 50 times by replacing opium poppy with flowers [42]. In the Chapare, earnings from rubber have been found to reach four times the value of coca bush per hectare [39]. In Buner, in Pakistan, household incomes were more than doubled through development efforts between 1976 and 1991: opium poppy cultivation had been all but eliminated since 1983 [39]. Moreover, the success in Thailand in reducing the level of opium production has proved what development efforts can achieve where decades of coercion have failed [44]. The current level of production is half that of 1984 and only a quarter of that of the mid-1960s.[7]

The success of the programme of alternative development in Thailand, considered one of the most effective in the world [47], has been attributed to the broad development framework in which it operates. The approach has encapsulated a wide array of efforts aimed at enhancing food security, promoting alternative sources of income and increasing government services in the highland areas. It has been supported by initiatives aimed at involving target communities to help identify community problems and priorities, and in planning and implementing development interventions [38].

Although law enforcement is said to have played a significant part in the reduction in opium poppy cultivation in Thailand, a pragmatic approach has also been adopted. Eradication has generally only been undertaken at the point when alternative sources of income exist.[8] As such, eradication is viewed in terms of negotiated law enforcement, based on the provision of basic needs. The findings of a report undertaken by the United Nations International Drug Control Programme indicated that such a participatory and contractual approach to the population represented a major element in ensuring viability and sustainability [9]. The authorities have also distinguished between commercial cultivation and local consumption, conceding a level of household production [29, 47]. Such an approach allows that,

[7] A number of commentators have suggested that the level of opium poppy cultivation in Thailand in the 1970s is questionable, claiming that figures were inflated in order to attain more financial assistance [45]. Although the level of opium poppy cultivation has undoubtedly fallen, there is some uncertainty about whether it has fallen as dramatically as some might suggest [46].

[8] In Thailand, the authorities have adopted a gradual eradication process, based on their experience of annual reductions in opium poppy cultivation once remunerative substitute crops have been found. A minimum of three years is given for the transition to alternate crops after alternative net incomes are assured [29].

if opium poppy cultivation were to be abandoned as a source of income, there would be medical, social and cultural reasons for continuing household cultivation on a small scale [32]. Moreover, significant emphasis has been placed on keeping law enforcement activities distinct from the development programme [38].

Despite the achievements in Thailand, the success of alternative development has been limited for the most part to reducing drug crop cultivation at the local level. Substantial and sustained reductions have not been achieved. In most source areas, production continues to outstrip eradication. Moreover, the long-term nature of the initiatives in Thailand and the country's relative prosperity raise serious questions about the specific role that alternative development has played in that success. It remains to be seen whether it is a replicable model for countries such as Afghanistan and the Lao People's Democratic Republic, where off-farm income opportunities are extremely limited at present.

Studies of the distribution of project benefits have revealed that relatively wealthy households have often benefited disproportionately from project activities [15, 26, 48, 49, 50]. Such households are located in more accessible regions and often tend to be less reliant on drug crop cultivation [16, 38, 51]. Although the poorest are recognized as an important focus group, the general thrust of alternative development does not specify that they should be given priority. The evidence, therefore, tends to conflict with the assertion that drug crop cultivation is a function of the prevailing poverty that exists in source areas.[9] It also raises questions about the impact of such interventions on the poorer farmers, whose livelihoods are reportedly most dependent on drug crop cultivation. This is of particular relevance in Buner and Gadoon Amazai, also in Pakistan, which used to provide a ready source of itinerant opium poppy harvesters for Dir during the period in which opium poppy was cultivated there. In both Buner and Gadoon Amazai, cultivation still takes place on a small scale 10 years after the implementation of alternative development initiatives.[10] Moreover, evidence has suggested that reductions in coca bush cultivation in the Chapare, in Bolivia, have been accompanied by a deterioration in the general health and diet of the population, resulting in an increase in the incidence and intensity of malnutrition [31].

Little detail is available with regard to the impact of alternative development on the environment of source areas.[11] Permanent settlement, sedentary agriculture and improvements in land use, crop yields and soil conservation are, on the whole, regarded as beneficial. However, most of the alternative crops identified have

[9]Rather than define the intended beneficiaries of the project and focus on poorer households, poppy growers or those with specific irrigation problems, phase one of the Dir Project adopted the role of comprehensive rehabilitation [15]. Some have argued that lack of clarity combined with the vested political interests of the local hierarchy led to resource allocation favouring the more affluent farmer, who tended to grow fewer opium poppy crops [26]. Gaining access to Dir may have initially required a pragmatic approach that sought to ease the concerns of the wealthy and powerful.

[10]In addition, there is little detail of the motivations of persistent opium poppy growers in Buner, Malakand and Swabi, in Pakistan. The growers continued to grow opium poppy 10 years after the implementation of alternative development initiatives, only to see their crops destroyed each year.

[11]It is particularly telling that after 30 years of rural development interventions in the highlands of Thailand, where environmental protection has been one of the key objectives, the actual impact that alternative development has had on the environment remains unclear [50].

required considerably larger growing areas, resulting in an expansion of the area under annual plantation. More intensive farming systems have led to the use of chemical fertilizers and pesticides. Such systems also have long-term consequences for soil fertility and the pollution of the watershed [50]. Road access has increased commercial interests, such as tourism and agro-industry, and has facilitated illegal lumbering, all with concomitant effects on the environment [52]. Relocation of production has led to further deforestation in inaccessible areas. The balance between positive and negative impacts has not yet been quantified.

Implementation through government agencies has proved to be important in ensuring the sustainability of alternative development interventions. However, the capacity of recipient communities to manage their own resources and implement initiatives is currently limited, even in Thailand after almost 30 years of assistance [50]. Although village institutions and, more recently, community-level focus groups have been encouraged as a means of facilitating the participation of local communities, emphasis has generally been given to consultation and technical transfer rather than local capacity-building [30, 38].[12]

In practice, community development and participation have often been treated as separate components with independent activities, rather than as integral aspects of the project process. The needs and priorities of recipients and the disparate factors that influence household drug crop cultivation have not been adequately accounted for in the project design. Labour and land constraints, access to credit and the role that ecological degradation and law enforcement initiatives have played in household decision-making have been largely ignored in favour of a uniform approach, where emphasis is placed on the high economic returns that opium poppy and coca bush are reported to accrue per unit of land.

Household drug crop cultivation

Population density, diminishing landholdings and environmental degradation

The correlation between the size of landholdings and the proportion of land dedicated to drug crops is evident. Where household access to land is limited, both coca bush and opium poppy have been found to be extensively grown [28]. In Swabi, in Pakistan, the greatest proportion of land dedicated to opium poppy cultivation was found to be where average household landholdings were less than 0.75 of a hectare [43]. Similarly, in Achin, in Afghanistan, where mean household landholdings were less than 0.5 hectare, 65 per cent of cultivated land was dedicated to poppy cultivation [20]. That contrasts sharply with the situation in Sukhurd, in Afghanistan, where the farmland was considered rich, where crop yields were high and population density low, and where only 10 per cent of cultivated land was dedicated to poppy.

[12]Moreland et al. found that measures adopted in northern Thailand to empower local communities to initiate and manage their own development were given little emphasis, despite lessons from previous experience [50].

In the Chapare, in Bolivia, the amount of land dedicated to coca bush as a percentage of total farm area varied considerably. Although almost every household was found to grow a minimum amount, those with the least land were found to cultivate the largest proportion of their land with coca bush [21]. The smallest landholdings, of 2-3 hectares of tillable land, were in the "Zona Roja", where coca bush predominates [53]. Households with access to over 5 hectares of perennial crops, such as citrus, coffee, bananas or cocoa, rarely grew coca bush [54].

The relationship between land and drug crop cultivation has often been explained in terms of increasing population densities. Such increases are a common feature of source areas in south-west and south-east Asia;[13] they have also prompted migration from the highlands of Bolivia[14] and Peru to the coca leaf producing regions of the Chapare[15] and Upper Huallaga Valley. Restrictions on land use, immigration and increasing population pressure have reduced the availability of land[16] in those areas. The result has been a reduction in the size of landholdings and reduced fallow periods, leading to losses in soil fertility and diminishing yields [16, 56, 61, 62]. Both coca bush and opium poppy can be grown on the same plot for up to 15 years, considerably longer than traditional agricultural alternatives that satisfy the demanding requirements of households with limited access to land and modern inputs [15, 26, 32, 52, 60, 63, 64, 65, 66]. Within the context of increasing ecological degradation, drug crop cultivation can be seen as a survival strategy by which resource-poor farmers have mitigated the impact that population pressure [67] has placed on already limited resources.

The common response of alternative development to the problem of diminishing landholdings has been to encourage off-farm income opportunities and intensify agricultural production. Initiatives aimed at increasing off-farm income opportunities have included the encouragement of value-added activities and the provision of vocational training to improve employment prospects elsewhere. Regardless of the merits and limitations of each approach, the objective has been to increase the returns on labour.[17]

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[13]In Dir, in Pakistan, the density of population is particularly acute in Nihag and Usherai, where the majority of the area's opium poppy cultivation was undertaken [27, 55].

[14]In Bolivia, 92 per cent of those interviewed in Campero and Mizque were found to have less than 5 hectares of land [56].

[15]It is argued that migration from the highlands of Bolivia was driven by a process of economic stagnation and environmental degradation. Faced with diminishing agricultural yields, migration became the only means by which land-constrained households on the altiplano could satisfy their basic needs. However, that process led to a chronic labour scarcity in the highlands, affecting the household's capacity to manage on-farm resources effectively. Agricultural productivity declined further as a result, intensifying the pressure to migrate [57].

[16]The influx of landless peasants from northern Thailand and government restrictions on the use of forest land have placed increasing pressure on land availability in northern Thailand [58, 59, 60].

[17]Given the limited local off-farm income opportunities, some interventions sought to provide vocational training by which small landholders would be able to obtain employment elsewhere. However, it is unclear what the implications of such a strategy are for the long-term development of the area and the household division of labour. Locally based small-enterprise initiatives would seem to have a greater impact on the development of the area as a whole and constitute a strategy that may be more attune to the values and aspirations of local communities. Moreover, an approach that is aimed at developing local off-farm income opportunities would have a greater opportunity of integrating the needs and priorities of women than one that seeks to train migratory labour.

The intensification of agricultural production, however, has sought to increase both returns on land and labour. The introduction of higher-yielding varieties of seed, irrigation and improved agronomic practices have proved particularly successful in increasing the production of traditional crops and reducing food deficits in source areas.[18] However, many of the improved agricultural practices suggested for alternative cash crops have increased the demand on labour [50]. Without a thorough understanding of existing and potential labour resources and requirements, intensification may have increased agricultural yields of land while reducing the returns on labour. Such a strategy has failed to acknowledge the extent of opium poppy and coca bush cultivation on small holdings, explained as much in terms of labour constraints as of land scarcity.

Returns on land or labour?

Much of the discussion regarding the profitability of drug crops centres on returns on land, rather than labour. It is not clear, however, that land is the limiting factor for many drug crop producers.[19] Despite their suitability to the local environment, experience has shown that opium poppy and coca bush are rarely monocropped.[20]

In the Chapare, in Bolivia, very few households were found to grow in excess of 1.5 hectares of coca bush despite considerable variations in the size of landholdings. Of those who eradicated their coca bush crops in the Upper Huallaga Valley, in Peru, 76 per cent of households were found to have less than 2 hectares, regardless of their access to land [21]. In contrast, households in Turkey had on average access to 5 hectares of cultivable land and a ceiling of 0.5 hectare of opium poppy was grown [70]. Very few households have been found to dedicate more than 60 per cent of their cultivable land to opium poppy and coca bush, implying that such crops are generally grown as part of a wider cropping pattern aimed at self-sufficiency.[21] This tends to counter the belief that drug crops are grown purely for their high returns to land [6, 20, 21, 71].

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[18]In Afghanistan, high yields and increasing prices have been significant enough for wheat to compete with opium poppy in real economic terms in Helmand and Oruzgan, albeit during a time of falling opium prices.

[19]It has been argued that it is labour that acts as the limiting factor in the production of drug crops in some source areas [26, 27, 43, 63, 68]. The use and availability of hired labour in most drug crop producing areas, however, seems to suggest that it is not labour availability per se, but the availability of unpaid family labour or other cheap labour that acts as the real constraint on drug crop cultivation [28, 37, 69].

[20]The exception appears to be in Colombia, where it is reported that plantations of 15 hectares or more are financed by traffickers [10]. This is not confirmed in any of the other literature reviewed for this article.

[21]In the United Nations International Drug Control Programme report on Afghanistan [23], it is indicated that the rural cultivator in Afghanistan will balance the amount of land sown with opium poppy and household food requirements. When basic foodstuffs such as wheat and flour can be purchased easily for reasonable prices, the farmer may opt to dedicate a greater proportion of land to opium poppy cultivation. When wheat becomes too expensive or too difficult to purchase, however, the farmer will reduce the amount of land planted with opium poppy and increase wheat cultivation, until the balance of the two corresponds to household food and cash requirements [23].

In relation to other crops,[22] the labour requirements for both coca bush and opium poppy cultivation are considerable. Production techniques and the demand on labour vary substantially, however, according to the intentions and resources of the household. When drug crop prices are high, intensive cultivation is profitable, resulting in greater use of hired labour and modern inputs if they can be obtained. Low prices will not necessarily be reflected in reductions in drug crop cultivation. Simpler production methods may be employed, making greater use of family labour. Once coca bush is established, for example, unremunerated family labour is used to a considerable extent in its upkeep and harvesting. With little value attributed to that source of labour, both coca bush and opium poppy can make an important contribution to household income, even where prices are below theoretical costs of production [21, 75].

Consequently, comparisons that have focused on net returns on land may have proved misleading. Although net returns per hectare will often be more profitable for drug crops than licit alternatives owing to labour-intensive production, net returns on labour may be much lower owing to the substantial labour requirements of coca bush and opium poppy cultivation [76]. Some commentators have suggested that without the extensive use of unremunerated family labour, neither opium poppy nor coca bush would be profitable crops [21, 23]. Such a view is supported by the general reluctance of households to hire labour throughout the season despite it maximizing drug crop cultivation [66, 77].[23] This suggests that after deductions for hired labour, returns are not necessarily as remunerative as other crops. In Afghanistan, it has been claimed that rising labour costs in the crop season 1994/1995 were responsible in part for the decline in opium production [10, 23].[24]

In an attempt to minimize labour costs, households have adopted a variety of strategies. The primary emphasis of resource-poor households has been to limit household production to a level that is commensurate with the availability of family

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[22]In Afghanistan, the weeding of opium poppy alone has been estimated to require 225 days per hectare. Moreover, harvesting is considered particularly labour-intensive, owing to the relatively short period of time that the capsules remain productive and the skilled nature of the task [72]. Tapp has estimated that for the Hmong of northern Thailand, less than 0.2 hectare would require one person month of labour [32]. Estimates with regard to the total amount of labour required per hectare of opium poppy in the highland areas of the Lao People's Democratic Republic and Thailand vary between 300 and 486 person days, compared with 69 person days per hectare for rice, 178 days for paddy, 79 days for maize and 138 days for chilli [60, 63, 73]. Estimates of labour requirements for coca bush range from 69 to 368 days per hectare according to the intensity of cultivation. The demanding labour requirements of establishing coca bush have meant that most households need to hire labour in excess of traditional family and reciprocal labour arrangements [74]. In the Upper Huallaga Valley in Peru, those households with the smallest areas of cultivable land have relied the most heavily on hired labour, despite its relatively high cost [21, 75].

[23]Despite the important role that drug crops play in the economy of the household, priority is often given to subsistence crops [52, 60, 65]. Miles [73] has indicated that the Lisu will often substitute labour spent in the harvesting of opium poppy to clear grain swiddens. The reason for such a choice is explained in terms of the opportunity cost to labour. Although opium poppy is thought to provide higher returns, the season is limited to less than six months per annum. The value of the grain produced throughout the rest of the year far exceeds the income they forego in preparing rice and maize fields. Multicropping offers households that produce drug crops a total return on labour that compensates overwhelmingly for the reduction in labour productivity resulting from decreased opium poppy cultivation [73].

[24]Lee and Clawson [10] suggest that labour is the most significant factor in household production costs for coca leaf, accounting for 64-92 per cent of total costs, depending on the techncial level of production.

labour [28, 36, 63, 69]. Staggered planting has also served both to reduce the threat of crop failure and to spread the demands on family labour and reciprocal labour arrangements, minimizing the need for hired labour [63, 64]. For some households, the ability to negotiate particularly favourable sharecropping arrangements[25] and the availability of addict labourers[26] has prompted more intensive opium production.

Securing access to unremunerated or cheap labour has had important ramifications for the socio-economic position of the household and its members. A major determinant of socio-economic differentiation was found to be the amount of harvested opium poppy that could be sold rather than used for wages or household consumption among the Lahu [60]. An emphasis on family labour has resulted in particularly low levels of literacy among the Hmong of the Lao People's Democratic Republic and the opium poppy growers of Dir, in Pakistan [67, 81]. Moreover, licit agricultural production has been constrained by the high rural labour costs arising from the seasonal demands of both coca leaf and opium [35].

A better understanding on the part of policy makers of the labour and land constraints that households face would assist in the design of more appropriate interventions. Policy makers need to be better informed about the economic returns of land and labour on drug crops and their alternatives, the allocation of labour among different farm activities and the gender division of labour.[27] Where labour is a constraining factor, greater emphasis needs to be given to increasing labour productivity rather than increasing the yields of the land. A change in emphasis of that kind would have an impact on drug crop cultivation and wider implications for family labour, releasing it to undertake other activities. Such a strategy would be particularly important for rural women, who have been largely ignored as decision makers within the household and generators of value and income in the production of both coca leaf and opium poppy [22, 82].[28]

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[25]In Afghanistan, opium poppy cultivation is generally undertaken by annual sharecropping arrangements. Although agreements will differ, landlords will often secure as much as two thirds of the opium poppy harvest [78, 79]. Such access to cheap labour has prompted some landowners actively to seek skilled farm labourers from neighbouring districts to grow opium poppy on a sharecropping basis [80]. The use of modern inputs means that both landowner and sharecropper can maximize their returns on labour.

[26]In the Lao People's Democratic Republic and Thailand, labour costs have been minimized by using opium addicts as workers. This has prompted ethnic groups such as the Hmong and Lisu to locate their villages near Karen villages, where there is often a ready supply of addicts [60, 64, 66].

[27]During the author's visit to Dir, in Pakistan, it was widely stated that women were not involved in the harvesting of opium poppy but that they played an important role in the extensive sowing, weeding and hoeing needed. Other reports have suggested that women harvested opium poppy, in particular those from poorer households. Considering the role women played in other household farming activities, especially in looking after livestock, it is unclear what impact increasing the legal agricultural production of the area would have on women's working hours and status. If enforcement of the ban is expected to lower household income, women and children's working hours could increase, in particular within poorer households.

[28]Gillogy has suggested, in a personal communication [46], that the burden of the transition from opium-based to non-opium-based agriculture has fallen disproportionately on girls and young women. According to Gillogy, the result is more weeding; longer distances to fields, contouring and other soil conservation measures and year-round agricultural work because households plant a diverse array of crops in hope of hitting on one or two with a good market price that year.

The role of credit, debt and village traders

The cultivation of opium poppy seems to be intrinsically linked with informal rural credit in source areas, where opium poppy cultivators gain preferential if not sole access to informal credit arrangements [28, 43, 83]. The prevalence of household food deficits and the illicit nature of the opium trade, however, expose the most vulnerable to exploitation from village traders. Through the provision of consumer goods, the extension of credit and the offer of a ready outlet for opium, village traders gain a significant influence over household finances and thereby over household decisions with regard to crop production priorities [60, 73]. Because of this, the level of existing and expected household debt becomes an important determinant of the extent of annual household opium production.

In the Dir region, in Pakistan, the end of the winter is a time of particularly heavy borrowing. Dwindling cash reserves need to be supplemented with credit to satisfy subsistence requirements and purchase agricultural inputs in preparation for the new agricultural season [48, 67]. To gain access to such goods, households can either exchange surplus opium poppy from the previous year's harvest or obtain credit in cash or goods from the village shopkeeper, on the understanding that repayment will be made in opium [26, 48, 67, 68].

Similar methods of credit and repayment operate through Chinese Haw traders in Thailand and in the Lao People's Democratic Republic, many of whom are former caravaneers who have settled in highland villages [63]. The profits on trade are substantial, with the price of consumer goods 50-100 per cent higher than the lowland price. Repayment in opium is often 100 per cent higher than the value of the cash or goods originally lent and is often as much as 50 per cent of the total harvest [60].

The growing dependence on opium poppy as the sole source of cash income has meant that households have become particularly vulnerable to its fluctuating price. The occurrence of dramatic falls in price has prompted many households to increase their level of borrowing in order to meet their household expenditures [28]. Continued shortfalls in food production and the offer of credit have led many households to run up substantial debts. The result is often a spiral of debt that forces households to sell their opium poppy crop at particularly low prices to local traders [28, 52, 85]. Poorer households in Afghanistan, for example, have been found to sell their entire opium crop two or three months prior to harvesting at 20-30 per cent less than the harvest price [23, 72, 86]. The real gains for the trader are realized post-harvest, when prices can increase by as much as 100 per cent within two months [79].

Evidence suggests that both opium and coca leaf prices are often highly localized, depending on the market power that local buyers exert. The dominant market position that local shopkeepers and traders gain through the provision of credit and consumer goods is exacerbated by the illicit nature of the market for opium. Despite their dissatisfaction with local prices, many opium poppy cultivators will deal with village traders rather than risk arrest in the lowlands.[29] Producers, unable to look for

[29]In the Dir region, in Pakistan, although local traders (known as *beopari*) were found to buy at the farmgate, the majority of the trade in opium was done with the local shopkeeper [26]. The strong odour that emanates from raw opium makes its transportation a risky venture, in particular for villagers who may not have access to the appropriate contacts [37, 85].

alternative buyers for their opium, owing to debt repayments and the illicit nature of the industry, find their bargaining position severely weakened, in particular in the most inaccessible areas where the lowest prices are paid [26, 28, 60]. Consequently, the relationship between creditor (buyer) and debtor (producer) is potentially exploitative [34].

Within this context, households may be willing to adopt alternative crops even if they do not offer returns that are as remunerative as opium poppy and coca bush. There is considerable evidence to suggest that households will reduce drug crop cultivation in exchange for appropriate technical and financial support, and to escape repressive measures by both the State and traders. However, many are unable to forego the cash income derived from opium and coca leaf while they wait for profitable alternative production regimes to be developed and made available to them [61]. Opium provides a means of obtaining credit during times of food scarcity. Alternative development initiatives need to generate secure alternative income sources before opium poppy cultivation will be eliminated by poorer households [26, 48].[30] Greater attention needs to be given to supplementing such a means of credit, if households are to be able to meet their subsistence needs, pay off their existing debts and risk planting alternative crops [33, 83]. Moreover, law enforcement initiatives aimed at village traders could prove very effective in simultaneously disrupting both the extension agents and farmgate purchasers of opium.

Eradication, reverse conditionality and the relocation of production

The role of law enforcement in prompting changes in household agricultural practice is contentious. Some commentators have indicated that eradication is a prerequisite to creating the necessary conditions for successful alternative development [88]. Others have suggested that there are inherent contradictions between development and interdiction at both the policy and the operational levels and that the effects of this include impeded progress and increased vulnerability of the poorest [75]. As a result, the debate regarding the appropriate balance of carrot and stick remains one of the most intractable of alternative development, in particular as it concerns the process of relocation.

It has been argued that individual and moral orientations toward drugs and the drug trade affect household decision-making. Many households either will not entertain the possibility of growing opium poppy or coca bush, or are simply too afraid

[30]Credit in subsistence economies, however, has proved problematic. Lack of land tenure in many source areas and citizenship in Thai hilltribe villages has exacerbated the situation [16, 33]. In the Chapare, in Bolivia, the credit arrangements set up in 1987 under "PL-480" (the initiative sponsored by the United States Agency for International Development) came under particular criticism owing to its failure to offer households a financial bridge between eradication and the receipt of income from alternative crops. Some have argued that the stringent requirements of the loan programme, combined with harsh repayment schedules, exacerbated the economic position of those who took up the loan and may have led to an increase in coca bush cultivation [75, 77]. With loans at a minimum of $2,000 and an average of $6,500, it is unlikely that the scheme reached small farmers [87]. In Thailand, rice, seed, fertilizer and medicine banks have proved very successful with regard to uptake and repayment in both Pae Por and Sam Mun highland development projects [14, 16].

to produce drug crops owing to the social and legal condemnation they will endure. However, the concentration of opium poppy and coca bush cultivation in specific areas has led many to believe that there is a cultural[31] and economic consensus among local inhabitants with regard to the legitimacy of drug crop production [20, 79].

Alternative development has recognized the consensual framework and sought to implement social and economic change aimed at reducing the acceptability of drug crop cultivation. Teachers, elders and religious representatives have been targeted to act as local agents of change in the process. Law enforcement has served to indicate that drug crop cultivation is not only unacceptable but illegal. It has also sought to induce fluctuations in farmgate prices through the disruption of processing operations and supply lines [75].

The dramatic fall in coca leaf prices in 1989 is believed to be attributable to the concerted attacks of the Government of Colombia on the Medellín cartel. More recently, coca leaf prices in Peru have fallen by almost one third after the capture of many of the leading members of the Cali cartel [89]. However, aggregate changes in the level of coca bush cultivation show little variance in response to widely fluctuating prices [90]. Opium poppy cultivation has proved relatively unresponsive to declining prices once they have fallen below a given level [91]. This suggests that the lack of alternative sources of income and expectations of future price increases will induce many households to continue to cultivate opium poppy and coca bush, albeit to a lesser extent. Some households, however, have responded to falling coca leaf prices by undertaking basic processing, transcending existing cultural mores and participating in illegal activities [10].[32] Law enforcement can succeed in reducing cultivation at the margins but if alternative livelihoods are not available, such success may be achieved at the cost of social and political unrest.

Experience has shown that where eradication has been a precondition to assistance, farmers have opted to eradicate only some of their crop. In the Chapare, Bolivia, households were found to retain 0.5 hectare of a total 2 hectares cultivated as an insurance against vulnerability. Complete eradication would only be considered once farmers were assured of viable alternatives [53].

Where complete eradication has been enforced without the prior provision of alternative sources of income, it has had dramatic consequences for rural populations.[33] In the Tekshan Valley, in Afghanistan, the loss of income incurred by households that complied with an opium poppy ban introduced by their local

[31]In the border areas of China, the Lao People's Democratic Republic, Myanmar and Thailand, opium poppy has traditionally been cultivated by the Hmong, Lahu, Lisu and Mien [85]. In Afghanistan and Pakistan, opium poppy cultivation tends to be undertaken by Pashtoons, except in Badakhshan [72]. Among many of those groups, the intricacies of opium poppy growing and opium extraction is a component of every child's basic education [63].

[32]Increasingly, intermediaries are unwilling to buy raw coca leaf and are insisting on purchasing paste. Some growers are reluctant to undertake paste production and are moving out of coca bush cultivation. It is currently unclear what proportion of households are willing to undertake processing as a response to falling prices or the new demands of intermediaries.

[33]In Afghanistan, local initiatives aimed at reducing drug crop cultivation in Jurm, Kosh and Yaftal led to increasing levels of vulnerability owing to the lack of alternative sources of income [92, 93].

commander, combined with limited access to irrigated land and the failure of substitute crops, led to a shortfall in food supply and the migration of 1,500 families [93]. A similar phenomenon occurred in the Upper Huallaga Valley, in Peru, where both interdiction and eradication were ineffectual in altering the underlying economic advantage of cultivating coca bush over that of licit crops. The uncoordinated approach of law enforcement and development efforts left households unable to meet their basic needs once eradication had occurred [94]. Consequently, small farmers whose coca bush was eradicated migrated outside the project area and began cultivating coca bush in frontier zones as a means of safeguarding their livelihoods.[34]

Within a context of increasing vulnerability, it is perhaps rational for producers to respond to alternative development projects as if they were temporary bonanzas, opting to receive assistance but safeguarding their livelihoods through relocating to more inaccessible areas on a temporary or permanent basis. Temporary relocation has been a common reaction to alternative development initiatives.[35] Of greater concern is the permanent shift of drug crop cultivation both in human and geographical terms, and the concomitant loss in biodiversity that has ensued, in particular in the national parks of Bolivia, the Lao People's Democratic Republic, Myanmar, Peru and the northern highlands of Thailand [21, 94].[36]

It has been argued that alternative development has systematically failed to acknowledge the mobility of rural populations in source areas, where migration has been a traditional response to changing opportunities and risks in the rural economy [3, 21, 98].[37] In some source areas, inappropriate development interventions and, in particular, eradication can be seen to have played a major role in the relocation of producers to isolated areas free from state authority [21, 40, 43, 101]. Migration should thus be viewed as a litmus test of unsuccessful development initiatives [98].

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[34]Bedoya estimated that coca bush cultivation may have led either directly or indirectly to the loss of 700,000 hectares of forest cover in Peru since the 1970s, which is 10 per cent of the total deforestation of the Peruvian Amazon that took place in the twentieth century [35]. Guerra and Hernandes put the figure nearer 9 million hectares [95].

[35]It was reported that in Yaftal and Shewa, in Afghanistan, bans enforced by local commanders led to a shift in the location of opium poppy cultivation [72]. In the Dir region, in Pakistan, the scattered nature of landholdings provided farmers with the opportunity of diversifying their crop production and experimenting with alternative crops on irrigated land on the valley floor, while continuing to cultivate opium poppy on unirrigated land in the higher parts of the valley. In more remote areas in Pakistan and Thailand, relocation has involved crossing national borders to ensure cultivation can be undertaken unhindered [20, 32, 33, 38, 79]. In Thailand, it is reported that a favourite practice has been to plant opium poppy within the boundaries of another village so as to divert blame should the plants be discovered [46].

[36]In Bolivia, Isiboro Secure and Amboro national parks have already been encroached upon by coca bush growers and there is thought to be an increasing threat to the Beni [96]. Abiseo national parks and the national forests of Von Humboldt, Huanoco and Biabo are also inhabited by coca-producing peasants [35]. By May 1994, it was thought that Isiboro Secure National Park contained 1,500 hectares of registered coca bush cultivation and an estimated 5,000-6,000 hectares of illicit cultivation. Estimates in 1996 suggested that illicit cultivation could have increased to 15,000 hectares.

[37]In Bolivia, one quarter of the population was found to be residing in a place other than that of their birth in 1976 [99]. The Chapare, in particular, has been found to contain a mobile population, where a third of the population is thought to be transient and 10,000-22,000 families are said to have left the area in 1990. Falling opium poppy yields and conflict have also often acted as triggers for migration for the Lisu [34, 64, 85, 100].

The explicit link between reductions in drug crop cultivation and the provision of development assistance has led to incidences of reverse conditionality, where local communities threaten to cultivate, or actually begin to cultivate drug crops as a means of gaining access to development interventions.[38] The provision of compensation for eradicated crops has exacerbated the process. Not only have the authorities been unable to prevent households from restarting cultivation after payment has been made,[39] there is also evidence that compensation has encouraged some farmers to start cultivation in order to receive subsidies [10].[40]

In addition, reverse conditionality has had serious implications for the allocation of project resources.[41] Because of uncertainty as to the resources and motivations of drug crop producers, alternative development initiatives have often adopted a comprehensive strategy to improve the socio-economy of the entire area rather than target drug crop producers or the poorest. In an attempt not to be seen to be discriminating against those who do not grow drug crops, the targets of the initiatives have often included the better off, who are less dependent on coca bush and opium poppy for their livelihoods. Such a strategy does not satisfy the objectives of either alternative development or conventional development interventions.

Some commentators have argued that it may be more effective to separate the issues of essential rehabilitation and development, which are required for their own sake, from the issue of drug crop cultivation. Where drug crop cultivation is a livelihood strategy, making assistance dependent on conditions and clauses that cannot easily be enforced is neither justified nor effective. Emphasis should be given to a more subtle approach, based on substituting the safety net that drug crop cultivation has given resource-poor households through increasing crop yields and encouraging agricultural diversity [23].

It is important that alternative development programmes assist drug crop cultivators, not drug crop cultivation. The point at which enforcement is brought to bear will depend on the motivations and circumstances of those households undertaking opium poppy and coca bush cultivation. Evidence indicates that the timing of enforcement and its close association with the wider development programme may have played some role in the relocation of opium poppy and coca bush cultivation.

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[38]In Kunar, in Afghanistan, it has been suggested that some farmers have planted opium poppy adjacent to the road as a means by which to attract development assistance [23]. In Pakistan, in Usherai, Dir, a 90 per cent increase in opium poppy cultivation in 1996 was attributed largely to the small valley of Ali Gha Sar and its desire to be included in the wider district development programme.

[39]In the Chapare, in Bolivia, households were paid $2,000 per hectare of coca bush eradicated; however, it was estimated that the cost to plant one hectare of coca bush is $1,000-1,500. Therefore, for every hectare of coca bush eradicated, 1.5-2 hectares could be replanted [10].

[40]The report by Lee and Clawson [10] suggests that 23,000 hectares of coca bush were voluntarily eradicated between 1988 and 1992, at an imputed cost of $45 million. In the same period, however, 29,000 hectares were planted or discovered.

[41]In the Dir region in Pakistan, the growing prosperity of the western valleys was often cited as an example of the relationship between socio-economic development and reduced opium poppy cultivation. Remittances from the Middle East and the availability of labour and local off-farm income opportunities were seen as integral to the low level of opium poppy cultivation in valleys such as Sultan Khel. Despite the low incidence of opium poppy cultivation, Sultan Khel and other valleys on the western side of the Panjorka received assistance. The decision was justified on the basis not of poverty but that to neglect those areas would result in an expansion of opium poppy cultivation [26].

It is essential that the process of relocation is understood if alternative development is not to reduce cultivation in one area, only to see it increase in neighbouring regions.[42]

Conclusion

The success of alternative development needs to be viewed within the context of what it can realistically hope to achieve [10]. Budget constraints,[43] the wider macroeconomic framework and the flexibility of traffickers have all tended to undermine such interventions. Given existing levels of demand, economics dictates that where drug crop cultivation is squeezed in one area it will undoubtedly occur in another. Considering the prevalence of rural underdevelopment and the fact that only 87.5 hectares of opium poppy and 27.5 hectares of coca bush are required to satisfy the entire cocaine and heroin demands of, for example, the United States, there is a need for an approach that addresses both the supply of, and the demand for, illicit drugs if a sustainable reduction in the total amount of drug crops cultivated is to be achieved [93, 104].

At the local level, experience has shown that alternative development has been closely associated with reductions in drug crop cultivation. Households have been found to abandon coca bush and opium poppy cultivation despite their reportedly unassailable profitability [36, 43, 63]. Off-farm income opportunities and alternative cropping systems have led to increases in income, both in absolute terms and in relation to drug crops [15]. Despite such localized successes, drug crop cultivation continues to increase. At present, the motivations and circumstances that determine household drug crop cultivation remain largely unexplored. It is impossible, therefore, to attribute local reductions in drug crop production to, or disassociate new areas of cultivation from, alternative development initiatives. An analysis of the outcome of specific project activities has also proved problematic, owing to the scarcity of accurate baseline data.

Research to date has generally focused on aggregate trends in drug crop cultivation at the national, regional and village levels. Project appraisal, design and monitoring have concentrated on static data collection techniques that give little guidance as to how development and law enforcement interventions can influence

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[42]In Pakistan, successive alternative development initiatives saw opium poppy cultivation relocate to neighbouring districts. For instance, with the success of the Dir project in 1996, opium poppy cultivation became centred in the Ambar and Pranghar district of Mohmand and Salarzai, Utmankhel and Barang districts in Bajaur. Those areas were not necessarily the most remote districts but were adjacent to former areas of cultivation in Malakand and Dir [43].

[43]It is also important to recognize that, despite the rhetoric, financial aid for crop substitution and development assistance from the United States is still insignificant. For example, in 1997, it represented only 10.6 per cent of the overseas narcotics budget. Law enforcement, military counter-narcotics support and eradication still command over 65 per cent of the total budget. Moreover, military counter-narcotics support is being given greater priority each year [102]. Bertram and Sharpe discuss at more length the allocation of resources to demand and supply-side strategies of the Government of the United States [103].

decision-making at the household level.[44] No in-depth study has been done to date of the conditions and priorities that individual farmers take into account when making decisions about their involvement in the cultivation of drug crops.

The lack of detailed analysis at the household level means that current initiatives tend to regard the producers of illicit drug crops as a homogenous group. Alternative development initiatives have ignored the multifunctional role that drug crops play in the livelihood of the household and the diversity among drug crop producers, in an attempt to bring about quick and visible reductions in drug crop cultivation.[45] The specific socio-economic, cultural and environmental circumstances that influence household production are consequently overlooked in project design. Rather, alternative development initiatives have adopted a uniform approach where emphasis is placed on the high economic returns that opium poppy and coca bush are reported to accrue per unit of land [4, 19, 20, 22, 24].

Such a simplified model of human behaviour, emphasizing economic rationality over that of other motivations, is both inadequate and inappropriate given the variety of circumstances and opportunities facing drug crop producers.[46] Such a model offers no explanation of the wide variance in drug crop cultivation at the regional, district and household levels.[47] Moreover, discussions regarding the economic profitability of drug crops fail to account for the process of graduation that many households in source areas have undertaken as they move from drug crop cultivation to licit economic activities without the provision of technical support from external agents. Documenting such a process, to include the reasons why a significant proportion of households continue not to grow drug crops in areas where they are cultivated intensively by the majority of farmers, could provide the framework in which to further our understanding of the role of social costs and economic profitability in household decision-making in source areas.

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[44]Surveys have proved problematic in drug crop producing areas, providing only a snapshot of complex and dynamic processes, offering little with regard to methodological rigour and failing to cross-check information to ensure its validity. Ahmed has indicated that population figures for the Pashtoon tribal areas bordering Afghanistan and Pakistan can be overestimated by as much as three to four times for the male population and significantly underestimated for the female population. This is explained by a political and cultural framework in which men are associated with political and military prestige and any information regarding women is considered private, in keeping with the practice of seclusion [106]. Understandably, any information regarding more sensitive issues such as the extent and profitability of illicit drug cultivation will also be set within a wider political and cultural context, in particular, what respondents believe the data will be used for.

[45]Dudley [8] states that one of the results is that large, poorly considered projects are thrown at complex situations. In Bolivia, in the Chapare, the approach of the agro-industrial projects seems to reflect 1960s development thinking. At that time, it was typical to assume that the project team had all the answers and had simply to hand them to the peasantry, who accepted them without question. In short, the drug control imperative is being used to justify the worst features of naive, top-down development [8].

[46]Lee and Clawson suggest that the approaches of the United States Agency for International Development to crop substitution are too driven by economic models of peasant behaviour [10].

[47]In the Dir region, in Pakistan, for example, opium poppy cultivation is undertaken in the valleys east of the Panjorka River. In the west, opium poppy cultivation was always negligible. Moreover, in villages where drug crop cultivation is concentrated, although opium poppy and coca bush are grown by a wide section of the community, they are not grown by all its members [20]. Even among drug crop producing households, there is large variance in the extent of household cultivation and their commitment to drug crop cultivation [26]. This does not seem atypical of source areas [15, 23].

It is important to recognize that the cultivation of opium poppy and coca bush meets the demanding requirements of both the local environment and the rural economy. Attempting to replace the income received from opium poppy and coca bush with substitute crops is a necessary but insufficient condition for reducing levels of cultivation. Such a strategy will satisfy only wealthier households that produce illicit crops for extra income. Alternative development programmes need to recognize the high level of socio-economic differentiation that exists in source areas and target their initiatives accordingly. To achieve this, greater attention needs to be given to the resource constraints, aspirations and motivations of the household and the wider community. For those most dependent on drug crops, interventions need to give precedence to securing livelihoods through the extension of food crops and the promotion of value-added activities. For those less economically reliant on drug crop cultivation, greater emphasis could be given to applying social and legal pressure. Such a strategy would satisfy the objectives of both alternative and conventional development interventions.

Any programme aimed at persuading farmers to change from cultivating drug crops to alternatives will require very close and patient involvement with the communities concerned. Emphasis will need to be given to the heterogeneity of drug crop producing households and how structural and motivational factors are prioritized across socio-economic, spatial and cultural groups. Where motivations and resources differ, different interventions will be required. Only by ascertaining the role that opium poppy and coca bush cultivation plays within the socio-economy of the household will effective and sustainable interventions be determined that apply the appropriate balance of carrot and stick, to the right people, at the right time. To continue in the current analytical vacuum could be seen to be rewarding those who have alternative livelihoods and ignoring those who do not. This has implications not only for the cost-effectiveness of such a strategy: it also raises questions about the unintended consequences of alternative development, in particular with regard to its impact on the poor and the process of relocation. Greater understanding of decision-making at the household level would assist in determining more effective and sustainable initiatives aimed at reducing both existing and potential drug crop cultivation, and improving the life choices of beneficiaries.

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Drugs, addiction, deviance and disease as social constructs

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ABSTRACT

In the present article, an attempt is made to deconstruct some common categories widely used in the literature on substance abuse. First, the occurrence of a drug problem in western societies is analysed within a historical perspective and in the context of the category of addiction. This is followed by an examination of the way that substance use is ideologically sanctioned and classified into deviance and/or disease in either biological or societal terms. The drug issue does not appear to be a static, objective reality but changes in different historical contexts. By the same token, the social labelling of substance abuse in terms of deviance and disease is sometimes ideologically driven. Any approach to these questions should be sensitive as to context and explanations should go beyond exclusively internal or external causes.

Drugs

At first sight, substance-related literature deals with a straightforward terminology. Categories such as drugs, addiction, dependence and, more generally, deviance and disease are often used uncritically. They function as accepted a priori conjectures which do not need to be discussed. Such a reification of concepts then implies that they map an objective reality which is decontextualized and not historical. This epistemological stance of naive realism contrasts with a long tradition in the social sciences, showing that reality itself is a social construct embedded in changing cultural and historical contexts [1-4]. For example, social research has shown the changing concepts of childhood through the ages, throwing new light on what was previously regarded as a naturalized category [5-6]. Even a biological fact such as gender has been shown to have no counterpart in the way societies construct and redefine its presumed characteristics [7-8]. The study of pain, which is particularly relevant to drugs, can also be understood better in a temporal cultural dimension [9-10]. Hence, any substance-related issue leading to so-called social problems needs to be placed in its sociological, economic, historical, cultural and political context. Taking a theoretical perspective on the literature should accompany any meaningful review by situating it in its cultural environment and taking account of the author's intellectual background.

Along these lines, careful attention should be given to the history of substance in order to grasp the meaningful changes in attitudes towards their consumption. Without attempting an exhaustive review of such work, a few significant studies and events are detailed below to illustrate this theoretical position.

In the context of American history, dramatic shifts in attitude towards drugs have been documented by authors involved in public health work in the United States of America. Buchanan [11] shows that drug-taking habits are deeply embedded in social dynamics which have, in turn, promoted or inhibited their use. He identifies three cycles marked by major national conflicts: the American Revolution, the Civil War and the decade of the 1960s, with its civil rights movement and the war in Viet Nam. Buchanan stresses what he calls the country's intense love-hate relationship with drugs, revealing a deep-rooted ambivalence between feelings of liberty and duty. After each of the national crises mentioned, drug use increased dramatically and was followed by phases of public disapproval and intolerance. He argues that these cycles symbolize a shift between a commitment to societal institutions and commonwealth to the expression of individualism in a reaction against society. Thus, drug use is interpreted as having deeper meanings than a mere desire for intoxication.

Musto [12] also describes dramatic historical swings over the past two centuries in the United States of America. During the nineteenth century, the use of opiates and cocaine was widespread. Around the turn of the century, this attitude started to change. Drugs were considered dangerous and harmful until the 1940s, followed again by more relaxed societal attitudes in the 1960s and 1970s. Nowadays, there is a clear resurgence of strong negative reactions to drug use. He notes that the periodicity of these cycles, alternating between enthusiasm and abstinence, are roughly a lifetime apart, favouring a kind of social amnesia which wipes out the historical memory of these phenomena. As a consequence, like Sisyphus, society confronts the problem each time as if it were new, with the risk of repeating past errors, and often in a very passionate climate. It should be noted that extreme positions in such ideologically loaded debates tend to negate historical facts in order to increase the weight of their arguments and to legitimize their polarized positions on the basis of fixed categories. Musto explains the cyclical nature of drug use by a kind of learning curve followed by social amnesia. Usually the elite first experiments with drugs; then their use becomes popular and more people are confronted with their negative consequences; as a result, their use declines and people forget how bad they can be. After some time the process starts all over again [13].

It is well known but often ignored in mainstream discourses on drug use that psychoactive substances have been consumed throughout history. Opium use, for instance, can be traced across civilizations for about 8,000 years [14]. The permanency of this fact does not of course imply that the epidemiology and significance of these phenomena are unchanging and constant. A more comprehensive account stretching across different civilizations is, unfortunately, beyond the scope of the present review. It is, however, the nineteenth century that is the most interesting, because it saw significant innovations which made drugs available in new forms. It marked the advent of organic chemistry, allowing for the synthesis of morphine, cocaine and heroin. The invention of the hypodermic syringe in 1850 opened new routes of substance administration. The rapidly growing pharmaceutical industry

made mass production and global distribution of drugs possible, thus making a significant quantitative change in drug availability and consumption. Not surprisingly, the nineteenth century coincided with the onset of the systematic study of substance abuse based on new scientific paradigms [15]. The social problems linked to drug use also began around this time. Most historical studies focus on this period, as with the literature mentioned above.

In Europe, changes of attitude concerning drug use can be observed during the past century but clearly defined cycles of tolerance and repression tied to specific events cannot be identified easily. For example, in France [16], drugs in general were not considered a problem before 1970, mainly because they were closely linked to a medical use. In particular, morphine serves as a model for the elaboration of a sociological discourse of the drug phenomenon. A German chemist, Friedrich Sertuerner, discovered this psychoactive constituent of opium in 1817 and called it morphine because of its hypnotic properties. Its powerful analgesic characteristics were much appreciated by physicians to relieve the pain of their patients. Prior to the nineteenth century, social, religious and stoical philosophical attitudes considered that pain was sent by God. The right not to suffer became progressively a human right and the discovery of anaesthesia was a key moment in this evolution. Under medical control, morphine was administered to alleviate the psychological pain of unsteady nervous states.[1] Many persons who were prescribed morphine by physicians continued to self-administer it so as to benefit from the psychological well-being it brought them. During that time, there was no distinction between such iatrogenic intoxications and hedonistic purposes. Together with the transformation of societal attitudes towards pain another transformation of mentalities emerged regarding the rapport to one's own psyche. This shift first became visible through the accounts of aesthetic experiences of writers and artists. The artificial paradises described by authors such as Baudelaire or de Quincey showed the greater public how drugs could open doors to the imagination. Substances were taken to cure moroseness and sustain creation. In the century of Freud, dreams served as new methods by which to reveal the unconscious. Similar states could be induced by psychoactive drugs. Reflecting this evolution, the first groups of morphine users were to be found in the medical world of physicians, dentists, nurses and pharmacists, as well as in the artistic world. It was a drug of the upper classes and only spread to other strata of society in the latter part of the century. This democratization marked an increase of production, diffusion and consumption of substances. As a consequence of this development, the discourse related to drugs changed radically. By the 1870s morphine was denounced as a social peril, linking it to the then popular concept of degeneration. Drug users were identified as driven by perverse, egotistical, immoral, remorseless, morbid tendencies that were thought to be hereditary. It is interesting to note that these disqualifying descriptions were never applied to upper class users but reserved for the lower classes. Ideas of the corruption of race based on genetic explanations led Darwin's cousin, Sir Francis Galton, to advocate eugenic sterilization of people with inferior degenerate genes. On this ideological ground there was a gradual differentiation between "good" users who were victims of the prescriptions of their physicians, and "bad" users who were responsible for their predicament and therefore unworthy of compassion.

[1]The adverse effects became evident only after 1850 when the new technique of injection produced much stronger effects with accompanying signs of dependence.

Throughout the ages, opium was entered into various therapeutic preparations and was variously considered as a panacea for cholera, insomnia, syphilis, tuberculosis and mental disturbances. A general cure-all for body and mind, it was used by the elite for pleasure, especially in the form of laudanum, a mixture of opium, wine, saffron, cinnamon and cloves, which was invented by the English physician Thomas Sydenham in the seventeenth century. These ingredients strongly evoke the Orient which always served the Occident as a theatre for its representations, as described by Edward Said [17] under the term "Orientalism". The multiplication of travel opportunities in the nineteenth century to the strongholds of the European colonial powers contributed to the spread of opium parlours, where opium was smoked à la Chinoise. Known as the "black idol", opiomania was never a lower-class intoxication. It was a leisure drug that induced dream-like and meditative states of mind. It was the drug most frequently used by artists, and smoking it involved complex rituals. In spite of its medical uses, no iatrogenic intoxications were observed and clinical problem cases were extremely rare. Its consumption became a problem only when it was assimilated into the morphine problem model around the 1870s.

Unlike the traditional opium substance, cocaine and heroin were new fin de siècle drugs in a synthesized form. The alkaloid contained in the coca leaf was isolated by Albert Niemann, a German chemist in 1859. By 1880, its anaesthetic effects were well-known and first applied in the field of ophthalmology, followed by a widening of its therapeutic indications. It was observed to be very efficient against throat diseases, infections of the mucous membrane and asthma [18]. At the same time, it was found that cocaine was a powerful psycho-stimulant praised in particular by Freud. In his book, *Über Coca*, published in 1884, he suggested prescribing cocaine to cure people from morphinism (morphine addiction). Hence the adverse effects of both substances became cumulative, increasing the risk of accidents such as seizures or heart attacks.

Heroin was obtained from a diacetylation of morphine in 1874 by C.R.A. Wright and further studied by a chemist from the pharmaceutical company, Bayer, who introduced it as a remedy in 1898. This time, physicians thought to dispense a miracle cure especially recommended for respiratory diseases. The same error that had been committed with cocaine was made with heroin, that is, it was used to treat morphinism, which meant substituting one substance with an even more potent one.

By the turn of the century, the drug problem existed in the collective representations of European society. There was a clear change in the general attitude towards substance users. From considering morphinism as a consequence or symptom of a disease, the attitude moved towards disqualification of the users via aetiology. The portrait of the user emphasized a neuropathological hereditary constitution. The popular imagery saw him or her as a deviant inferior being. This shift from disease to deviance destabilized the medical world, especially since many of its members were involved in the problem: for them, it was a question of treatment or exclusion. Treatment attempts aimed at full abstinence which was equated with recovery. Discussions turned on the timing of the withdrawal process: abrupt stoppage or gradual reduction of dosage. The uncertainties about therapeutic approaches revealed the doubts about the psychogenetic, biological or psycho-sociological origins of toxicomania which were to persist into the twentieth century.

The historical examples of opium, morphine, heroin and cocaine show how the category of drug was constructed during the nineteenth century. They have in common the blurring of the idea of a remedy that was intended to cure with its opposite, the latter being a substance which turned out to be hazardous to the user's health. This ambiguity continues to be embedded in language (droguerie, droguiste, drugstore etc.), revealing that these issues still rest on shaky ground. The generic category of drugs goes well beyond the definition of a substance forbidden by law, since the extent of its prohibition has varied greatly over time. Drugs have much to do with human behaviour and experience, involving the self and the other on a continuum between pain and pleasure.

Addiction and dependence

Probably the most cited in attempts to characterize substance-related problems, the term drug is often accompanied by the term addictive as if the latter were an inherent quality of the product itself. How can addiction or its related concepts of dependence and tolerance be defined? The task seems difficult; Akers [19] calls addiction a troublesome concept that has been widely misunderstood and misused. Alexander and Hadway [20] judge the literature on opiate addiction chaotic and bewildering. The World Health Organization (WHO) has preferred to use the term dependence which is defined as a psychic, sometimes a physical state resulting from the interaction between a living organism and a substance, characterized by behavioural modifications and other reactions which always comprise a need to repeat the consumption of the product in order to re-experience its psychic effects and sometimes avoid the discomfort of frustration. According to WHO, this state may be paralleled or not by tolerance, and the same individual might be dependent on several products. Such a definition underlines the importance of the interaction between a user and the substance, which means that the drug is not to be considered a mere stimulus, encapsulating precise intoxicating effects, but that the person taking it is an important part of the process. Substances, however, are classified by WHO as a function of their intrinsic addictive characteristics, using a less useful distinction between physical and psychological dependence. The separation of mind from body in trying to understand drug use seems particularly irrelevant if one considers that drugs are psychoactive, mind-altering substances in constant interaction with bodily processes. At best, the distinction between the physical and psychological can indicate the levels of phenomena involved. Physical effects are linked to tolerance and withdrawal effects, that is, the need to increase the dose or the frequency of drug intake and the somatic reactions of stomach cramps, muscle spasms, chills, fever, diarrhoea, nausea etc., linked to the abrupt stoppage of use. Such pain cannot, however, be classified as a purely physical phenomenon but has to be considered in its psychological dimension. The classic examples of substances that have these effects are heroin and alcohol.

The concept of physical dependence implies a deterministic outlook which limits seriously any therapeutic hope. It predicts that once a user has taken a dangerous drug he or she will be hooked, with little chance to gain control. It also implies a social policy advocating total prohibition, since the drug itself is seen as the cause of addiction. The person is seen as passive and helpless in front of the

pernicious substance. Alexander and Hadway [20] have called such a view the exposure orientation on addiction. They contrast it with an adaptive view of addiction which suggests that drug use is an attempt to reduce the distress that existed before it was first taken. Opiate users thus are at risk of addiction only under special circumstances, that is, when they are confronting difficult situations and trying to cope by turning to drugs. The problem lies in the persons's psychological deficiencies and not in the drug itself. Thus, drug prohibition would be of no effect since the individual would still have to confront his or her stress and deal with it. In this view, the user has the choice of finding alternatives, searching for help and ultimately abandoning his or her dangerous habit.

A number of facts show that there is no universal and exclusive connection between such drugs as opiates and physical addiction. Any person using drugs does not necessarily become an addict. The effects of psychoactive substances are extremely variable from person to person and are relative to a number of factors among which are prior history of drug use, genetic susceptibility, cognitive factors, such as expectancy and attributions, environmental stresses, personality and opportunities for exposure [22]. People who have come to use drugs by accident, such as hospital residents who were given regular doses of morphine for pain relief, have not demonstrated an irresistible craving for such substances after release. It is estimated that about one quarter of the American soldiers in Viet Nam took heroin. Most of them, once back home, were able to quit without major difficulties. Similar observations hold for the period of the American Civil War. The case of controlled users, of which physicians are the best known group, shows that regular intakes of opiates over decades do not lead to tolerance or to withdrawal symptoms during abstinence. Heroin can be used on a regular but infrequent basis without dependence or catastrophic consequence [23]. It has also been found that former heroin addicts can completely stop using it or shift to casual use. Epidemiological studies have established that many heroin users are adolescents who grow out of their addiction and become abstinent later in life. People can experience withdrawal symptoms from much milder substances than opiates, such as sedatives, tranquillizers, laxatives, nicotine and caffeine. This evidence shows that no deterministic physiological mechanism can explain physical addiction exclusively.

If at the level of physical dependence there are fairly clear indicators, this is much less so with psychological dependence. It is defined by WHO as a psychic impulse to absorb periodically or continuously a substance in order to derive pleasure from it or to avoid a sensation of unease. The terms of this definition are much more difficult to put into operation than the physical syndrome discussed above. The psychological symptoms of drug dependence, such as craving and the compulsive necessity to take the substance regularly, go beyond the issue of toxicomania and can appear whenever the absence of a person, an object, a place or a situation creates a feeling of anxiety, stress or serious discomfort often coupled with psychosomatic signs. A number of behavioural patterns are very similar to psychological dependence linked to drugs but are not caused by any pharmacological substance. Lovers have been described as addicted [24]. Overwhelming involvement in sex and/or food resembles the compulsiveness that is classically associated with drugs. Activities such as gambling, shopping, jogging and working also fit into the category of addictions. Such an extension of the use of the concept of addiction is indeed puzzling and does not contribute to the understanding of the underlying processes.

Theoretical difficulties with the term "addiction" does not mean that it does not exist. It is not a unitary construct but a multidimensional concept. As noted above, there is no definition in terms of the intrinsic pharmacological properties of a drug. While such a reductionist description has been widely used, it is nowadays recognized that addiction is not merely a chemical reaction but also an experience, most often one of physical or psychological pain relief [25]. The shift from drug to person is necessary to account for the variability of the effects of different drugs in different cultures and on different individuals. Hence, if physical dependence is not to be equated to psychological dependence, they cannot at the same time be considered separately. By the same token, substance use cannot be analysed independently of a person's cultural context and cognitive, emotional and social functioning.

Hess [14] notes that, during much of opium's long history, addiction appears to have been unknown or at least not recognized and described as such. Addiction became progressively an issue during the nineteenth century along with the discrediting of drug use as a degenerate activity. Taken beyond the threshold of facts, addiction is a stigmatizing label. If substance use is described as a disease or a crime, the loss of control attributed to the state of addiction is considered deviant behaviour outside societal norms. The declared addictive property of a drug also serves to induce fear as means of prevention. Labelling a drug as addictive is intended to discredit it; the opposite is considered to signify downplaying the seriousness of the problem. The loaded ideological undertones of this apparently semantic point are often very pronounced in the literature and obstruct efforts to comprehend the complexity of the issues involved.

Deviance

The temptation to reify categories like drugs, addiction and dependence can be understood in reference to the biological process involved. Whenever a phenomenon can be ascribed to nature, it appears to gain in objectivity, reality and transparency and therefore exclude historical and cultural relativity. The concept of deviance, which apparently is more remote from a biological cause, has been attached to heredity. During the nineteenth century, deviance was thought to originate in a person's genes. Subsequently, but on the same level of analysis, that of the individual, deviance was explained by the characteristics of the person and his or her personality, cognitive abilities or behavioural skills. It was only in the 1960s that sociologists from the Chicago School argued that deviance was not part of an individual's actions but is defined by society and the person who internalized it. Deviance is co-constructed by society and the individual whether he or she accepts or refuses the label. The normal and the stigmatized are not absolutes but viewpoints [26-28]. From the perspective of the excluded, one observes a recomposition of the social fabric with different norms, forming alternative worlds to society. The task of the researcher is to understand the viewpoints of this otherness which are often invisible from the outside. The war on drugs and, more surreptitiously, on users seems to be based on the absolute paradigm of the outsider. Drugs have been systematically linked to the unwanted foreigner and urban poor ghetto dweller who are considered a threat to society. There have been spectacular shifts in history in the public concern about drugs. At times it has created moral panics, a phrase coined by

Cohen [29] to describe the reactions of the media, police, public, politicians and action groups as

> "... [a] condition, episode, person or group of persons emerges to become defined as a threat to societal values and interest; its nature is presented in a stylized and stereotypical fashion by the mass media ... . Socially accredited experts pronounce their diagnoses and solutions; the condition then disappears, submerges or deteriorates and becomes more visible. Sometimes the panic passes over and is forgotten, except in folklore and collective memory, at other times it has more serious and long-lasting repercussions and might produce such changes as those in legal and social policy or even in the way society conceives itself."

There are several explanations for this complex phenomenon [30-31]. From such a constructionist stance, the existence of the drug problem as a purely objective condition can be questioned: what characterizes the problem is largely the attitude of the majority of the public. This becomes evident with the category of deviance.

Disease

Disease or illness[2] as a category bears a close similarity to the category of deviance. Indeed, disease is a deviance from the normative yardstick of health. It connotes a disorder that has been widely fantasized. Diseases have, throughout history, served as symbols and representations for something else. In Greek antiquity, disease was the expression of the god's wrath; for the church, it was often a punishment for the sins of the patient. Such projections always disqualified the sick person, implying that, in one way or the other, he or she was responsible for it. On the collective scale, the imagery concerning the great epidemics such as leprosy, cholera, syphilis and, above all, plague, exemplify the stigmatizing of illness. On a more individual level, diseases such as tuberculosis and cancer, described by Sontag [32], have been interpreted as reflecting the particular predisposition or temperament of the person. There has been an invariant link established between biological and moral defects even if the diseases themselves have changed. More recently, the case of acquired immunodeficiency syndrome (AIDS) has shown the way in which those who are ill are viewed as dangerous untouchables, a view enhanced by an association with deviant, excessive and/or abnormal sexuality. The reification of the concept of disease appears particularly inappropriate for AIDS. As Sontag [33] notes, AIDS is not the name of an illness but a clinical construction, an inference describing a terrain for a spectrum of conditions that are often lethal after a period of latency. Adding an ostracizing societal attitude to the severeness of an illness seriously increases the sufferings of the patients.

The disease concept has been applied mainly to alcoholism, less often to drug use. Such medical models emphasize the role of physiological addiction anchored in

[2]The two terms are not synonymous. A disease is strictly a biological entity, that is, an alteration in structure or function of the organism. An illness is a reaction to a change in one's physical state bearing social, psychological and cultural connotations.

genetic factors and leave aside the psycho-social aspects of the problem [34-35]. Thus, the future alcoholic is considered to have an innate predisposition to drink excessively even before the problem is manifest. Such a reductionist view treats alcoholism as a unitary and discrete category instead of seeing it as a complex multidimensional pattern of behaviour. Using the disease model oversimplifies the issue in a purely medical perspective [36]. Neuhaus [37] notes some logical inconsistencies in this trend of thought. Indeed, there is a circularity in reasoning by labelling someone an alcoholic because he or she drinks too much and explaining that he or she drinks too much because he or she has the disease of alcoholism. There is another inconsistency to note. The purely biomedical model sees people as not responsible either for the problem or the solution [38]. The claim that treatment must be complete abstinence, inherent in the belief that alcoholism is a medical condition, has, however, been made by Alcoholics Anonymous. This organization functions according to an enlightenment model which states that people are not responsible for the solution of their predicament but are blamed for causing their own problem. This again shows the shift from a biological defect to a moral defect. The disease model of alcoholism has been applied to drug issues but with less research effort to ground it on an empirical basis (even though findings on the hereditary origins of alcoholism have not been solidly established). Whenever theorists stress physical addiction exclusively, they operate within the same framework.

Dichotomies

The theoretical background of the social sciences in general and the approaches concerning drug issues in particular rest upon traditional dichotomies. Going back to Locke and Descartes, the opposition involved empiricism versus nativism (i.e., acquired or innate determinants of a person's cognizance and behaviour). Subsequently, these polarized views were renamed the nature-nurture debate, contrasting the role of biological and cultural factors. In different times, the emphasis on one at the expense of the other shifted like the swinging of a pendulum. Ideological and political interests are clearly involved in explanations referring to internal versus external causes. Whichever side is chosen in terms of these dichotomies, the result remains the same: the person and the environment are viewed as separate entities without considering their interwoven connections. Biological and cultural processes mutually constitute each other so that, as Cole put it, "the form of our nurturing is our nature" [39].

The paradigm of separating the individual from the environment has been transposed to the terrain of toxicomania. The drug abuser, the addict, the deviant and the ill person are rarely considered as subjects embedded in their historical sociocultural contexts [40]. The internal defect model is a perfect example of this way of thinking. The origin of a person's problem is unilaterally located within the subject without any reference to his or her surroundings. It is of interest to note that the causal processes invoked are not exclusively biological. The abuser can also be found guilty because of his or her moral or psychological flaws owing to severe personality disorders, independent of any contextual factor [31]. Explanations other than the internal defect model have, however, advocated the role of the environment

but left it largely unspecified or limited it to immediate external conditions, such as family constellations or peer influences. In order to grasp the complexities of the drug issues, a comprehensive framework is needed in which cultural, social, psychological and biological levels are taken into account.

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Drugs, alcohol and crime: patterns among Canadian federal inmates

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ABSTRACT

The present article explores the connection between alcohol and illicit drug use on the one hand, and crime on the other. The data were collected in a survey of 8,598 male inmates in (on average, about two weeks into the sentence) Canadian federal penitentiaries using a Computerized Lifestyle Assessment instrument. This survey instrument poses questions about various aspects of an inmate's life before incarceration. Results show that 79.4 per cent of inmates had used an illicit drug at least once in their lifetime. More recently, 50.3 per cent of inmates had used such drugs at least once during the six months prior to their most recent arrest; this was true for 45.8 per cent of most recent inmates during the four weeks prior to their most recent arrest.

In the six months prior to their arrest, 76.3 per cent of inmates had used alcohol at least once; this was true for 56.8 per cent of inmates during the preceding four weeks. Nineteen per cent of all inmates had used drugs every day or almost every day during this six-month period and about 34 per cent had used

them at least once a week. Results also indicate that substance use is highly prevalent on the day of the most serious crime for which federal inmates were admitted to Canadian penitentiaries. However the Drug Abuse Screening Test (DAST) and the Alcohol Dependence Scale (ADS) indicate that the majority of inmates who use drugs and alcohol are not alcohol or drug dependent but that substance use on the day of the crime may facilitate criminal activity. Yet, statistics show that one half of the most serious crimes are committed in the absence of alcohol or other drugs. Despite a strong association, it cannot be concluded that the ingestion of an intoxicant causes crimes. Substance use and criminality are related in a complex way.

Introduction

Numerous scientific studies show that there is a statistical association between the use of illicit drugs and criminality [1-5]. The strongest link is generally found with simple acquisitive crimes of various kinds, such as theft, break and enter and robberies.

Less information is available about how the use of the various types of illegal drugs are related to criminal activity and if there is an association between specific drugs and the type and intensity of such activity. Considering differences in the cost of drugs, addictive potential and other pharmacological properties, one could expect such differences to exist.

There is also a statistical association between the use of alcohol and crime, the strongest link being with homicides and assaults. Studies show that often both the perpetrator and the victim had been drinking prior to the violent criminal act [6-7]. It has also been shown that a large proportion of other types of crimes were preceded by drinking on the part of the offender [8].

Possibilities for studying the relationships

Alcohol is a legal substance in most countries and its sale is monitored by governmental agencies. Thus, information is available that allows assessments of the aggregate level of association between alcohol and criminal acts. Studies have been undertaken in various countries and other kinds of jurisdictions. Owing to the controls exercised over the sale of alcohol, it is also possible to study the impact of sudden changes in the availability of alcohol on the level of crime. Such changes come about when, for example, the legal drinking age is lowered, when the sale of beer or wine is allowed in grocery stores or when a strike stops the transportation or sale of alcoholic beverages. Studies at this kind, however, have been overwhelmingly limited to the link between alcohol use and violent crime.

The possibility of establishing aggregate levels of association between the use of illicit drugs and crime is severely limited. Only rough estimates can be made of the availability and levels of use of the various types of drugs at any point in time. Indirect indicators must be used, such as the cost of a drug on the street or the quantity of drugs confiscated by authorities. Such estimates do not have the

accuracy needed for cross-sectional or time trend analyses which try to assess the causal impact of drugs on crime. General population surveys are used from time to time to assess levels of use of various types of drugs but costs would become prohibitive if this method were used for assessing the strength of the relationship between drugs and crime. Other methods must therefore be used.

Official records, such as court documents and police records, are often used. In the case of victims of homicide, it is possible to gain access to information on drug and alcohol use through the coroner's inquest [9-10]. The survey method has, however, been used to fill the gap in available information: through victimization surveys and self-report studies it is also possible to make comparisons between alcohol use and drug use in relation to deviance, delinquency and crime. The most cost-effective self-report studies are those carried out with known offenders, in particular with offenders who are readily available for surveys in jails and prisons.

Causality in the association between alcohol, illicit drugs and crime

Obtaining estimates on statistical associations between the use of psychoactive substances and crime is only a first, relatively easy, step. The ultimate goal is to estimate the strength of the causal relationships that exist between the two. A particularly useful measure of the causal impact of substance use and abuse on criminal activity would be to estimate the proportion of crimes in a society that can be said to be caused by the use of alcohol and illicit drugs, respectively. In the health sciences, it is common to look for this attributable fraction, or etiologic fraction, for an illness or other health condition. This is done through the use of standard statistical procedures which vary somewhat, depending on the nature of the data. Only recently has the logic of attributable fractions been applied to causal estimates in the area of alcohol, drugs and crime.*

A research programme is under way, aimed at estimating attributable fractions of alcohol and drugs on crime, specifically, at establishing the proportion of various types of crimes that can be said to be caused by the use of alcohol, cocaine, heroin and cannabis. The authors are restricting their assessments to examples in Canada but a more general objective is to find methods that can be standardized so that this procedure can be replicated in other countries.

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*Estimates of causal impact, such as attributable fractions, can be assigned with much greater ease and confidence in the case of risk factors related to illnesses. The direction of causality can often be based on almost irrefutable causal models. For example, if the task is to assess the impact of an occupational hazard—such as exposure to asbestos fibres—on the risk of lung cancer and to compare this to the risk of smoking, there is not much scientific basis for entertaining the competing hypothesis that a propensity towards lung cancer explains past smoking patterns and/or choice of an occupation where asbestos is handled and fibres are inhaled. This means that measures of association can, with some confidence, be used as measures of causal impact. This aspect of the assignment of attributable fractions is non-controversial but it is not so with psychoactive substances and crime. These two entities essentially refer to forms of behaviour with no necessary time-ordering; central causal processes in the models must take into account human free will and a host of social and psychological factors.

Nature of the data

Data for the present article, which explores the connection between alcohol and illicit drug use on the one hand, and crimes on the other, were collected in an ongoing survey of inmates entering Canadian federal penitentiaries. The article therefore deals with crimes detected by the police and processed by the courts, and for which the individual charged was found guilty and given a sentence of at least two years in prison. Several different selection processes were applied to the totality of criminal activity in Canada before the data used were collected.

The generalization of the findings to all criminal activity and all individuals committing crimes in Canada is therefore unknown. However, the sample inmate population comprises a greater number of individuals who have committed serious crimes and who have relatively long criminal careers than any other population available for study. The social problems and costs linked to their criminality are more serious than for any other group and extend far beyond their individual lives. For these reasons, the findings presented below have a great deal of social relevance in their own right.

Methodology

Computerized Lifestyle Assessment instrument

Upon intake, all inmates in Canadian federal penitentiaries are required to respond to a survey instrument that poses questions about different aspects of the inmate's life (see table 1). The Computerized Lifestyle Assessment instrument (CLAI) is a computer-driven questionnaire administered at the time the inmate is being assessed for treatment needs and for placement in a suitable facility at the beginning of the prison sentence. This is done, on average, about two weeks into the sentence.

The Correctional Service of Canada (CSC) started using CLAI with a few inmates in 1989. During the following two or three years, penitentiaries in other parts of the country were included in this type of survey. Administration of the survey continues and, at the time of writing, the number of cases in the computer file is approximately 20,000. The number of inmates available in the data file is 16,957. Of these, 284 (or less than 2 per cent) are women. This sub-group has been omitted from the analyses but will be the subject of a subsequent report.

Although coverage of CLAI was inconsistent in the five administrative regions of CSC during the first years of implementation, 12.5 per cent of cases in the CLAI data file were from the Atlantic region, 40.9 per cent were from the Québec region, 32.6 per cent were from Ontario, 10.1 per cent were from the Prairie region and 3.8 per cent were from the Pacific region. The best geographical coverage in CLAI data was achieved between the years 1993 and 1995. The number of new male inmates assessed with CLAI was 8,598.

Table 1. Main content areas of the Computerized Lifestyle Assessment instrument questionnaire

Health	*Relationships*	*Drug use*	*Alcohol use*	*Criminal activity*
Nutrition	Spouse	Initiation	Initiation	Initiation
Physical activity	Family	Lifetime use	Lifetime use	Lifetime criminality
Smoking	Friends	Overall impact on various life areas	Overall impact on various life areas	Assessed drug and alcohol impact on crime
Sleeping habits	Community	Patterns prior to age 18	Patterns prior to age 18	Number of crimes on current sentence
Physical health		Patterns 6 months prior to arrest	Patterns 6 months prior to arrest	Most serious crime on current sentence
Mental health		Patterns 28 days prior to arrest	Patterns 28 days prior to arrest	
		Dependence scale (DAST)	Dependence scale (ADS)	
		Treatment	Treatment	

Demographic and background characteristics of new admissions during the period 1993-1995

The CLAI questionnaire contained a number of questions concerning the demographic characteristics of the individual inmate. The proportion of new inmates born outside Canada was 18.0 per cent; and 26.2 per cent were members of a non-white racial or ethnic group. Aboriginal offenders made up 5.5 per cent and Black offenders 8.6 per cent of all new admissions. The mean age at admission was 32 and the median was 31. Six per cent of inmates had never attended school and 7 per cent had six years or less of formal schooling.

Completing the questionnaire

It took the inmates approximately two hours to complete the CLAI questionnaire, which contained a few questions on their views concerning the instrument. Eighty per cent of the inmates considered that the task of filling in the questionnaire was “easy”, while 16 per cent considered it “a little difficult”, 2 per cent considered it “quite difficult” and the remaining 2 per cent considered it “very difficult”. As for the length of the questionnaire, 81 per cent considered it about right, 12 per cent considered it too long and 7 per cent considered it too short. Slightly more than one half the inmates (53 per cent) said that they understood the instructions and questions “very well”, 42 per cent understood them “quite well”, and 5 per cent did not understand them “too well”; 91 per cent said they liked doing the survey and 90 per cent said they would encourage a friend to take it.

Robinson, Porporino and Milison [11] conducted a reliability and validity assessment of some components of CLAI on a sample of 503 inmates and concluded that the instrument had good psychometric properties and a high concordance with information on an inmate’s file.

Results

The Computerized Lifestyle Assessment instrument contains detailed questions concerning the past habits of drug and alcohol use of the newly incarcerated individual: his initiation to use and his patterns of regular use prior to age 18 are probed. More recent use is covered by questions pertaining to the six months and four weeks immediately prior to arrest. The situational association with criminality is measured by a series of questions on the use of drugs and alcohol on the day that the crime was committed. Here a descriptive account is given of the use of drugs and alcohol by inmates, starting with initiation and ending with the narrowest focus and the most relevant to direct causation: use of psychoactive substances on the day of the crime.

In addition to the factual information on the use of psychoactive substances, CLAI contains questions that ask the inmate to make an overall assessment of the impact of drugs and alcohol on all of the crimes he has committed, as well as detailed assessments of the influence that his use of these substances has had on his judgement, aggressive tendencies and the likelihood of his committing the crime etc. Such estimates are naturally coloured by the perpetrator's subjective perceptions and, sometimes, wishful thinking. Subjective estimates, however, provide useful comparisons with more objective statistical estimates of the causal impact of drugs and alcohol on crime. Subjective estimates of causal impact and the factors affecting them form the second part of the results presented herein.

Drug and alcohol use patterns among the inmates

Lifetime patterns

The prison population had a history of relatively extensive alcohol and drug use. Nearly four in five inmates (79.4 per cent) had used non-medical psychoactive drugs, almost exclusively illicit ones, at least once in their lifetime and 52.1 per cent had used them with a frequency of at least once a week over a period of time. Nearly 19 of 20 regular users (93.9 per cent) had quit drugs voluntarily at least once. Alcohol had been used at least once by 95.1 per cent of the inmates. Using the same measure as that for drug use, 62.7 per cent had used alcohol regularly, at least once a week, and 78.1 per cent of the regular users had stopped using it voluntarily at least once.

The mean ages at which the inmates reported initiation to drug and alcohol use and to regular use of drugs and alcohol is shown in table 2. The proportions of users in the total inmate group of 8,598 individuals are shown in parentheses. About two-thirds of initial users of both alcohol and drugs later became regular users. The time elapsed from experimental drug use to first regular drug use (1.5 years) was less than half that of the corresponding time elapsed for alcohol use (3.5 years). This may be an indication of the relative strength of the social, psychological and pharmacological factors which determine the formation of dependence on drugs versus alcohol.

Table 2. Mean age at first use and at the beginning of first regular use of alcohol and illicit drugs

	Alcohol	*Drugs*
First use	14.5 years (95.1 per cent)	16.2 years (79.4 per cent)
First regular use	18.0 years (62.7 per cent)	17.7 years (52.1 per cent)

By far the most common drug of initiation was cannabis (either in the form of marijuana or hashish) which was chosen at first use by 85.6 per cent of the inmates who had taken drugs at least once in their lifetime (see table 3). The use of cocaine (including crack) and lysergic acid diethylamide (LSD), which were the second and third drugs of choice, was very low by comparison. Marijuana/hashish also dominates (but not as strongly as at initiation) as the drug of choice among the 52.1 per cent of inmates who had used illicit drugs regularly before the age of 18; 56.8 per cent of them had used at least marijuana on a regular basis (see table 4).

Table 3. Type of drug used at initiation to drug use

Drug	*Percentage of users*
Marijuana/hashish	85.6
Cocaine	4.1
LSD	3.0
Glue or gas	1.9
Tranquillizers	1.1
Amphetamines	0.8
Heroin	0.8
Other drugs	2.7

Table 4. Percentage of inmates who used major drugs on a regular basis prior to age 18 (multiple responses possible)

Drug	*All inmates*	*All inmates who had used drugs regularly*
Marijuana/hashish	29.6	56.8
LSD	10.6	20.3
Cocaine	7.3	14.0
Tranquillizers	4.9	9.4
Amphetamines	4.4	8.4
Barbiturates	4.2	8.1
Phencyclidine (PCP)	3.9	7.5
Glue or gasoline	3.0	5.8
Methylenedioxyamphetamine (MDA)	2.5	4.8
Crack/cocaine	2.0	3.8
Heroin	1.9	3.6
Quaaludes	1.0	1.9

Recent use of drugs and alcohol

As noted above, 79.4 per cent of the inmates had used an illicit drug at least once in their lifetime. More recently, 50.3 per cent of inmates had used such drugs at least once during the six months prior to their most recent arrest, and this was true for 45.8 per cent of the inmates during the four weeks prior to the most recent arrest. In the six months prior to their most recent arrest, 76.3 per cent of inmates had used alcohol at least once and 56.8 per cent had used it at least once during the four weeks prior to the most recent arrest.

Drugs had been used by 19 per cent of all inmates every day or almost every day during the six-month period, and about 34 per cent had used them at least once a week (see table 5).

Table 5. Frequency with which various types of drugs were used during the six months prior to the most recent arrest

(Percentage of all inmates)

	Every day or almost every day	*At least once a week*
Alcohol	13.3	44.4
Drugs with alcohol	5.7	18.1
Drugs:	19.1	33.7
Cannabis	10.8	24.5
Cocaine	9.0	17.9
Heroin	2.7	4.2
Tranquillizers	2.1	6.4
Opiates	2.3	5.6
Hallucinogens	1.0	3.1
Stimulants	1.0	2.8
Sedatives	0.9	3.0
Inhalants	0.4	0.8

Drug users dominated over alcohol users in daily or near-daily use (19.1 per cent compared to 13.3 per cent). There were more inmates who had used alcohol on at least a weekly basis than there were drug users with the same frequency of use (44.4 per cent versus 33.7 per cent). Cannabis, cocaine and heroin were the three drugs most commonly used on a daily basis. It is probably a reflection of the addictive property of heroin that the difference between daily or near-daily use and use at least once a week is small, compared to the other drugs. An indication of the prevalence of the combined use of alcohol and drugs is the finding that, during the six months prior to incarceration, 9.7 per cent of inmates (i.e., 19.3 per cent of inmates who had used drugs during that period) had always or often used their drug together with alcohol and that 5.7 per cent of inmates reported that they had used alcohol together with drugs every day or almost every day during that period (see table 5). During the most recent four-week period prior to arrest, 11.1 per cent of inmates had used drugs every day and 25.2 per cent had used drugs on average at

least every other day. The mean number of days of use among those who had used drugs at least once during the four-week period was 14.9 per cent. This translates into a drug use of 50.3 per cent of all days during that period. In the total population of inmates, at least one type of illicit drug was used on 24.3 per cent of days. The 11 per cent of inmates who had used drugs daily accounted for 45.4 per cent of all drug use days in the population.

Criminality patterns among inmates

The inmates in the present study were convicted for the first time (including for juvenile offences) at the mean age of 17.9 years. Close to one quarter (24.7 per cent) were serving their first sentence, while 20.9 per cent had one or two previous convictions, 21.6 per cent had been convicted three to five times before, 11.7 per cent had been convicted six to nine times and 21.4 per cent had been convicted more than ten times.

In assessing the crimes committed over their lifetime, 53.2 per cent of the inmates reported at least some of their crimes had been committed under the influence of drugs and 28.8 per cent considered that most or all of their crimes had been committed under the influence of drugs. In the same way, 50 per cent of the inmates considered that some of their crimes had been committed under the influence of alcohol and 24.1 per cent that most or all of their crimes had been committed under its influence.

In considering the total sample, inmates had been convicted for a mean number of 4.1 crimes on their current sentence. Those who were under the influence of drugs when committing at least one of those crimes had been convicted for 5.3 crimes while those who were under the influence of alcohol had been convicted for 4.5 crimes on their current sentence and those who were not under the influence of either drugs or alcohol had been convicted for 3.9 crimes. This is another indication of the somewhat more intensive criminal behaviour of those using drugs and alcohol in connection with their crime.

Drugs, alcohol and the current most serious crime

The focus of the present paper is the use of alcohol or drugs on the day that a crime was committed. Looked at first will be the proportion of inmates who reported the use of alcohol, drugs or both alcohol and drugs on the day of a crime. The last section will report on the assessment by the inmates of the causal role of alcohol and drugs when committing a crime and the probability of their committing the crime under the influence of drugs given their habits in the four weeks prior to their arrest.

The crime selected for special study is the current crime for which the inmate received the longest sentence, which can be said to be the most serious of the crimes for which he was serving time. Table 6 shows the distribution of the types of crime in our sample.

Table 6. Most serious crime on the current sentence

Crime	*Number*	*Percentage*
Robbery or attempted robbery	1 811	21.1
Drug offence	1 427	16.6
Break and enter	1 146	13.4
Sex offence	1 052	12.3
Assault or wounding	581	6.8
Murder or manslaughter (homicide)	535	6.2
Theft	466	5.4
Fraud or forgery	262	3.1
Driving while intoxicated	235	2.7
Possession of stolen property	174	2.0
Attempted murder	130	1.5
Possession of a weapon	128	1.5
Other traffic offence	109	1.3
Abduction or kidnapping	61	0.7
Extortion	46	0.5
Other type of offence	416	4.8
Total	8 579	100

Just over one half of the inmates (50.6 per cent) had used either illicit drugs or alcohol or both on the day of committing their most serious crime. Table 7 shows the patterns of use for various major crimes on the sentence. There was a rather clear distinction between acquisitory crimes and violent crimes in the prevalence of use of drugs and alcohol. While homicides and, more pronouncedly, assaults and woundings were predominantly alcohol-related, crimes such as thefts and break and enter showed a higher prevalence of drug use on the day of the crime. Robberies and attempted robberies, however, showed the clearest preponderance of drug use. There was little involvement of drugs in sex offences and, where drugs had been used, this had occurred mostly in combination with alcohol.

Given the way the question was phrased in referring to the day of the crime, it is possible that in some cases the inmate may have referred to the use of alcohol or drugs that occurred after the crime was committed but on the same day. It was possible to control for this by analysing responses to a question asking how many hours prior to the crime the use of a substance had occurred. The results showed that a maximum of 1.9 per cent of the alcohol use, 3 per cent of the drug use and 2.1 per cent of the combined use of alcohol and drugs had not occurred until after the crime.

It may seem surprising that drug offences had such a low representation in drug-related cases. This can be explained by the lesser drug crimes of possession and minor trafficking which receive sentences that are milder than the minimum two-year sentence required for incarceration in a federal penitentiary. Most of the more serious drug crimes are committed by individuals who are not themselves regular drug users.

Cocaine was the drug most often used on the day of the crime (see tables 8 and 9). Inmates had consumed cocaine during the day in close to one half (46 per cent) of all drug-related crimes (see table 8). The bottom line of table 9 shows that the

Table 7. Use of alcohol or drugs on the day of the most serious crime, by type of crime

(Percentage)

Crime (and number committed)	*Drugs*	*Alcohol*	*Alcohol and drugs*	*No substance used*
Robbery or attempted robbery (1,811)	25	15	17	43
Drug offence (1,427)	18	5	6	72
Break and enter (1,146)	24	20	12	44
Sex offence (1,052)	3	30	11	55
Assault or wounding (581)	9	38	22	31
Murder or manslaughter (535)	8	31	19	42
Theft (466)	30	19	17	34
Fraud or forgery (262)	10	10	2	78
Driving while intoxicated (235)	0	83	10	6
Possession of stolen property (174)	13	22	7	58
Attempted murder (130)	10	28	19	43
Possession of a weapon (128)	13	27	13	47
Other crimes (632)	12	23	12	53
Total, all crimes (8,579)	16	21	13	49

Table 8. Drug use on the day of the most serious crime, including drugs used together with alcohol, by type of crime

(Percentage)

Crime (and number committed)	*Marijuana*	*Cocaine/crack*	*Heroin*	*Other drugs*
Robbery or attempted robbery (754)	15.0	50.3	10.2	24.5
Drug offence (342)	25.7	49.7	14.3	10.2
Break and enter (413)	31.5	44.8	4.4	19.4
Sex offence (153)	41.8	27.5	0.7	30.1
Assault or wounding (176)	25.6	31.8	1.7	40.9
Murder or manslaughter (148)	15.5	35.8	0.7	48.0
Theft (220)	12.3	66.8	5.9	15.0
Other crimes (318)	22.6	40.3	7.5	29.6
Total, all crimes (2,524)	22.3	46.0	7.4	24.4

overall cocaine involvement rate per 1,000 most serious crimes was 135 (i.e. 13.5 per cent of all most serious crimes were such that the inmate/offender had used cocaine on the day of the crime). For cannabis, the rate was about one half of that (66 of 1,000 crimes) and for heroin it was one sixth of the rate for cocaine (22 per 1,000 cases).

Cocaine was used most frequently in connection with thefts and, second, with robberies and attempted robberies. Heroin was most prevalent in connection with drug crimes and robberies. Break and enter was most often connected with marijuana use, while the crimes of assault (murder/manslaughter and assault/wounding) were linked with drugs other than the three specified in tables 9 and 10: tranquillizers (14 per cent), LSD (5 per cent), PCP (4 per cent) and barbiturates (4 per cent).

Table 9. Rates per 1,000 inmates who had used marijuana, cocaine/crack, heroin or other drugs on the day of the most serious crime on their current sentence, including drugs used together with alcohol, by type of crime

Crime	*Marijuana*	*Cocaine/crack*	*Heroin*	*Other drugs*	*No drugs used*
Robbery or attempted robbery	62	209	43	102	584
Drug offence	62	119	34	25	760
Break and enter	113	161	16	70	640
Sex offence	61	40	1	44	855
Assault or wounding	77	96	5	124	697
Murder or manslaughter	43	99	2	133	723
Theft	58	315	28	71	528
Other crimes	46	82	15	60	796
Total, all crimes	66	135	22	72	706

Interesting patterns could be observed in the combinations of alcohol and the different types of drugs. Cocaine (especially crack/cocaine), and even more so heroin, was used predominantly without alcohol (see table 10). Use of marijuana and tranquillizers was, on the other hand, more prevalent in combination with alcohol. Also of interest are the combination of LSD with alcohol, and the fact that when more than one type of drug was used, they were more likely to have been used together with alcohol than without alcohol in a truly multi-substance combination.

Table 10. Types of drugs used on the day of the most serious crime, alone and together with alcohol

(Percentage)

Drug	*Drugs (1,411 cases)*	*Drugs and alcohol (1,123 cases)*	*Total drugs (2,534 cases)*
Cocaine	40.2	31.1	36.1
Marijuana/hashish	18.6	26.7	22.2
Crack/cocaine	14.0	4.7	9.9
Tranquillizers	4.0	12.2	7.7
Heroin	11.7	1.9	7.3
LSD	1.2	2.9	2.0
Barbiturates	2.1	3.0	2.5
PCP	1.6	2.0	1.8
Amphetamines	0.9	0.5	0.
Methadone	0.3	0.1	0.2
Glue or gas	0.3	0.3	0.3
MDA	0.1	0.1	0.1
Quaaludes	0.1	0.2	0.1
Other types of drug	2.5	3.4	2.9
More than one type	2.5	11.0	6.2
Total	100	100	100

Assessments of causality between alcohol and drug use and crime

Assessments of lifetime causality

All inmates who had used drugs at least once in their lifetime were asked to assess the overall effect that drug use had had on their involvement in crime. A small proportion (4.8 per cent) said that their use of drugs had decreased their criminal activities, while 44.2 per cent reported that their drug use had increased their involvement in crime, and the remaining 51.1 per cent judged that their drug use had had no effect on their criminality. The same assessments for the causal impact of alcohol showed that about the same percentage as for drugs attributed a decrease in criminal activity to their alcohol use (3.7 per cent), fully 63.6 per cent considered that alcohol had had no effect one way or the other, and 32.7 per cent considered that their alcohol use had contributed to their criminal behaviour.

Assessment by inmates of the acute effects of alcohol and drugs on behaviour and judgement

Inmates who had used drugs, alcohol or both on the day of committing their most serious crime were asked how these substances had affected them. Among those who had used drugs, 78.7 per cent said that the use of the drug had made them more likely to commit the crime, 83.4 per cent said the same about alcohol, and 90.9 per cent said so about the combination of alcohol and drugs that they had used.

Among those who said that the use of a substance had made them more likely to commit their most serious crime, a large majority considered that its consumption had affected their judgment at the time of the crime (see table 11). A much greater proportion of inmates reported that alcohol had made them more argumentative, aggressive and violent than was the case for users of illicit drugs. The users of both alcohol and drugs on that day fell somewhere in between, but closer to the pattern for drugs than for alcohol.

Table 11. Drug and alcohol affected inmates who reported being more prone to argue and be rude to others, more aggressive or violent, and affected in their judgement by the substance taken on the day of their most serious crime

(Percentage)

	Drugs	*Alcohol*	*Drugs and alcohol*
Judgement affected	83.1	92.4	90.9
More prone to argue	33.6	51.1	44.4
More aggressive	37.1	60.6	52.1

Crimes committed in order to obtain drugs or alcohol

Questions on the effects of having been under the influence or having used alcohol or drugs on the day of the crime imply a natural-causal type of model in explaining the relationship between substance use and crime: having used the sub-

stance in some way caused the perpetrator to commit the criminal act. Another major type of explanation of the association is that of means unto an end: a crime was committed in order to get one or more psychoactive substances for personal use. In response to the question "Was this crime committed to get or while trying to get drugs for your own personal use?", about two thirds of the inmates who had used drugs at the time of their most serious crime indicated that this was the case. Acquisitory crimes, such as theft (83.6 per cent), robbery (78.1 per cent), fraud (70.4 per cent) and break and enter (68.1 per cent) were the crimes most commonly committed in order to obtain drugs among those who had used drugs on the day of the crime. Those who either used alcohol or both substances reported this reason in lower percentages (7.8 per cent and 38.7 per cent, respectively).

Discussion

Evidence of an association between alcohol and drug use and crime abounds. The link between drugs and crime can take many different avenues. Some individuals who experience cognitive impairment or disinhibition while intoxicated may manifest impulsive behaviours [12]; others experiencing financial problems arising from heavy use of an expensive drug would be inclined to commit crimes that will provide the financial means for obtaining their drug [13]. There are several additional pathways that link alcohol and drugs to crime. For the purpose of investigating these, and their contribution to the overall associations, it is important to obtain information on the joint prevalences of the various types of psychoactive substances and major types of crimes in key populations. The CLAI data bank offers several key insights into the alcohol, drug and crime relationship among Canadian federal inmates during different periods of their lifetime.

Intoxication and crime

One half of the inmates were under the influence of alcohol or a drug on the day that they committed their most serious crime. This figure is comparable to data compiled by the United States Bureau of Justice Statistics [14] which, in 1997, recorded that 51 per cent of prisoners in the United States of America had reported using alcohol or drugs while committing their offence. The data in the present paper are also comparable to the statistics on drug involvement reported by the United States Office of National Drug Control Policy [15] which estimated that between 17 per cent and 36 per cent of inmates had used drugs at the time of their offence. When asked if their offending was affected by their substance use, nearly three quarters expressed the belief that there was a link. Although personal assessments of the role of substance use in the commission of crimes must be regarded as prone to information bias, it can be noted that this proportion does not differ very much from the estimates obtained for the present study. Still, caution is necessary: some subjects may have preferred to portray their crimes as substance induced in order to minimize their responsibility. More objective information, however, is available which supports subjective assessments of this kind. For instance, the present analysis showed that those who were under the influence of drugs had committed, in the past, more crimes than those who were not. Apart from driving while intoxicated, assaults

and thefts were the most important crimes to be committed under the influence of alcohol or drugs; driving while intoxicated and assault were more likely to be committed by alcohol users, while theft was predominantly committed by illegal drug users.

Despite the heavy involvement of drugs, alcohol was the substance most often used by federal inmates. Alcohol is also more strongly associated with crimes that have raised the level of concern in society more than any other: crimes of violence. In addition to the objective information on the type of crime committed by the inmates, the observation was made in their self-reports which indicated a greater propensity towards argument and aggressiveness than was the case for illicit drugs. According to Roth [16], it must be concluded that examination of the link between mind-altering substances and crime, especially violent crime, should not be done without a careful evaluation of alcohol use. The majority of those who used alcohol on the day of a crime exhibit a pattern of regular alcohol use. The association between crimes and patterns of use and dependence on alcohol will be examined in a subsequent paper.

Cocaine was second in prevalence of use after cannabis among federal inmates in the period immediately prior to arrest. It was, however, the illicit drug most commonly used by federal inmates on the day that they committed their most serious crime. The proportion of cocaine users on the day of the crime was double that of cannabis users. Moreover, the proportion of cocaine users among the study population was astonishingly high in comparison with national statistics. While about one per cent of the Canadian population used cocaine over a 12-month period, 28.8 per cent of federal inmates had used it during the six months prior to incarceration. Robberies represent the most common serious crime committed by those who used cocaine on the day of the offence (break and enter and theft were the second and third most common). Robberies made up one third of all crimes committed by cocaine users, while they represented less than one quarter of all crimes committed by federal inmates in the population of newly admitted inmates. The need for money is strongly associated with the criminal activities of users of this expensive drug. This interpretation is supported by their responses: 68 per cent of cocaine users said that their need for drugs made them commit their most serious crime. This figure is much higher that the one reported by the United States Bureau of Justice Statistics [14] or the United States Office of National Drug Control Policy [15] where between 10 per cent and 20 per cent of male inmates indicated that they had committed their offence in order to obtain money for drugs. The difference may in part reflect the incarceration policies of the two neighbouring countries. Nonetheless, it must be kept in mind that a considerable proportion of the cocaine users did not put the blame for their criminal activities on the drug used. In agreement with Hunt [17], it must be concluded that drug use is not the only factor to consider when analysing the link between drugs and crime. Other factors, such as the price of a drug in relation to marginal income from illegal sources, the other sources of income available and the level of addiction should be carefully considered.

Compared to other studies, especially from Europe [18-23], there were few heroin users in the population surveyed for the present paper. Like cocaine users, they are over represented among robbers. In addition, more than one quarter of heroin users had been admitted to a Canadian penitentiary for a drug offence. These

two criminal activities represent more than two thirds of the most serious crimes among heroin users newly incarcerated in Canadian federal prisons.

Conclusion

Substance use is highly prevalent on the day of the most serious crime for which federal inmates were admitted to Canadian penitentiaries. Preliminary analyses on the DAST and ADS scales used in CLAI indicate that the majority of the inmates using drugs and alcohol were not alcohol or drug dependent. Instead, substance use on the day of the crime may have facilitated their criminal activities. At the same time, one half of the most serious crimes were committed in the absence of alcohol or other drugs. Despite a strong association, it cannot be concluded that the ingestion of an intoxicant causes crimes. Substance use and criminality are related in a complex way. In any event, the high rates of alcohol and drug use in the inmate population suggests that this issue deserves more systematic exploration. One step in this direction would be further examination of how criminality and the level of dependence on drugs and alcohol are related. Beyond the role of substance use and abuse, it is necessary to highlight the importance of controlling for individual factors (e.g., propensity towards criminality) and contextual factors (e.g., the possible role of drug control laws in determining the price of illicit substances and the level of criminality) in studying the relationship between alcohol and drug use and crime.

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Substance abuse among secondary-school students and its relationship with social coping and temperament

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ABSTRACT

Alcohol, cannabis and ecstasy use was investigated in a representative sample of 843 secondary-school students aged 14-19. In addition to answering questions on substance use, the participants completed questionnaires concerning social and behavioural factors, achievement at school and perceived substance use among friends. All the students completed Cloniger's Tridimensional Personality Questionnaire and the Eysenck questionnaire. It was found that 76.5 per cent of the students had consumed alcohol at least once in their lives, 38.4 per cent had abused alcohol, 27.1 per cent had used cannabis and 5.5 per cent had used ecstasy. Gender differences were significant in the use of alcohol and ecstasy, with male subjects outnumbering females; the trend was reversed for cannabis use. The extent of exposure to alcohol and illicit drugs was more common among males than among females. Elements found to be associated with illicit drug use included high socio-economic group, low levels of achievement at school, high rates of failure at school, less involvement in volunteer social activities, transgressive behaviour, high scores in novelty seeking on the Tridimensional Personality Questionnaire and social coping impairment according to the Eysenck scale. Results of the present study suggest an increase in alcohol and illicit drug use among young people, in comparison with the results of previous studies, with the early onset of substance use in adolescents (persons aged 14-16). Many of the behavioural and psychometric changes associated with substance use do not correlate with the extent of exposure to alcohol and drugs. Such changes may be attributed in part to premorbid disorders and temperamental features. Prevention strategies need to focus on children and adolescent subtypes who show specific lifestyle, behavioural and psychological features.

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Introduction

Drug use most often begins in early adolescence. The sequence from tobacco use and alcohol consumption to marijuana use and then to the use of other drugs has been found in almost all long-term studies of drug use [1, 2]. The risk of moving on to heavy drugs has been found to be more than a hundred times higher for persons who have smoked marijuana at least once in their lives than for those who have not [3, 4]. The use of different illicit drugs and alcohol among students, based on the results of questionnaires completed by adolescents and young adults about their use of alcohol and cannabis, appears to be a widespread problem [5, 6]. Nevertheless, the differences in age and gender, the cultural variations, the types of schools attended and the different structures of the self-administered questionnaires make the results of those studies difficult to compare.

According to self-reported surveys of adolescent students in Nova Scotia, in Canada, carried out in 1991 and 1996, over one fifth (21.9 per cent) of the students reported having used alcohol, tobacco and cannabis in the 12 months prior to the 1996 survey [6].

In a study conducted in the United States of America and published in 1997, marijuana was the illicit drug used most often among medical students; it was reported to be used by 19-21 per cent of the students in the study [5].

On an undergraduate campus in the United Kingdom of Great Britain and Northern Ireland, the incidence of recreational use among college students of 3,4-methylenedimethoxymethamphetamine (MDMA), also known as ecstasy, was investigated more than 10 years ago [7] and again recently. Four years after the first study, the use of ecstasy had increased from 16 per cent to 24 per cent [8].

Concern about these developments is supported by the findings of a British survey on the lifestyle of medical students [9]: reported use of cannabis and other illicit drugs had more than doubled in comparison with the data recorded in 1984 in the same area. In the 1994 survey, 49.2 per cent of the participants having used cannabis, 22 per cent had tried other illicit drugs and 39.3 per cent had anxiety ratings within the clinically significant rage; finally, in the 1998 update, cannabis had been used at least once or twice by more than half the males and by 40 per cent of the females, and 10 per cent of the participants reported regular (at least weekly) use [10]. Consistent with those findings, a recent study found that rates of cannabis use increased from 15 per cent of the sample group at age 15 to 52.4 per cent of the same sample group at age 21 [11].

In Italy, few data are available about the proportion of young people using alcohol, cannabis and amphetamine derivatives. The 1995 European Schools Project on Alcohol and other Drugs Study [12] revealed that, in Italy, alcohol was consumed by a large proportion of students and that cannabis was used by nearly 20 per cent of the students.

An anonymous self-administered questionnaire on psychotropic drugs, completed by 3,212 secondary school students in Canada, showed that a proportion of

personal problems were related to the use of psychotropic drugs (13.2 per cent among drug users, compared with 3.8 per cent among those who consumed alcohol only). Whether personal problems had been induced by the effects of drugs, or whether such problems already existed, thereby contributing to the vulnerability that opened the way for substance abuse, remains difficult to evaluate [13].

Aggressiveness, delinquency and poor social skills have been of prime interest in studying the psychological and behavioural traits as risk or predictive factors for alcohol and substance abuse [4, 14]. Drug and alcohol disorders generally follow rather than precede the onset of behavioural problems, suggesting that the former may be caused by the latter [15, 16]. Rates of cannabis use have been correlated with a history of violent behaviour [11] and antisocial personality disorder is considered by one author to be the personality profile most often associated with an individual's risk of alcoholism [17].

The relationships between adaptation to stress, coping strategies and substance abuse have become a popular focus of inquiry [18]. Low academic achievement, disinhibited personality and susceptibility to peer pressure were independent predictors of self-reported drinking behaviour and experimental drinking in a laboratory setting [19] and of illicit drug use [20]. Accordingly, early predictions of an alcohol use disorder in adulthood included early reports of underachievement in first grade by the child's teacher, some early problems in adaptive behaviours in school, dropping out of secondary school, whether the family set definite rules about school during adolescence and how often the adolescent worked on homework with his or her family [21].

The personality trait that suggests a strong tendency to seek novelties and low harm-avoidance seems to be another predictive factor for alcoholism and substance abuse among adolescents [22-24]. Such differences in both novelty-seeking and drug- seeking behaviour, while influenced to some degree by genetics, appear to be modifiable by early development experiences [25].

The literature supports the hypothesis that, given the same exposure to alcohol and illicit drugs, preferences for psychoactive drugs and the development of multiple use, poly-drug abuse and dependence could be influenced by environmental factors, lifestyle and psychological and behavioural features, all of which contribute to a young person's vulnerability [4].

If the hypothesis of the relationship between the consumption of alcohol and the use of drugs and psycho-behavioural factors could be confirmed, the early screening of risk factors [26-28] in school and the detection of more vulnerable subtypes among children and adolescents could become a priority of prevention programmes. In turn, primary prevention efforts could be enhanced, not only by avoiding the initial contact with alcohol and drugs per se, but by changing the conditions that affect lifestyle, behavioural and psychological risk factors. Secondary prevention efforts could focus on developing specific strategies, targeting adolescent subtypes having different degrees of vulnerability.

In order to better understand the extent of substance abuse, including the effect of coming into contact with gateway drugs, the drug preferences of Italian teenagers and the possible connection illicit drug use has with demographic, social, behavioural and psychological risk factors, a study was conducted to determine the rate of self-reported alcohol consumption and cannabis and ecstasy use among secondary-school students, some psychosocial features of the participants, their coping style and personality traits.

Material and methods

Subjects

The study was based on a sample of 843 students aged 14-19 living in the province of Parma, Italy, and attending one of five secondary schools in the second half of 1998. The cohort was a stratified, randomized sample that included persons from all the areas of the province and the entire range of school grades and types of schools (focusing on a range of disciplines, including professional, technical and scientific fields and more traditional education). The mean age of the sample was 16.38 years (standard deviation: 1.69). Of the persons in the sample, 411 (48.75 per cent) were males and 432 (51.24 per cent) were females.

Before the study began, each person in the sample received detailed information about the survey and agreed to participate in it. The anonymity of the questionnaires was guaranteed.

Five subsamples were taken from the cohort. The first subsample comprised subjects who did not use alcohol or other illicit drugs; the second comprised those who admitted to having consumed (but not abused) alcohol without other illicit drugs; the third, those who reported having abused alcohol without other illicit drugs; the fourth, those who reported having used alcohol and cannabis; the fifth, those who reported having used alcohol, cannabis and ecstasy. In the sample were two ecstasy users who did not smoke cannabis or drink alcohol and three cannabis users who did not report their alcohol use; because they were so few in number, they were not included in the statistical analysis.

Measures

A questionnaire dealing with substance use (alcohol, cannabis and ecstasy) and another dealing with demographic data, the lifestyle and behavioural attitudes of the students as correlates of substance use, were distributed. Cloninger's Tridimensional Personality Questionnaire [29] and the Eysenck Questionnaire [30] were used to investigate aspects of personality.

The supply of illicit drugs, their general availability and their perceived use among peers were also tested.

Questionnaire on substance use

The questionnaire on substance use was designed as a modified version of the one developed by Müller and Abnet [31] comprising 16 items that dealt with the use of both licit and illicit drugs.

The assessment of alcohol use was based on replies to a series of questions. The first question determined whether alcohol had ever been consumed by the subject. The second question concerned the frequency of alcohol consumption (the number of times alcohol had been consumed in the previous 30 days). The third question was presented as a detailed list of various alcoholic beverages where the number of alcoholic drinks consumed per day could be indicated. Another question evaluated the frequency with which spirits were consumed (daily or weekly, if at all). More than two drinks of wine or beer every day or more than three drinks of spirits every week constituted alcohol abuse.

Another item measured intoxication rates both in the previous 12 months and in the lifetime of the respondent.

As for cannabis use, the respondents were asked to indicate if they had ever smoked cannabis. To determine the frequency of current cannabis use, respondents were asked to indicate how many times they had used cannabis in the previous six months.

As for ecstasy use, the respondents were asked to indicate if they had ever taken ecstasy or similar drugs. To determine the frequency of current ecstasy use, the respondents were asked to indicate how many times they had used ecstasy in the previous six months.

In order to evaluate the use of illicit drugs and alcohol among classmates and friends, respondents were asked to estimate the percentage of their friends who consumed alcohol, smoked marijuana or used ecstasy.

Construct validity

The correlation between self-reported use of alcohol and illicit drugs and estimated use among friends supports the construct validity of the study. Regardless of whether the replies to the self-reported questionnaire were casual or incoherent, the rates of alcohol and drug use should correlate with the perception of use among peers, because of the affiliation of those experimenting with drugs to peer groups using illicit drugs. Thus, a lack of correlation between the self-reported rates of alcohol and drug use and the estimated rates of their use among peers reduces the significance of the results obtained by the study.

Questionnaire on behavioural, social and environmental factors

The questionnaire covered the following items concerning environmental and behavioural factors:

(*a*) Home area (urban (town) or rural (province): whether the subjects were resident in the town of Parma or in the rural part of the province);

(*b*) Socio-economic group (high, medium or low), related to parents' occupation: whether subjects' parents were professionals, employees, labourers or unemployed;

(*c*) School achievement (good or poor), related to self-reported mean school grades: good was rated as over 6, poor was rated as under 6;

(*d*) Hours of homework: whether the subjects were spending more or less than two hours per day on homework;

(*e*) School failure: whether the subject had failed exams and whether they had been refused admission to the next school level at least once;

(*f*) Involvement in volunteer social activities: whether the subjects were permanently involved in voluntary activities with social institutions, non-profit associations or non-governmental organizations;

(*g*) Transgressive behaviour: whether the subjects had been suspended from school for bad conduct or had frequently missed hours or days at school to avoid tests or evaluations; and whether the subjects had frequently committed driving violations;

(*h*) The setting conducive to substance use (alone, with friends, in the peer group);

(*i*) Substance use in discotheques.

The selection of items included in the questionnaire was based on research suggesting that environmental and social influences, school underachievement, incidence of dropping out of school and defiant and transgressive behaviour were conditions that increased the likelihood of students experimenting with illicit drugs. Bonding to social institutions and participating in voluntary activities were regarded as protective factors [4]. The settings in which psychoactive substances were used (e.g. discotheques) were also investigated.

Social coping

Social coping was assessed according to the Eysenck scale in the reduced version of 48 items, modified by Sanavio [30]. The Eysenck questionnaire included the following four scales:

(*a*) Emotional stability and instability;

(*b*) Extroversion and introversion;

(*c*) Social coping and social coping impairment;

(*d*) Social desirability and undesirability.

In particular, the Eysenck questionnaire was used to investigate the third scale listed above, the social coping capacity, focusing on poor adaptation to stress, poor coping skills for social relationships and poor harm-avoidance behaviour. Those characteristics had been found to be related to an increased likelihood of substance abuse [4].

Temperament

The assessment of novelty-seeking behaviour was made with Cloninger's Tridimensional Personality Questionnaire [29], which included scales measuring three different temperament-related dimensions: reward dependence, harm avoidance and novelty-seeking. Cloninger defines temperaments as stable dimensions of personality that seem to be influenced by genetic factors. The first temperamental trait identified by Cloninger corresponded to novelty-seeking, the proneness of individuals to involve themselves in new and unknown experiences, to seek sensations with high emotional impact and to be rewarded by risk-taking activities. A high novelty-seeking tendency, together with a low harm-avoidance tendency have been found to be linked to a higher likelihood of alcohol and substance abuse.

Statistical analysis

The statistical analysis included the chi-square test, multivariate analysis of variance, analysis of covariance, logistic regression analysis and the Pearson correlation between substance abuse and behavioural, temperament-related and psychological data.

Results

The results of the study on alcohol use and abuse and cannabis and ecstasy use among secondary-school students are shown in table 1.

Table 1. Alcohol, cannabis and ecstasy use among secondary-school students

Students	*Persons who abstained from alcohol and illicit drugs*	*Alcohol users*	*Alcohol abusers*	*Cannabis users*	*Ecstasy users*
Number	198	645	324	229	47
Proportion (percentage)	23.49	76.51	38.43	27.17	5.57

The abstinent students (accounting for 23.49 per cent of the total) and the students who used alcohol (accounting for 76.51 per cent of the total) together represented 100 per cent of the sample (843 subjects).

Alcohol abusers, cannabis users and ecstasy users were included in the category of alcohol users. The first group, consisting of 198 subjects (71 males and 127 females), reported having abstained from using alcohol or illicit drugs. Of the 843 participants in the study, 645 (76.51 per cent) had consumed alcohol at least once,

324 (38.43 per cent) had abused alcohol, 229 (27.17 per cent) had smoked cannabis at least once in their lives and 47 (5.57 per cent) had used ecstasy.

As shown in table 2, of the younger students (aged 14-16), 73.39 per cent had consumed alcohol at least once in their lives; in addition, alcohol abuse was common among the adolescents in the study and the proportion of cannabis users (21.24 per cent) was not significantly lower among the adolescents than among the older students. Of the younger students, 3.64 per cent reported that they had used ecstasy at least once in their lives.

Table 2. Alcohol, cannabis and ecstasy use among secondary-school students aged 14-16

Students	*Persons who abstained from alcohol and illicit drugs*	*Alcohol users*	*Alcohol abusers*	*Cannabis users*	*Ecstasy users*
Number	124	342	152	99	17
Proportion (percentage)	26.61	73.39	32.62	21.24	3.64

The age profiles of the students in the study who had abused alcohol and used cannabis and ecstasy are shown in figures I, II and III respectively.

Figure I. Alcohol abuse: age profile

(Percentage)

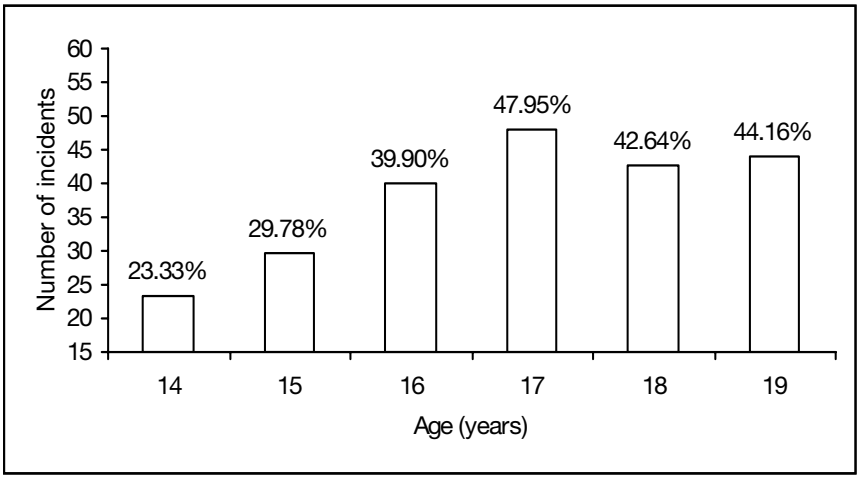

Figure II. Cannabis use: age profile

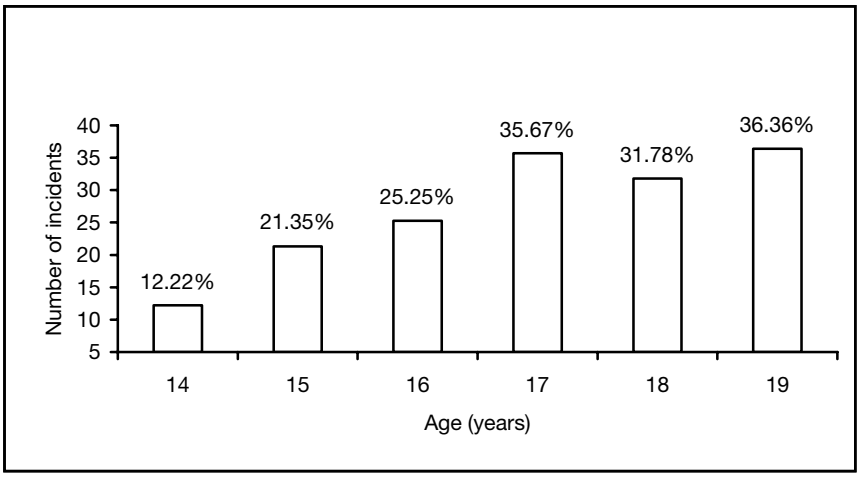

Figure III. Ecstasy use: age profile

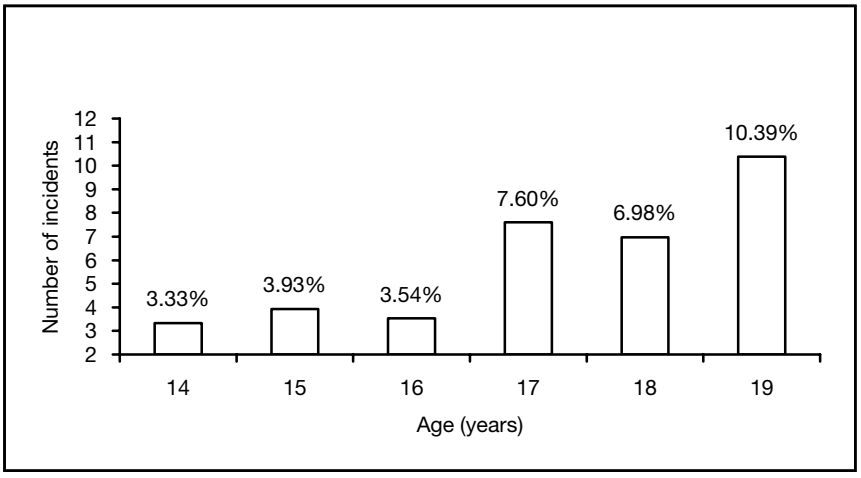

Table 3 shows the gender distribution of the students who had used alcohol, cannabis or ecstasy.

Table 3 shows that the majority of abstinent students were female and that there were more male than female alcohol users and abusers and ecstasy users. No gender-related differences were observed among the cannabis users.

The amount of alcohol consumed and the frequency of exposure to cannabis and ecstasy in the previous month are shown in table 4.

Table 3. Alcohol, cannabis and ecstasy use among male and female secondary-school students

Students	*Persons who abstained from alcohol and illicit drugs*	*Alcohol users*	*Alcohol abusers*	*Cannabis users*	*Ecstasy users*
Males	71	341	186	122	30
Proportion (percentage)	17.27	82.96	45.26	29.68	7.29
Females	127	304	138	107	17
Proportion (percentage)	29.39	70.37	32.94	24.77	3.94
Significance	—	P<0.05	P<0.005	—	P<0.05

Table 4. Amount of alcohol consumed and frequency of exposure to cannabis and ecstasy in the previous month

Students	*Alcohol use (drinks per month)*	*Cannabis use (exposures per month)*	*Ectasy use (exposures per month)*
Males	66.45 ± 3.5	13.92 ± 1.68	11.10 ± 0.6
Females	23.26 ± 2.1	8.16 ± 1.02	2.88 ± 0.3
Total	45.95 ± 2.5	13.20 ± 1.36	8.13 ± 0.4

Males showed a significantly higher amount of alcohol consumption, cannabis use and ecstasy use.

A total of 435 (51.60 per cent) of the participants admitted that they had been drunk at least once in their lives; 223 (54.12 per cent) were males and 212 (49.18 per cent) were females. The frequency of an episode of drunkenness was not significantly different between males and females. A total of 46 (5.45 per cent) of the participants (8.25 per cent of the males and 2.78 per cent of the females) reported having been drunk 20 times or more in their lives.

All but two of the subjects reported that they had used ecstasy and had also smoked cannabis and abused alcohol.

The perceived use of alcohol and illicit drugs among peers (shown as a percentage of classmates or friends) correlated significantly with the self-reported use of alcohol and illicit drugs (measured in terms of the number of exposures in the previous month), supporting construct validity. The correlation between the self-reported use of alcohol and illicit drugs and their perceived use among peers demonstrates that the questionnaires were not answered casually, since those students who used more alcohol or illicit drugs also tended to be more involved in peer groups using drugs.

The perceived use of alcohol and illicit drugs among peers (the estimated percentage of classmates or friends using them) correlated significantly with the self-reported use of alcohol and drugs (measured in terms of the number of alcoholic drinks that were consumed or number of exposures to drugs in the previous month):

Correlation	*Proportion of peers using alcohol (percentage)*	*Proportion of peers using cannabis (percentage)*	*Proportion of peers using ecstasy (percentage)*
Number of drinks or number of exposures to drugs in the previous month	p<0.001; r = 0.370	p<0.001; r = 0.369	p<0.001; r = 0.340

Note: p = significance; r = correlation.

The participants were divided into the following five groups, according to the extent to which they used substances (see table 5):

(*a*) Group 1: persons who abstained from alcohol and illicit drugs;

(*b*) Group 2: alcohol users;

(*c*) Group 3: alcohol abusers;

(*d*) Group 4: alcohol abusers who smoked cannabis;

(*e*) Group 5: alcohol abusers who smoked cannabis and used ecstasy.

Alcohol abusers were included in groups 3, 4 and 5 but illicit drugs were used by those in groups 4 and 5 only.

Table 5. Groups of students characterized by substance used, extent of use and gender

Item	*Persons who abstained from alcohol and illicit drugs*	*Alcohol users*	*Alcohol abusers*	*Cannabis users and alcohol abusers*	*Ecstasy users and alcohol abusers*
Number	198	321	95	182	47
Proportion of total sample (percentage)	23.48	38.08	11.26	21.59	5.57
Males (percentage)	17.23	37.62	15.53	22.33	7.28
Females (percentage)	29.40	38.51	7.19	20.88	3.93
Significance	p<0.05	—	p<0.01	—	p<0.05

The scores in psychometric areas (social coping and temperament-related aspects) obtained for the five groups are presented in tables 6 and 7.

Table 6. Scores obtained using Cloninger's Tridimensional Personality Questionnaire

	Persons who abstained from alcohol and illicit drugs	*Alcohol users*	*Alcohol abusers*	*Cannabis users*	*Ecstasy users*
Novelty-seeking	16.27 ± 0.35	16.54 ± 0.27	17.81 ± 0.44*	19.07 ± 0.38*	19.17 ± 0.77*
Harm-avoidance	18.62 ± 0.39	17.92 ± 0.30	16.43 ± 0.55*	16.79 ± 0.41*	17.06 ± 0.67
Reward-dependence	18.51 ± 0.28	18.60 ± 0.21	18.98 ± 0.37	19.02 ± 0.27	17.53 ± 0.48

Note: * = statistical significance $p<0.01$.

Table 7. Scores obtained using the Eysenck questionnaire

	Persons who abstained from alcohol and illicit drugs	*Alcohol users*	*Alcohol abusers*	*Cannabis users*	*Ecstasy users*
Introversion	8.41 ± 0.21	8.73 ± 0.18	8.87 ± 0.21	9.42 ± 0.20*	8.87 ± 0.40
Emotional instability	6.36 ± 0.23	6.29 ± 0.19	6.07 ± 0.36	6.54 ± 0.25	6.70 ± 0.43
Social coping impairment	2.92 ± 0.14	3.16 ± 0.11	4.22 ± 0.21*	4.38 ± 0.17*	5.53 ± 0.34*
Social desirability	6.86 ± 0.18	6.65 ± 0.14	5.96 ± 0.25	5.42 ± 0.19	5.55 ± 0.39

Note: * = statistical significance $p<0.01$.

The percentage of subjects living in rural (provincial) areas was higher among the alcohol users and abusers who did not use illicit drugs (group 2 (70.5 per cent) and group 3 (70.96 per cent)) than in other groups.

The assessment of the students' socio-economic group showed no significant variation among those who abstained from alcohol and illicit drugs, alcohol users, alcohol abusers and cannabis smokers. In contrast, among ecstasy users (group 5), there were more persons from higher socio-economic groups.

The evaluation of temperament-related aspects using Cloninger's Tridimensional Personality Questionnaire revealed significantly higher mean scores in the area of novelty-seeking among alcohol abusers and among cannabis and ecstasy users than among abstinent subjects. The proneness to seek sensations of high emotional impact was found to be associated with alcohol abuse and cannabis and ecstasy use. The tendency to be novelty-seeking was progressively higher in groups 4, 5 and 6 compared with groups 1 and 2. Novelty-seeking, being an inherited psychological and behavioural condition, was not attributable to the effects of substance abuse, being regarded instead as a pre-existing condition.

Among alcohol abusers and cannabis users, significantly lower scores (compared with the scores of students who abstained from alcohol and illicit drugs)

obtained using the Tridimensional Personality Questionnaire in the area of harm-avoidance were associated with high novelty-seeking. The unexpectedly moderate scores in the area of harm-avoidance among ecstasy users suggest the need for further study in order to better understand the relationship between temperament and addiction.

The evaluation of social coping impairment using the Eysenck questionnaire showed significantly higher mean scores for alcohol abusers, cannabis users and ecstasy users, compared with the scores of students who abstained from alcohol and illicit drugs and the scores of alcohol users. Subjects who had used illicit drugs showed more difficulties in coping with intimate relationships and had poor social skills. Results of the Eysenck questionnaire revealed poor adaptation to social relationships and showed that subjects who abused alcohol and used illicit drugs, particularly ecstasy, had more social problems.

Scores in the area of introversion obtained using the Eysenck questionnaire were higher for cannabis users than for students who abstained from alcohol and illicit drugs and for alcohol users.

It is likely that social coping impairment existed prior to substance abuse but this was not conclusively demonstrated by the present study.

The Pearson correlation did not reveal any significant relationship between the number of exposures to alcohol, cannabis and ecstasy and the scores obtained using Cloninger's Tridimensional Personality Questionnaire. Social coping impairment was directly correlated with both the number of drinks of spirits and wine. No other correlation was shown between Eysenck's psychometric measures and the extent of exposure to illicit drugs.

Discussion

Key findings

The results of the study reveal that the use and abuse of alcohol is widespread and that the use of cannabis and ecstasy is common among secondary-school students in the area of Parma, Italy. The use of psychoactive drugs and alcohol seems to take place extremely early in life, as shown by the proportion of 14-year-old users in the sample, suggesting that such activity may occur for some adolescents even earlier, at the age of 12 or 13.

Males who have used and abused alcohol and used ecstasy outnumber females. In contrast, no significant gender-related differences were observed among cannabis users. Exposure to psychoactive drugs and alcohol was more common among males.

Cannabis and ecstasy use, reported only by students who abused alcohol, indicates that alcohol abuse acts as a gateway for the use of illicit drugs.

The significant relationship between behavioural and psychometric findings and the amount of substance use taking place (including the use of multiple drugs,

polydrug abuse and the number of exposures) indicates that better understanding and monitoring of secondary-school students' lifestyles, psychological traits, performance at school, transgressive behaviour and social coping ability could be used to enhance primary and secondary prevention strategies.

Alcohol use and abuse

The findings show that most of the students (76.51 per cent) consumed alcohol at least once before and a number (38.43 per cent) abused alcohol. Consistent with previous surveys in Italy and other European countries, there was a preponderance of male subjects among alcohol users and abusers [12, 32]. The amount of alcohol consumed in the previous month was also higher for male subjects.

Although it is difficult to compare the results of a local study with those of a national survey, the data indicate that there is an increase in the use of alcohol, consistent with the European Schools Project on Alcohol and other Drugs Study of 1995 [12]. In 1995, the frequency of alcohol consumption (10 times or more in the previous 30 days) among students of the same age was 18 per cent for males and 5 per cent for females. In the present study, the proportion of subjects who reported having consumed alcohol 10 times or more in the previous 30 days was 24.55 per cent for males and 9.04 per cent for females.

The high proportion of subjects who consumed alcohol among the younger students (14-16 years old) suggests that contact with alcoholic beverages occurs in Italy at an early age and frequently, despite the fact that it is prohibited by law to sell alcohol to adolescents under 16 years of age. In Switzerland, a study on the early use of alcohol among children 10-17 years old revealed that 28 per cent of those children had used alcohol at least once in their lives [33].

Although the extent of alcohol abuse seems to have increased, the number of participants who said they had been drunk 20 times or more in their lives (8.25 per cent of males and 2.78 per cent of females) was less consistent. "Controlled abuse" of alcohol seems to prevail among the majority of the students in the study conducted in Italy, who showed a low rate of episodes of uncontrolled drinking ("binging") and drunkenness. Wine, the preferred alcoholic beverage in the sample studied, is associated with less frequent drunkenness and "binging" episodes. That confirms the view that wine, if consumed without other alcohol, is the beverage of moderation. The evidence indicates that those who drink beer, spirits, or those beverages and wine are not only heavier drinkers but are probably more rebellious and deviant [34].

The high prevalence of drunkenness among males compared with females suggests that the compulsive use of alcohol is associated with the male gender. A survey of university students in Scotland revealed that a slightly higher percentage of female students consumed alcohol compared with male students, but that the males consumed significantly more drinks per week [35].

The proportion of subjects who smoked cannabis but who did not abuse alcohol and the very small number of students who used ecstasy but not cannabis and alcohol suggest that the availability of illicit drugs and the likelihood of an addiction developing increase among alcohol abusers: the subjects who abstained from alcohol and illicit drugs and the subjects who used alcohol but did not abuse it showed the same low level of risk for cannabis and ecstasy use.

It is not possible to give a definitive explanation for the link between alcohol abuse and illicit drug use: on the one hand, cultural, psychological and psychobiological factors existing prior to the subject's abuse of substances could support the close relationship [23, 36-40]; on the other hand, self-medication (self-treatment) of alcohol-induced psychological and behavioural changes may be related to increased use of other psychoactive substances [41-44]. However, the results of the present study support efforts made to develop illicit drug prevention strategies that target alcohol abusers as a high-risk group. The results also support the development of prevention strategies that include both licit drugs (such as ethanol) and illicit drugs. Consistent with the results of the present study, early nicotine addiction and alcohol abuse were found in other studies to be predictive of other drug use in adults [45, 46].

The extent to which alcohol abuse occurred at an early age (at age 14) among the subjects in the present study should be regarded by public health authorities as a particularly alarming development because of the link between alcohol-correlated pathologies and the possible harm to psychological and behavioural development during adolescence.

Cannabis use

More than 25 per cent of the students in the sample reported having used cannabis. In studies conducted in Italy in 1995 (self-reported unpublished data), 19-20 per cent of secondary-school students reported having used cannabis. No significant gender-related differences were found in the proportion of subjects who had smoked cannabis at least once in their lives. In contrast, the analysis of cannabis exposure demonstrated a significantly higher prevalence of cannabis use among male subjects, suggesting that cannabis is used by most females in low doses in a recreational context, and by males in high doses, indicating that males tended to be more dependent on cannabis.

Using cannabis at an early age, as did more than 20 per cent of the participants aged 14-16 years, may increase the risk of heroin and cocaine addiction in that age group, as demonstrated in a previous study [1].

The media and public opinion have contributed to a broad misunderstanding of the issue of the spread of cannabis use among students in Italy, resulting in an underestimation of the risks of cannabis use. Although the sample of cannabis users included students who had smoked at least once in their lives, previous studies of students' experimentation with cannabis have found that almost 40 per cent of the subjects who had tried cannabis became continued users of it [47].

Ecstasy use

The findings of the present study show that 5.57 per cent of the students in the study reported having used ecstasy. That implies widespread use of amphetamine derivatives among secondary-school students in Italy. Self-reported data in this field did not distinguish ecstasy from other amphetamine derivatives available in tablet form on the illicit market. Students described ecstasy as the stimulants sold in tablet form as MDMA. Both the proportion of MDMA users and the extent of MDMA exposure was greater among males than among females. The entactogen, energizing and psychedelic effects of ecstasy seemed to be more attractive to males than to females; the latter were found to take such tablets also for their effect on body weight [48-50]. The age of onset of ecstasy use was 16-17 years for most of the subjects. Some male subjects, however, had experimented with ecstasy at the age of 14.

Other studies conducted in the north of Italy in 1998 showed higher numbers of ecstasy users: 7.00 per cent in Padua and 8.7 per cent in Milan. Those data cannot be easily compared with the present findings, however, because the selection of participants was different [51].

Psychological and behavioural features of student subtypes

Previous studies comparing students in rural and in urban areas found that the former showed a higher prevalence for alcohol use (particularly excessive use) [52, 53]. The present study showed that alcohol use and abuse were more consistent among students in rural areas than among students living in urban areas.

Conflicting data have been reported with regard to the relationship between habits involving alcohol use, substance abuse and socio-economic status. A Swedish survey suggested that special attention in the form of work to prevent alcohol abuse should be given to young people in lower socio-economic groups [54]. A positive relationship between income level and high alcohol intake was shown in other studies [55]. The results of the present study do not show any relationship between alcohol use (and abuse) or cannabis use and the socio-economic status of the family. High socio-economic status was significantly more prevalent among the ecstasy users than among the other groups, suggesting that amphetamine derivatives were the drug of choice of a segment of society having more stable social integration, money available and preferences for certain stimulants.

Underachievement and failure at school have been frequently associated with alcohol and substance abuse. Other studies have found that drug use is significantly higher in young people who are school dropouts than in those who stay in school [56] and that a student's level of academic performance contributes to the likelihood of him or her using gateway drugs [57].

The possible causal relationship between failure at school and substance abuse is still unclear: on the one hand, the effects of cannabis and alcohol include cognitive deficit and memory dysfunction that could impair performance at school [58, 59]; on the other hand, students with conditions associated with failure at school that

exist prior to substance abuse, such as low self-esteem, may be more at risk of taking drugs [4, 60, 61]. The data show a close association between difficulties at school, few homework hours and low school achievement among illicit drug users; ecstasy users, in particular, reported failure at school.

There is evidence of the protective role of involvement in social institutions, local community groups and volunteer associations [4]. In the present study, about 10 per cent of the students who abstained from alcohol and illicit drugs were involved in volunteer social activities; significantly fewer students that reported alcohol abuse and cannabis and ecstasy use were involved in such activities.

Unexpectedly, about 40 per cent of the students using marijuana and about 60 per cent of those using tablets reported that they used those substances when they were alone (that is, not together with their peers). Such a pattern of substance abuse could indicate a strategy of self-medication [43, 62] associated with social exposure anxiety, rather than a ritualized social behaviour. Discotheques and rave parties appear to be the main settings in which ecstasy was used, according to the self-reported data. Such settings are probably preferred subconsciously, because of the effect of fast music, which has been found to be able to influence brain monoamine release [63].

A variety of studies investigating risk factors for alcohol abuse, childhood hyperactivity and antisocial personality traits showed that deviant behaviour in childhood and early adolescence was linked to alcohol abuse [64]. Earlier studies showed that diagnoses of current conduct disorder were reported in 82.1 per cent of cannabis users [65] and that ecstasy users exhibited elevated impulsiveness in both self-reported data and behavioural studies [66]. Similarly, the present data demonstrated a low mean rate of transgressive behaviour among students who abstained from alcohol and illicit drugs and among alcohol users, a high rate among alcohol abusers and illicit drug users and a particularly high rate among ecstasy users, consistent with the results of previous studies that suggested aggressiveness was a risk factor existing prior to substance abuse [67].

It has been suggested that a close link exists between sensation-seeking and drug use [68]. The different dimensions of sensation-seeking were identified as strong predictors of future drug use: “disinhibition” was a common factor in drug use for both sexes. In males, a response of “thrill- and adventure-seeking” indicated moderate alcohol consumption and a response of “experience-seeking” indicated cannabis use [69]. In addition, a novelty-seeking temperament has been reported to be a predictive factor for substance abuse in other studies [22-24]. Similarly, for participants in the present study who used illicit drugs and abused alcohol, higher mean scores in the area of novelty-seeking were obtained using Cloninger’s Tridimensional Personality Questionnaire.

Previous studies showed that cannabis and ecstasy users tend to exhibit depressive traits [70, 71] and that alcohol abusers tend to be less extroverted [72]. Such findings may be connected with the significant impairment in social coping, according to the Eysenck scale, that was shown among participants of the present study who used illicit drugs and abused alcohol.

The lack of statistical correlation between psychometric changes and the reported extent of exposure to alcohol and drugs, apart from the relationship between social coping measures and the consumption of alcohol, suggests that underlying the effects of substance abuse, including psychiatric disorders, high novelty-seeking, low harm-avoidance, social coping deficit and social undesirability, may be a complex premorbid disorder associated with substance abuse but not completely due to substance abuse [71, 73-75].

In conclusion, the present study suggests that high numbers of adolescents are exposed to alcohol and illicit drugs while in secondary school, that the risk of cannabis and ecstasy use is associated with alcohol abuse and is rarely evident in subjects who abstain from alcohol. Transgressive behaviour and lower school achievement, a proneness to seek new and intense emotional experiences and to exhibit risk-taking behaviour, poor social skills and inconsistency in coping with interpersonal relationships have been found to correlate with a tendency to experiment with drugs and abuse alcohol.

The present findings, although preliminary and obtained from a limited sample, indicate the need for specific early intervention that targets children and adolescents whose performance at school is poor, whose behaviour is disruptive, whose temperament tends to be novelty-seeking and who are maladjusted socially. The aim is to prevent substance abuse and the use of gateway drugs among young adults. In addition, the different psycho-behavioural features of student subtypes, characterized by an increase in substance use, suggest that secondary prevention strategies can be enhanced if the appropriate methodologies are used.

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Drug characterization/impurity profiling, with special focus on methamphetamine: recent work of the United Nations International Drug Control Programme

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ABSTRACT

In view of the increase in the manufacture of, trafficking in and abuse of synthetic drugs around the world, as well as the increasing involvement of organized criminal groups, there is an urgent need to identify the extent of such activity, the supply sources, the trafficking routes and the distribution patterns. Drug characterization/ impurity profiling are scientific tools used to support regular operational and intelligence work in this area by law enforcement authorities. Impurity profiling, the analysis of the various impurities in clandestinely manufactured drugs, by type and quantity, is not a routine technique. In order to provide more information on a seized drug sample than that obtained by using normal chemical analysis, and to identify any links between two samples of seized drugs, experienced chemists and dedicated equipment are required. In addition, close cooperation between forensic laboratories and law enforcement authorities is essential if all relevant information on links is to be followed up effectively. The present paper provides a brief introduction to drug characterization/and impurity profiling, focusing on activities and findings of the methamphetamine impurity profiling programme currently being carried out by the Scientific Section of the United Nations International Drug Control Programme.*

Introduction

The continuing demand for illicit drugs has led, in the last two decades, to the proliferation of clandestine laboratories synthesizing a wide variety of drugs of abuse in an increasing number of countries. Advances in chemical knowledge and technology, the increased availability of basic chemicals, precursors and equipment,

*Much of the work undertaken as part of the methamphetamine impurity profiling programme has been supported financially by the Government of Japan. The authors wish to acknowledge the technical assistance of B. Reiter in sample analysis under the impurity profiling programme.

and easier access to literature on the subject, including underground literature, have contributed to that development. As larger and larger consignments of clandestinely manufactured synthetic drugs are being intercepted in some regions of the world, law enforcement authorities require enhanced capacity to identify the supply sources of such drugs, the drug trafficking routes used, the distribution patterns followed and any links between samples of seized drugs. Drug characterization/impurity profiling, that is, the systematic characterization of seized drug samples by physical and chemical means, are valuable scientific tools used to support intelligence-gathering and operational work by law enforcement authorities.

Throughout the world, characterization and impurity profiling of seized drugs are increasingly being used to complement routine investigative work by law enforcement authorities. Chemical links between samples may be established, material from different seizures may be classified into groups of related samples and the origin of samples may be identified. That information may be used for evidential purposes or it may be used as a source of more general intelligence to identify drug trafficking patterns and distribution networks. Drug characterization/ impurity profiling may also assist in identifying output from new illicit drug manufacturing laboratories and in monitoring methods commonly used in illicit drug manufacture, which, in turn, may provide information that is helpful to other intelligence-gathering units or regulatory authorities, for instance in programmes for monitoring precursors. Finally, drug characterization may provide supportive evidence in cases where there is a need to differentiate illicitly manufactured drugs from those diverted from licit sources.

Recognizing the need for a cohesive international strategy in this area, the Commission on Narcotic Drugs, in its resolution 1 (XXXIX) of 24 April 1996, requested the Executive Director of the United Nations International Drug Control Programme (UNDCP) to develop standard methods for the profiling/signature analysis of key narcotic drugs and psychotropic substances. Since the adoption of that resolution, activities initiated by the Scientific Section of UNDCP have been aimed at developing methods for the characterization and impurity profiling of such substances, at supporting basic research to assist in the interpretation of analytical results and at contributing to the development of operational capacity, at the national and regional levels, in drug and precursor characterization and impurity profiling. Those activities also contribute to the development of greater intelligence capability, which in turn improves the capacity of UNDCP to estimate and forecast the drug problem.

Pursuant to Commission on Narcotic Drugs resolution 1 (XXXIX) and the Action Plan against Illicit Manufacture, Trafficking and Abuse of Amphetamine-type Stimulants and Their Precursors, adopted by the General Assembly at its twentieth special session (Assembly resolution S-20/4 A of 10 June 1998), UNDCP activities have focused on methamphetamine and its main precursor, ephedrine, above all in south-east Asia, which has been particularly affected by the clandestine manufacture of, trafficking in, and abuse of that drug in recent years.

The current involvement of UNDCP in drug characterization/impurity profiling is not new. Pursuant to Economic and Social Council resolutions 159 II C (VII) of 3 August 1948 and 246 F (IX) of 3 August 1949, an international programme for

opium research was initiated as a result of concerns about the prevailing global situation with regard to the availability of opium and the multiplicity of source countries. The programme was aimed at developing methods for determining the origin of opium by chemical and physical means. The adoption by the Council of its resolution 548 D (XVIII) of 12 July 1954 led to the creation of the United Nations narcotics laboratory, the predecessor of the Scientific Section of UNDCP. A total of 148 research papers, published over a period of 16 years under the serial heading "The assay, characterization, composition and origin of opium", summarize the results of that first comprehensive research programme on the subject carried out under the aegis of the United Nations. The development of methods for the characterization of opium was discontinued in the late 1960s, when efforts began to focus on heroin, which was being increasingly abused.

Drug characterization/impurity profiling*

For synthetic drugs, practical experience has shown that the impurity profiles of the products from a given illicit laboratory are characteristic. Provided that there is no change in the method or the conditions of drug synthesis, variations in the impurity content of drugs synthesized at different times by the same chemist in a clandestine laboratory are believed to be relatively small. Consequently, based on their chemical characteristics, samples of seized drugs can be classified into groups identified by their chemical impurity profiles, and a given sample or group of samples may be associated with an individual chemist or laboratory operating clandestinely. It is thus possible to link together illicit drug consignments from the same source and to build up a database of related drug samples over a period of time. Moreover, the presence of some characteristic cutting agents may indicate the involvement of certain illicit drug manufacturing or trafficking organizations. While such chemical profiling information may not help to identify the origin of a synthetic drug sample (that is, the location of the illicit drug laboratory), it may be used to link samples from a series of manufacturing batches** to a single chemist or laboratory and to identify the source of supply or distribution.

Similarly, starting materials used in illicit drug manufacture may also contain certain characteristic impurities. The impurity content and the type of impurities may vary depending on the nature of the starting material, on whether a precursor chemical was diverted from legitimate sources or was itself manufactured clandestinely. The identification of characteristic impurities (or impurity patterns) in precursors may therefore help to link them to a commercial or clandestine source. In addition, knowledge about the presence of certain impurities in starting materials may also help to link finished products to those starting materials, and ultimately to the source of such materials.

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*In a manual available from UNDCP, entitled *Drug Characterization/Impurity Profiling: Background and Concepts* (ST/NAR/32), more detailed information is provided on the characterization and impurity profiling of both plant-based and synthetic drugs.

**Drugs manufactured in a single synthesis (that is, in the same process) are referred to as a "batch".

Operational value to law enforcement investigations

From an investigative point of view, drug characterization may be carried out either for evidential purposes or for intelligence purposes: it may be used to help to confirm a connection between two or more samples in, for example, illicit drug supply cases for prosecution purposes; or it may be used to provide more general intelligence, for example, to identify local, regional or international distribution networks and sources of illicit drug supply, in support of law enforcement investigations. In particular, it may help: *(a)* to establish specific links between two or more samples of seized drugs; *(b)* to classify material from different drug seizures into groups of related samples, thus building up distribution networks; and *(c)* to identify the source of a sample of seized drugs. Such information may be used for evidential purposes or as a source of intelligence, to identify samples that have a common history. A fourth purpose of drug characterization is to monitor illicit drug manufacturing methods and the chemicals used.

Thus, depending on the nature of the drug sample investigated, the information generated through drug characterization may be used to identify from where, how and to what extent a drug has been distributed. It may be used to provide intelligence on the number of sources of the drug (for example, on whether or not those sources are within a country) and on the drug distribution network (for example, on the points of distribution). Information obtained from drug characterization may also be used to estimate how long a particular clandestine laboratory has been operating and to assess the scale or output of an illicit drug operation. At the national and international levels, the examination of drug samples may provide valuable information on new or established drug trafficking routes and distribution patterns.

The role of the drug analyst

In recognizing the potential contribution of drug characterization/impurity profiling to the operational work of law enforcement authorities, it is important to recognize the role of the drug analyst. Irrespective of the equipment and software available in a laboratory carrying out the impurity profiling, the results have to be interpreted carefully by an experienced analyst, especially if they are to be presented in court.

Several factors may complicate the establishment of links between drug samples. One such factor, independent of source or distribution, is the possibility of a change occurring in the impurity content of a drug sample as the main drug and/or its accompanying impurities decompose. Such a change (sometimes referred to as the “ageing” of a drug sample) may occur as a result of the conditions to which the sample is subjected, in particular exposure to light, heat and/or air. Thus, a chemical comparison of drug samples related by source yet exposed to different environments during the supply chain could suggest that the samples are not linked. In a similar way, certain aggressive cutting agents, such as ascorbic acid, may alter the composition of a drug sample over time; thus, a chemical comparison of older samples may not provide any useful information to help link the samples together.

The analyst should take such considerations into account when interpreting and communicating the findings of drug characterization/impurity profiling to law

enforcement authorities. Moreover, in order to draw correct conclusions from the comparison of chemical impurity profiles of different drug samples, it is necessary to assess the quality of the chemical link between the samples. The "strength of evidence" of results is determined by two factors: *(a)* the closeness of the correlation of two or more impurity profiles; and *(b)* the frequency of the particular profile pattern. An unusual profile pattern, that is, a profile that is not frequently encountered, or the presence of unusual individual components in the profile may increase the strength of evidence. For example, the presence of unusual cutting agents may provide a critical source of information to help link samples and may provide evidence of direct (immediate) links in conspiracy or dealer/user cases. The overall strength of evidence may be further improved by combining information from chemical profiling with information from other investigative approaches (such as information provided by examining the packaging materials).

While, in some cases, visual (physical) examination of samples may provide additional evidence of a direct link between the samples, it is important to recognize that physical characteristics of tableted drugs (tablet markings ("logos"), shape, dimensions, weight) do not necessarily bear any relation to the location where the drug material (powder) was manufactured. Similarities in the physical characteristics of samples of seized tablets simply suggest a relationship at the level of the tableting laboratory; the drug powders themselves may be from different sources. Conversely, different physical characteristics do not necessarily mean that there is no relationship between the two samples; drug powders manufactured at the same time in the same laboratory may be tableted at different times using different moulds or different tableting machines.

Limitations

The key to successful programmes for drug characterization/and impurity profiling is cooperation, at all levels, and across borders. Considering the number of authorities, at the national and regional levels, involved in the control of illicit drug manufacture and trafficking, political commitment is essential.

Frequently identified obstacles to increasing the use of programmes for drug characterization/impurity profiling at the operational level include the following: lack of authentic samples (i.e. samples where information on the source of manufacture or details of the synthesis route are available); lack of an appropriate mechanism, or even legislation, for the timely exchange of seized samples and relevant information; and a lack of understanding of the purpose, needs, possibilities and limitations of drug characterization/impurity profiling, resulting in a lack of collaboration and feedback between laboratories and law enforcement authorities. Critical areas from the point of view of the drug analyst include: *(a)* knowledge about clandestine manufacturing methods; *(b)* handling of samples and sampling for analysis; *(c)* procedures for the extraction and preparation of samples; *(d)* analytical procedure; *(e)* data evaluation; *(f)* use of intelligence; *(g)* training; and *(h)* international cooperation. Government agencies need to address all these areas when developing a programme using drug characterization/impurity profiling as operational tools.

The role of the United Nations International Drug Control Programme

Activities of the Scientific Section of UNDCP in the area of drug characterization/impurity profiling are designed:

(*a*) To encourage and assist target countries in their efforts to embark on impurity profiling activities, in order to enhance activities aimed at gathering operational intelligence related to trends in drug and precursor trafficking;

(*b*) To promote the training of personnel involved in carrying out and utilizing impurity profiling, including law enforcement officers, intelligence and regulatory personnel, laboratory managers and analysts;

(*c*) To encourage cooperation, at the local, regional and international levels, in the area of drug impurity profiling, including the development of a network of laboratories to collect and share information derived from the chemical analysis of seized drugs;

(*d*) To develop and disseminate analytical methods for the characterization and impurity profiling of seized drugs and their precursors, to be applied at the national level, including manuals explaining the operational value;

(*e*) To enable the Scientific Section to serve as a reference centre for methamphetamine characterization and impurity profiling.

UNDCP will continue to carry out background work and make the findings of its work available, so that national laboratories with limited resources may build upon those findings. Specific activities include the collation of information on known manufacturing methods, the precursors and chemicals used, alternative precursors and chemicals, and the routes used for the synthesis of the precursors. Activities also include the collection, as well as the distribution to interested national laboratories, of the following: relevant articles from scientific literature; drug samples seized in different parts of the world; key starting materials from different sources; and reference samples of key impurities and analytical data on them. Finally, activities also include: experimental work and applied, scientific research on, for example, selected synthesis routes used in clandestine laboratories; research on the impurities of key starting materials; and research on the impact of certain cutting agents on impurity profiles. All of the above-mentioned activities are aimed at providing a practical basis that could be used as a starting point for meeting the requirements of individual countries that are establishing operational drug profiling programmes.

UNDCP acts primarily as a facilitator and catalyst. All activities are carried out in close collaboration with scientists from national forensic laboratories already engaged in programmes in the area of drug characterization/impurity profiling.

Clandestinely manufactured methamphetamine: manufacturing routes and impurities

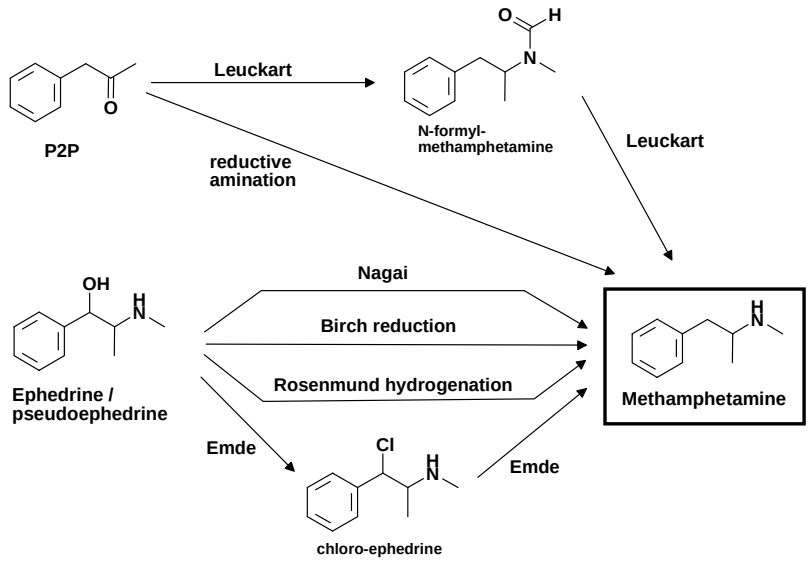
The reasons for the presence of trace impurities in clandestinely manufactured drugs are manifold: impurities may be generated *de novo*, as by-products during drug manufacture; they may already be present in the starting materials, reagents and/or solvents and may be carried over unchanged to the final product; or they may

arise from reactions of original impurities present in starting materials. One complication may be the presence of impurities that are unrelated to drug manufacture, such as inadvertent, external contamination, the deliberate addition of small quantities of certain substances to improve the "quality" or "saleability" of the end-product (for example, the addition of flavouring agents) and the introduction of impurities through contaminated cutting agents.

In order to be able to assess the significance of the presence or absence of an impurity in the end-product, and to draw correct conclusions from similarities and differences in impurity profiles, it is crucial to understand the chemistry of illicit drug manufacturing processes, in particular, the generation and stability of impurities, the significance of individual impurities for a given synthesis route, and the extent of possible variation in impurity profiles of drugs synthesized via the same route. This information may be obtained by carrying out a detailed chemical analysis of samples of known manufacturing origin. In the absence of such authenticated samples, the link between synthesis routes and attendant impurities may be established through a series of controlled laboratory experiments on different synthesis routes used in clandestine drug manufacturing laboratories.

Methamphetamine can be manufactured by a number of synthesis routes. Figure I shows the six most frequently encountered routes used in the clandestine manufacture of methamphetamine. Two major groups of synthesis can be distinguished: *(a)* syntheses starting from 1-phenyl-2-propanone (P-2-P) and yielding racemic methamphetamine, such as the Leuckart route and reductive amination; and *(b)* synthesis routes using optically pure *l*-ephedrine or *d*-pseudoephedrine as starting materials, thus yielding the more potent *d*-methamphetamine. The latter include the Nagai route, Birch reduction, Rosenmund hydrogenation, and the Emde route with chloro-ephedrine as intermediate

Figure I. Most common synthesis routes of clandestinely manufactured methamphetamine



Only a few systematic scientific studies of samples of methamphetamine synthesized in controlled laboratory experiments have been published. There have been even fewer studies investigating how modification of the synthesis method may induce specific impurities, and the impact of small changes in the experimental conditions on the impurity pattern. Experience shows, however, that minor changes in synthesis can have a major impact on the formation of by-products, and thus on the complexity of the impurity profile. Parameters expected to have an impact on the impurity profile of the final product include: *(a)* the reaction temperature; *(b)* the reaction time; *(c)* the scale of reaction and the proportions of the initial chemicals; and *(d)* the extent and means of purification of intermediates and end-products [1].

It is difficult to duplicate clandestine manufacturing methods in laboratory studies. The reasons for this include: *(a)* the unavailability of authentic underground recipes;* *(b)* the fact that the scale of reactions in controlled laboratory experiments is smaller than that used in clandestine laboratories; and *(c)* the need to take safety precautions in legitimate laboratories [2] (chemists working in clandestine laboratories normally do not take any such precautions and are not concerned about the environmental impact of their activities).

In order to be able to assess the variability in impurity profiles generated during the synthesis of methamphetamine, UNDCP has carried out a limited number of laboratory experiments focusing on the most frequently encountered synthesis routes. Results from these "model syntheses" carried out under controlled laboratory conditions confirm a number of published findings [1, 2], and allow the following general conclusions to be drawn:

(*a*) The relative similarity of the profiles obtained from a series of experiments using the same synthesis route may vary from one route to another;

(*b*) There may be differences in the impurity profiles of products obtained from model syntheses carried out by using the same route but slightly modifying the recipes;

(*c*) Even when samples are synthesized under controlled conditions in the same laboratory using the same recipe, batches with identical profiles are difficult to reproduce;

(*d*) There are no significant differences in yield by most synthesis routes;

(*e*) The impact of purification on the impurity profile depends on the synthesis route and varies from one impurity to another;

(*f*) Purification of the crude base product by distillation significantly reduces the total intensity of the impurity profile; and the impact of purification of the hydrochloride end-product is also considerable and may even result in the removal of impurities, which are described in the literature as "route-specific";**

*"Synthesis route", "synthesis method" ("recipe", "modification") and "batch" are used in the following manner: "synthesis routes" are the major ways of synthesizing methamphetamine (Leuckart route, Nagai route, Emde route etc.); a "synthesis method" is a particular modification of a synthesis route that follows a specific "recipe" describing the ratios of reagents and details of the reaction conditions (temperature, duration of the reaction etc.); and drugs manufactured in a single synthesis, that is, in the same process, are referred to as a "batch".

**"Route-specific" means unique to a single synthesis route.

(*g*) Re-use of the crystallization solvent (that is, the "mother" liquor) considerably increases the total profile intensity but does not have a significant impact on the pattern of the impurity profile.

A review of the literature suggests the existence of certain "route-specific" impurities. Practical experience in the analysis of samples, however, shows that, for most synthesis routes, such "marker impurities" do not exist and there is some overlap between the impurities generated by different routes. Therefore, rather than individual "marker impurities", it is the pattern of impurities and their intensity ratios in the impurity profile that seem to be characteristic of individual synthesis routes and different recipes.

Methamphetamine characterization and impurity profiling: results and observations

Chemical characteristics (impurity profiles)

A selection of impurity profiles of seized methamphetamine is shown in figure II.

As can be seen, there are significant differences between impurity profiles. A comparison of the profiles of samples of seized methamphetamine with those from samples synthesized under controlled laboratory conditions revealed that the majority of samples examined appear to have been synthesized with ephedrine as the starting material. While samples from the Czech Republic and the United States of America seem to have been synthesized via different modifications of the Nagai route, some samples from east Asia and most samples from south-east Asia showed characteristics of the Emde route of synthesis (see figure III). In contrast, samples from Sweden are suspected to have been manufactured from P-2-P via the Leuckart route.

Because the work of UNDCP has focused on south-east Asia and because of the nature of samples from that subregion, detailed analytical investigations have concentrated on the Emde route. The distinctive feature in the impurity profile of methamphetamine synthesized via this route is a characteristic group of impurities at relatively high retention times (20-24 minutes) (see figure III). In terms of analytical findings, a number of those impurities have been characterized by their mass spectra and their molecular weights determined using gas chromatography-mass spectrometry with chemical ionization. None of the mass spectra have been found in the literature or in common mass spectral libraries.

Amongst the samples of seized methamphetamine assumed to have been synthesized via the Emde route, differences in the impurity profiles were apparent. For example, a particular subgroup of samples was characterized by the presence of relatively large quantities of a substance identified as methamphetamine dimer (see figure III). Other subgroups could also be identified. The appearance of such distinct subgroups within samples may be attributed to modifications in the synthesis route. However, further work will be required to confirm this and to correlate specific reaction conditions with a particular pattern of impurities.

Figure II. Impurity profiles of samples of methamphetamine seized in different countries (1 = methamphetamine, 2 = ephedrine, 3 = caffeine, IS = internal standard)

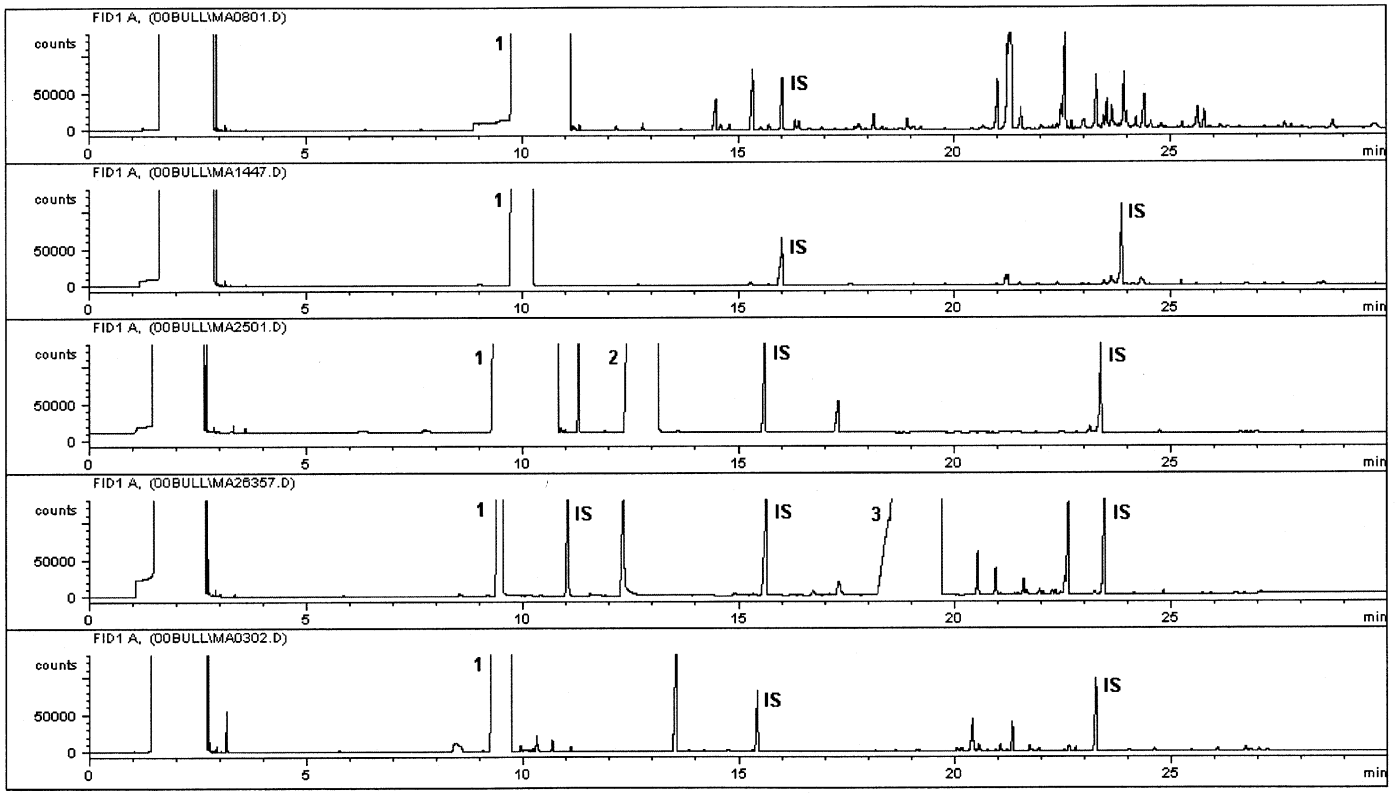
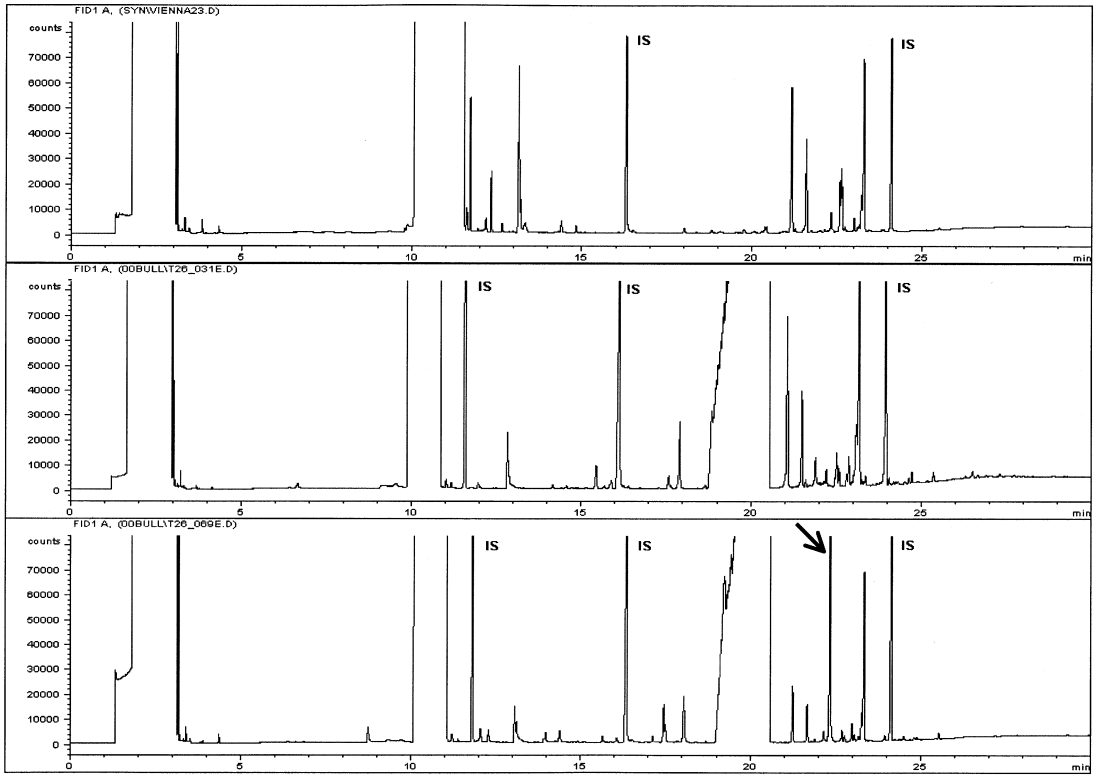


Figure III. Impurity profiles of methamphetamine samples: a sample synthesized under controlled laboratory conditions via the Emde route (top) and two samples of seizures made in south-east Asia (middle and bottom) (IS = internal standard)



Note: The arrow indicates an impurity identified as methamphetamine dimer, which is characteristic of a particular subgroup of the samples examined.

Apart from synthetic impurities, the impurity profiles of some methamphetamine samples from south-east Asia also showed the presence of traces of *N*-acetylcodeine, 6-monoacetylmorphine (6-MAM) and, sometimes, codeine (see figure IV). This finding strongly supports the assumption that the illicit manufacture of methamphetamine and the refining of heroin sometimes took place at the same location (i.e. that illicit heroin manufacturers might be increasingly manufacturing synthetic stimulants as well).

In terms of drug content, the typical (modal) content of methamphetamine hydrochloride in tablets from south-east Asia ranged between 25 mg and 30 mg. This converted to a purity of approximately 30 per cent relative to tablet weight. Caffeine was present in the majority of tablets, usually also in concentrations of approximately 30 per cent of tablet weight. In some samples, the presence of large amounts of ephedrine suggested that that substance, rather than representing unreacted starting material, had been added as an adulterant. The total content of extractable impurities (excluding caffeine and ephedrine) was usually less than 0.5 per cent.

Physical characteristics

In addition to findings from chemical impurity profiling, physical characterization of samples of seized drugs may provide valuable information in support of the operational work of law enforcement authorities. For synthetic drugs, this applies in particular to drugs in tablet form, where comparing, for example, their colours, logos, shapes, dimensions and weights can help to link them to a distribution network, a single source of production and, in some cases (by examining the defects or marks on the tablet surfaces), to the actual equipment used for tableting. A combination of the findings from both chemical and physical examinations is critical to the drawing of meaningful conclusions.

Since the majority of the samples from south-east Asia were tablets, their physical characteristics were examined. They were found to differ widely. Although the UNDCP collection of tablets is far from comprehensive and other, more extensive collections exist, it was possible to make the observations presented below.

In terms of logos, at least five types containing the letters “wy” were encountered among the tablets that were examined. Tablets with the two letters separated (not touching each other) and with an elongated letter “y” constituted the most common variant. Within that group, there were subgroups that could be identified by the size of the two letters, the length of the outer and inner lines of the letter “w”, the length and bend of the tail of the letter “y” and the width of individual lines of the impression. The first samples examined bearing the letters “wy”, currently by far the most frequently encountered logo on tablets from south-east Asia, were reported to have been from tablets seized in 1995. Samples of tablets seized before that date had a much larger variety of logos; the logo “99” was common.*

*In order to be able to analyse trends for intelligence purposes, it is essential to establish and maintain databases. The collected information could be more widely disseminated, for example, in the form of charts displaying logos appearing on methamphetamine tablets encountered, as has been done in a number of countries worldwide.

The typical weight of the tablets examined was between 80 mg and 95 mg (range: 60-115 mg); the typical dimensions were 6.0-6.1 mm in diameter and 2.9-3.2 mm in thickness. Nevertheless, a relatively wide range of figures was obtained for the overall weight, thickness and diameter, the latter, owing to the tableting process, being the least variable parameter. Various colours and shades were observed, but orange tablets seemed predominant in more recent samples. Examination of samples consisting of packs of 200 orange tablets with the logo "wy" and one or two green tablets inserted as markers* revealed that the impurity profiles of the two tablet types were not necessarily the same (see figure V). That finding suggests that the methamphetamine powders used to prepare the orange and green tablets were manufactured at different times.

Chemical and physical characteristics combined

Just as the orange and green tablets referred to above were shown to have different impurity profiles, samples of tablets with the same physical characteristics that have been seized in the same location may have different profiles. Conversely, similarities between physical characteristics of tablets have been confirmed by UNDCP impurity profiling work, even though the tablets had been seized in different locations (see figure VI).

The case described below illustrates the complexity of the links between physical and chemical information obtained from drug characterization/impurity profiling studies. In addition to providing direct support to law enforcement authorities working on an individual case, the results of such studies, if complemented with other information, can also provide intelligence that may be useful in understanding patterns of illicit methamphetamine manufacture and trafficking in a region.

In May 1999, a number of methamphetamine samples were received through the International Criminal Police Organization (Interpol). Although the samples were reported to have been seized in the same location, an examination of the background information seemed to indicate that they might have been seized in different locations, though in close proximity to each other. The samples consisted mainly of broken, presumably granulated tablets, and of tablets of inferior quality. They were packed in several plastic bags. While the contents of the bags were clearly distinguishable from each other by colour, three of the bags contained similar, homogeneous, broken material. Another bag contained partly intact tablets of inferior quality, whose physical characteristics (colour, shade, thickness, logo) differed. In addition, 10 dark orange, intact tablets of higher quality (based on physical appearance) were received. There were also two other samples: one consisted of an orange powder reported to be dyeing powder; the other consisted of a white, fluffy powder with a strong, sweet smell, reported to be ephedrine.

*The practice of adding one or two green tablets to a pack of 200 orange tablets, possibly as part of some sort of quality control procedure, is confirmed by law enforcement authorities in the subregion.

Figure IV. Methamphetamine impurity profile exhibiting traces of *N*-acetylcodeine and 6-monoacetyl-morphine (1 = *N*-acetylcodeine, 2 = 6-monoacetyl-morphine, IS = internal standard)

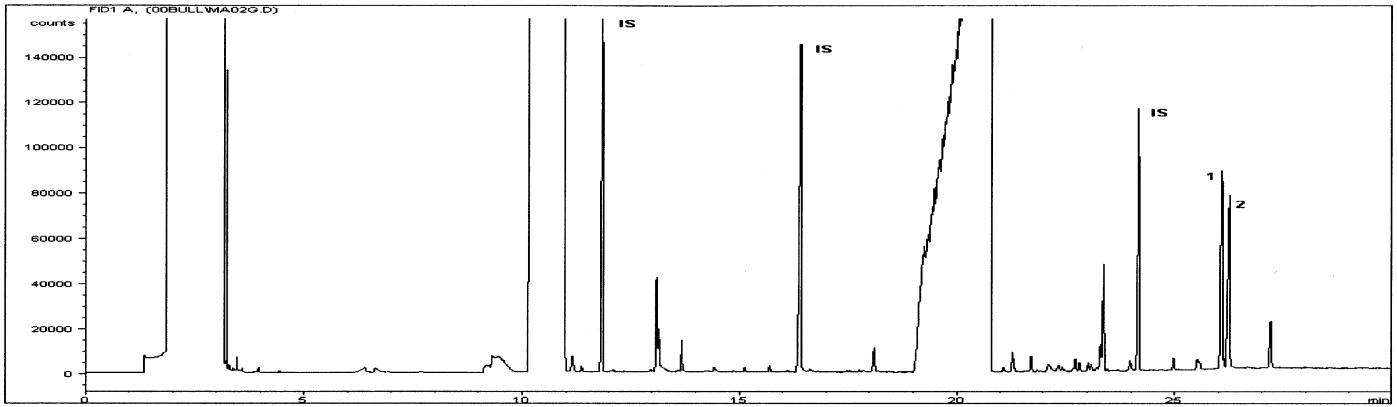


Figure V. Impurity profiles of orange and green tablets from the same case (IS = internal standard)

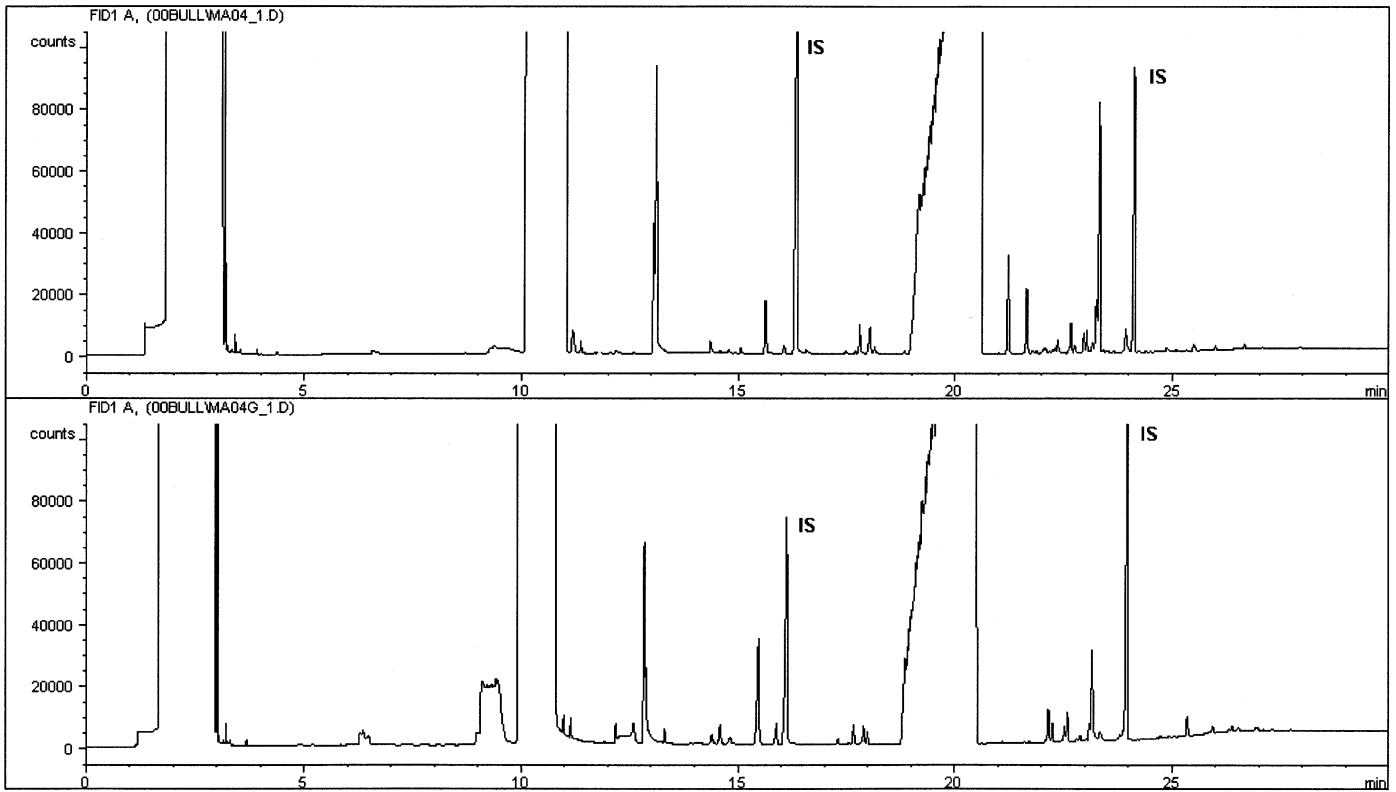
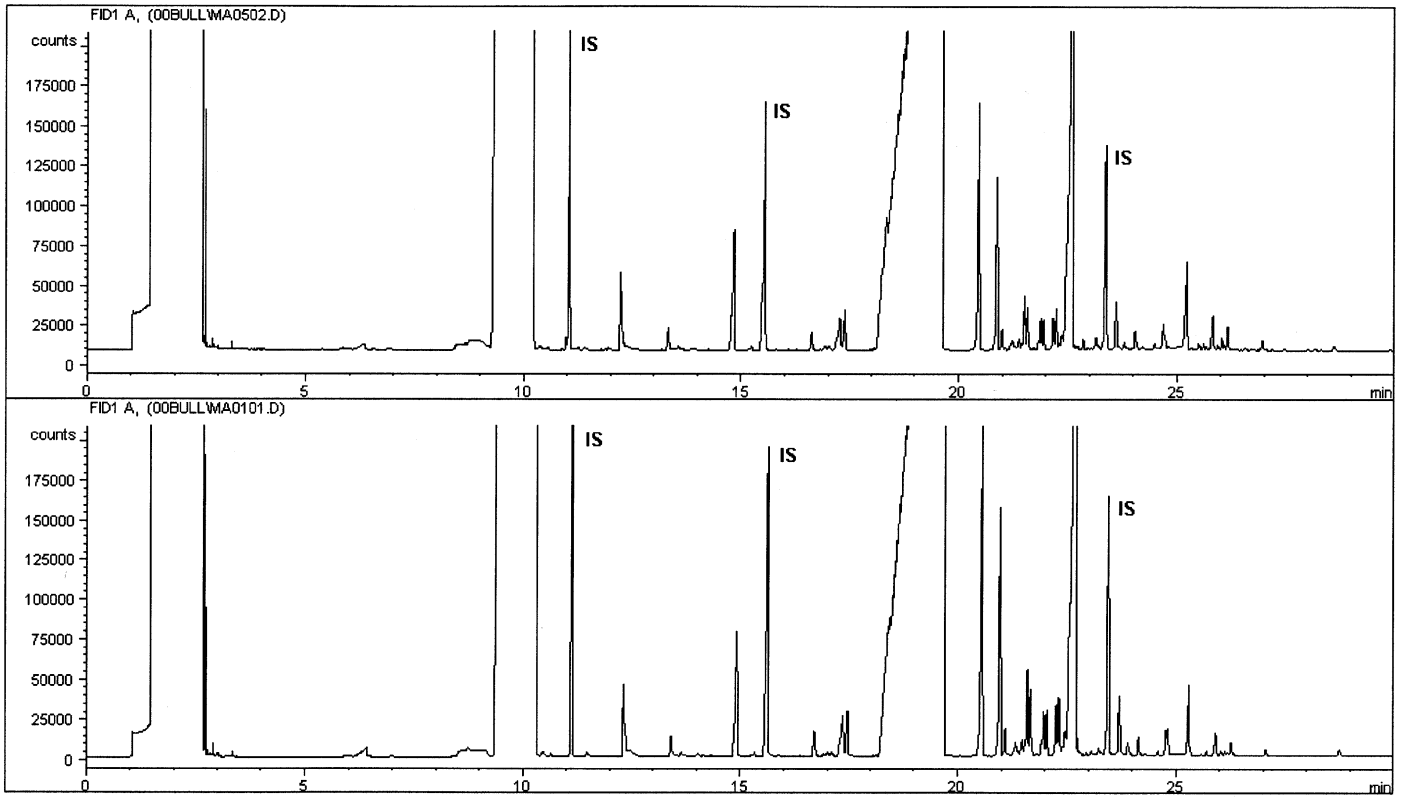


Figure VI. Impurity profiles of tablets of the same colour, shape, size and weight seized in different countries (IS = internal standard)



The impurity profiles of all the methamphetamine samples showed characteristics of methamphetamine manufactured via the Emde route of synthesis. Two subgroups of samples could be distinguished: one with intact and partly intact tablets and the other with ground tablet material. All the samples contained traces of ethyl vanillin* and relatively large amounts of *N*-methylephedrine. Caffeine was present as an adulterant. The purity of the broken or granulated tablet material was less than 20 per cent, while the intact tablets contained between 20 mg and 30 mg of methamphetamine hydrochloride (converting to a purity of 30 per cent relative to tablet weight). The 10 dark orange tablets were of the highest quality, in terms of both their physical characteristics and chemical impurity profiles. With the exception of one type of tablet of inferior quality, which did not bear any logo, the logo of the intact tablets was "wy". The "wy" imprint on the dark orange, high-quality tablets differed from that on the other tablets seized.

Some samples, although physically similar to the others, contained caffeine, ephedrine, *N*-methylephedrine and, in one case, also ethyl vanillin but little or no methamphetamine (less than 1 per cent). The powder reported to be dyeing powder was found to be similar, in terms of its impurity profile and overall purity, to the broken or granulated tablet material; thus, it seems to have been a homogeneous mixture of dyeing powder, methamphetamine, caffeine and ephedrine, ready to be tableted. Finally, the white, fluffy powder reported to be ephedrine was identified as pure ethyl vanillin.

The following information, as an example, may provide useful intelligence:

(*a*) Different types of methamphetamine were identified, indicating that the conditions of synthesis had been modified; this suggested that the seized methamphetamine might have been manufactured in more than one batch and/or in different locations;

(*b*) Tablets of good and poor quality were seized, as well as tablets with different or no logos, suggesting that different tableting specialists and equipment had been used and/or that the tableting had been done in different locations;

(*c*) Relatively large amounts of *N*-methylephedrine were present in the samples examined, indicating that that substance may have been used in the synthesis, either intentionally, as a result of a shortage of ephedrine, or unintentionally, having been presented and sold as "ephedrine".

In addition:

(*a*) Similar sample material may have been manufactured in different locations using the same synthesis route, underlining the potential of drug characterization/impurity profiling to provide supportive evidence for law enforcement operations;

(*b*) All samples contained, to a greater or lesser extent, ethyl vanillin and *N*-methylephedrine, impurities not frequently encountered, thus increasing the strength of evidence of a link between the different samples;

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*Ethyl vanillin is used for legitimate purposes as a flavouring agent and in perfumery. It was later confirmed that, in the region in question, ethyl vanillin was sometimes added to clandestinely manufactured methamphetamine tablets because of its strong vanilla-like odour and taste. By mid-2000, many samples believed to have originated in the region were shown to contain ethyl vanillin.

(*c*) The seized material included several bags of broken or granulated tablets and tablets of inferior quality, suggesting the existence of some kind of quality control procedure, whereby tablets of inferior quality could be withheld from the illicit market;

(*d*) Seized sample material was mislabelled or incorrectly reported, highlighting the need for appropriate training of personnel and for close collaboration between law enforcement and laboratory staff.

Development of an analytical procedure

All the findings presented above were generated using an analytical method developed by UNDCP. In 1997, when work on developing the method started, there was no suitable method available for the impurity profiling of methamphetamine tablets encountered in south-east Asia. Methamphetamine is chemically related to amphetamine, on which there is a vast body of literature; however, because of distinct features of the methamphetamine encountered in south-east Asia, the methods described in the literature could not be easily applied. The factors complicating the impurity profiling of the methamphetamine samples included the following: the low level of the impurities present; the nature of the impurities (almost exclusively basic impurities in methamphetamine vs. some neutral key impurities in amphetamine); the wide concentration range (from parts per million to percentage levels) of impurities encountered in the methamphetamine samples; the presence of tableting aids, adulterants and diluents, interfering with the extraction of the impurities; and the presence of ephedrine in amounts that suggested that that substance, rather than representing unreacted starting material, had been used as a diluent.

Based on samples of seized methamphetamine from 17 countries throughout the world, a method for the extraction of samples and their gas chromatographic analysis was developed. The method was optimized with regard to the extracting solvent, the pH for extraction, the amount of sample required and the analytical parameters, in particular the temperature programme used for gas chromatography. It was then refined and evaluated, to the extent possible (for instance, experiments on repeatability and long-term reproducibility were carried out), with emphasis on the type of methamphetamine currently encountered in south-east Asia. More than 500 samples, mainly from Thailand, but also from the Lao People's Democratic Republic, Myanmar and Viet Nam, were used. The method was also applied successfully to drug powders and crystalline samples* from other parts of the world, Australia, the United States and countries in east Asia and Europe (see figure II).

The following common guiding principles were used to develop the method:

(*a*) The sample pretreatment (extraction) procedure should be as simple as possible;

(*b*) The analytical procedure should ensure optimal peak resolution;

(c) The entire methodology should be robust and reproducible over a long period;

*Analytical difficulties have been encountered with a certain type of methamphetamine of very high (>98-99%) purity (commonly called "ice") from east Asia.

(*d*) It should be possible to search and compare the resulting analytical data in a reliable and rapid manner.

The parameters of the method developed are described below.

Sample extraction

A total of 30 mg of homogenized methamphetamine was dissolved in 1 ml of pH 10.5 buffer solution (pH 7 phosphate buffer + 10% Na_2CO_3 = 4+1 (v/v)) by shaking for 5 minutes. The solution was extracted with 0.2 ml of ethyl acetate (containing *n*-tridecane at 25 mg/l, diphenylamine at 35 mg/l and *n*-tetracosane at 20 mg/l as internal standards) by shaking for 5 minutes. It was then centrifuged for 5 minutes at 3,000 rpm and the organic layer was transferred to a small autosampler vial. The sample was analysed on the day of extraction.

Apparatus

A gas chromatographic system equipped with a flame ionization detector (GC-FID) was used (HP 5890 Series II GC, equipped with HP 7673 Injector). The parameters were as follows:

Column: 25 m x 0.2 mm x 0.33 µm Ultra-2 (HP)

Injection volume: 1 µl, splitless (1 min)

Carrier gas: nitrogen (150 kPa = 1.4 ml/min at 50° C oven temperature)

Temperature programme: 50 (1 min), 10° C/min to 300° C (4 min)

Injector/detector temperature: 250° C/300° C

FID gases:

air: 2.5 bar (flow rate: approximately 300 ml/min)

hydrogen: 1.4 bar (flow rate: approximately 30 ml/min)

Septum purge: 3 ml/min

Split vent: 30 ml/min

Data system: HPChemStation, Revision A.05.03 [273], Hewlett Packard 1990-1997

Signal parameters:

Peak width: 0.013

Sampling rate: 10 Hz

Signal plot: 10% offset

Conclusions

UNDCP has in recent years been engaged in the development of standard methods for the profiling/signature analysis of key narcotic drugs and psychotropic substances. So far, work has concentrated on methamphetamine and its main

precursor ephedrine. Methods have been developed for the characterization and impurity profiling of those substances, and basic research has been undertaken to assist in the interpretation of analytical results. The work has focused on south-east Asia.

Analysis of samples using the new impurity profiling method has enabled the identification and/or confirmation of new trends in illicit methamphetamine manufacture and the development of operational intelligence by law enforcement authorities in the countries concerned. As a result, more and more countries have shown an interest in the potential of drug characterization/impurity profiling, highlighting the need for regional and international cooperation. UNDCP has encouraged such cooperation through, for example, closer liaison with Interpol. It has also assisted target countries in their efforts to embark on profiling activities and served as a reference centre for methamphetamine profiling.

It should be recognized that drug characterization is a multidisciplinary activity whose usefulness can be maximized if close collaboration between laboratory personnel, police and customs authorities and an understanding of its purpose, needs, possibilities and limitations are ensured. Since the specific aim of any comparative study determines the analytical approach, law enforcement authorities must clearly specify the information that they expect from the forensic scientist.

It should be also recognized that drug impurity profiling is not a routine analytical technique. In order to provide more information on a seized drug sample than that obtained by using normal chemical analysis and to identify any links between two or more samples of seized drugs, experienced chemists and dedicated equipment are required. Moreover, any programme for drug characterization/impurity profiling must be ongoing to ensure that databases of results are properly maintained and remain useful.

In the future, in addition to developing analytical methods for the characterization and impurity profiling of various drugs of abuse, UNDCP will help to develop and strengthen operational programmes at the national and regional levels. To that end, it will develop guidelines for introducing analytical methods into operational programmes and will continue to analyse selected samples from key countries. Results will be shared with law enforcement officials and drug analysts in the countries concerned: *(a)* to raise awareness of the goals and limitations of drug characterization/impurity profiling in support of law enforcement activities aimed at gathering drug intelligence; *(b)* to show the potential of profiling in the investigation of illicit drug manufacturing routes and, ultimately, in programmes for monitoring precursors; and *(c)* to advance the area of law enforcement investigation and improve collaboration between law enforcement officials and forensic chemists. The value of such a role for UNDCP and the unique capacity of UNDCP to coordinate and facilitate cooperation in the development of national drug characterization/impurity profiling programmes have already been confirmed by countries in south-east Asia faced with the growing problem of illicit manufacture of and trafficking in methamphetamine, some of which have already started to develop their own operational drug profiling programmes.

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Determination of loss on drying or consistency of opium samples using microwave ovens

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Production Manager

ABSTRACT

A rapid method for estimating moisture in opium samples was being looked for to enable rapid payment to Indian opium cultivators. Efforts were made to replace the traditional "hand parakh" system and conventional oven method with a method that would provide rapid, simple, precise and reproducible results. A large number of techniques commonly used for the estimation of moisture in agricultural produce were tried, such as near infra-red spectrometry, low resolution pulsed nuclear magnetic resonance spectrometry, dielectric constant, time domain reflectometry and even instruments based on density measurements. Infra-red moisture balances were also tried. None of these techniques, however, yielded satisfactory results in regard to opium. Finally, the estimation of loss on drying was resorted to through the use of a microwave oven with a turntable facility. Results obtained with the microwave oven were within the acceptable limit, with a maximum standard deviation of only ±0.28, compared with the standard electric oven method.

Introduction

Opium is a cash crop for Indian cultivators. Its collection from the cultivators, its transportation to weigh-in centres and the way in which its value is assessed are being done in the very traditional and age-old manner which has hardly changed

since the imperial era. Payment to the cultivators for their opium is made not for the alkaloid content but for the total (unadulterated) solid content. The officer from the Government of India, who is deputed to make the assessment, uses his hand to assess the purity and consistency of the opium. The District Opium Officer, as he is known, dips his hand in the opium brought in containers by the cultivators and "senses" its purity and moisture content. The officer grades the opium on the basis of this assessment. The practice of testing opium by hand is popularly known as the "hand parakh" method.

Based on this assessment and gradation, a 90 per cent payment is made to the cultivator on the spot. The opium is then sent for detailed analysis to the laboratories at the Government Opium and Alkaloid Works. Final payment, made for the consistency of the product, is based on the laboratory results. The drawback in the hand parakh method is that the result will depend solely upon the skill and experience of the officer, with no actual scientific measurement being made. Given the number of cultivators at each weigh-in centre, which ranges between 300 and 400 each day, there has so far been no other way of rapidly determining moisture content. The drawback in determining consistency at the laboratory is the slow speed of disposal of the sample, thereby delaying the final disposal of the cases. In the laboratory, the loss on drying, or determination of consistency, is done in conventional electric ovens. The process adopted in the laboratory for this purpose is tedious, labour-intensive and time-consuming.

For the past two years, an intensive search has been conducted to identify suitable equipment for estimating loss on drying, or consistency of opium samples. During that time, a large number of alternatives have been tried but none met the requirements of rapidity, reproducibility, precision and simplicity. The reason for this was not the lack of availability of methods to the scientific world or consumer market but the inherent nature of opium which did not respond to the tests.

Materials

The materials used were:

(*a*) Microslides, porcelain plates 25 cm in diameter, rectangular glass plate and spatulae;

(*b*) BPL microwave oven, model 900-T, with turntable facility and microwave frequency of 2450 MHZ;

(*c*) Conventional electric oven and opium samples received from the Government Opium and Alkaloid Works, Neemuch.

Methods

Determination of loss on drying (% moisture) or consistency (% solid content) using a BPL microwave oven

Calibration

The microwave oven used in the present study was calibrated against opium samples of known consistency using the standard electric oven method for

optimization of time at the highest energy level. Studies have revealed that keeping the samples for a period of 10 minutes at the "High" or "10" level of energy in the microwave oven, followed by a standing or cooling time in the oven of 10 minutes, gave results comparable to the standard oven method. In the case of the BPL microwave oven where a turntable facility was available, the heating was uniform throughout the surface except in the central portion. Thus a measurement can be made at any point except for that particular area (see table 1).

Determination of consistency of opium samples using a BPL microwave oven

Loss on drying or the consistency of opium samples was determined on 75 mm x 25 mm glass microslides. Washed and cleaned microslides were dried at the High level for a period of three minutes in the BPL microwave oven until constant weight was reached. About 0.2 to 1.0 grams of thoroughly mixed opium sample was weighed accurately on tared microslides in triplicate. The slides were carefully kept on the round turntable of a BPL microwave oven. The space available on the turntable is adequate for 24 slides. Thus eight different samples can be tested in triplicate in one microwave oven at the same time.

Determination of loss on drying was carried out at oven level "High" or "10" for 10 minutes. A further 10 minutes were allowed as standing or cooling time, during which the plates or slides remained in the oven. The microslides were then transferred to a desiccator and weighed on a digital balance. The percentage of loss on drying or of consistency was calculated through the data of weights of the opium sample before and after drying (see table 2).

Conventional method of determining the percentage of loss on drying using an electric oven

One hundred grains (6.47989 grams) of a very accurately weighed opium sample were dried on porcelain plates at 100° C (±5° C) for 5 hours, or until constant weight was reached, in an electric oven. During the process, the mass is intermittently turned to make a free-flowing powder. The samples were done in triplicate.

Use of the "hand parakh" method at field weigh-in centres

In India, the opium produced during each crop season is collected and stored by the cultivators at their homes prior to rendering it to the Government. The Narcotics Control Bureau sets up temporary weigh-in centres at the end of the lancing season in each of the three opium growing states, namely, Madhya Pradesh, Rajasthan and Uttar Pradesh. The number of weigh-in centres varies from state to state depending upon the area of cultivation. At each weigh-in centre, the number of cultivators who submit their produce ranges between 300 and 400 each day. The District Opium Officer appointed by the Government of India makes a provisional assessment of the product by dipping his hand in the opium of each individual cultivator, sensing its consistency and feeling for foreign particles, adulteration etc. Separate laboratory tests for purity are carried out simultaneously in the temporary

laboratory set up at the centre. Based on the sensing test, the opium of each individual cultivator is categorized into different classes. Opium of the same class is mixed together and transferred in high density polyethylene (HDPE) containers of 35 kilograms capacity. A maximum of 100 such containers constitute one challan. The challans are sent to the opium factories where the opium is sampled by the laboratory for the final estimation, which is the basis for the final payment to the cultivators. In general, 10 to 16 samples are drawn from each challan. The samples are used for various tests, including the estimation of percentage of solid content or of consistency.

Results

Table 1. Uniformity test on BPL microwave oven model 900-T

Sample number	*Electric oven result (percentage)*	*BPL microwave oven result (percentage)*	*Average (percentage)*
1	63.33	63.20	
		62.67	
		63.18	
		63.46	
		63.48	
		63.43	
		63.25	
		64.35	
		63.00	
		62.58	63.25

Table 2. Testing for consistency of opium in BPL microwave oven and standard electric oven: comparison of results[a]

Sample number	*Electric oven result (percentage)*	*Microwave oven result (percentage)*
1	67.58	68.00
2	62.17	62.84
3	63.33	63.25
4	63.00	63.11
5	61.17	61.73
6	61.08	61.92
7	64.25	63.57
8	62.33	62.30
9	58.37	57.74
10	60.08	58.98
11	68.08	68.42
12	64.08	64.39
13	63.17	63.17
14	66.08	65.19
15	67.25	67.84
16	68.08	67.23
17	62.25	63.12
18	64.08	63.86
19	65.08	66.10

20	63.16	62.78
21	61.28	60.77
22	62.06	61.80
23	64.69	64.83
24	63.86	63.59
25	68.10	67.56
26	62.36	62.10
27	62.12	61.73
28	60.92	61.20
29	64.98	64.86
30	62.37	62.23
31	66.75	66.01
32	60.54	60.16
33	61.62	61.51
34	63.33	63.01

[a]Standard deviation, ±0.28

Table 3. Consistency of opium received from cultivators: comparison of results achieved using hand parakh method and in the laboratory

Sample number	*Hand parakh method (grade)*	*Consistency by using electric oven (percentage)*	*Consistency by using microwave (percentage)*	*Laboratory (grade)*	*Variation in grade*
1	II	64.32	64.02	III	1
2	III	60.38	60.73	IV	1
3	I	60.24	59.31	V	4
4	V	55.98	55.90	W.M.	1
5	III	61.30	61.19	IV	1
6	II	57.76	57.10	V	3
7	III	58.15	58.09	V	2
8	I	64.48	64.04	III	2
9	I	66.87	66.27	II	1
10	III	63.68	63.54	III	0
11	III	59.97	59.91	V	2
12	V	55.26	55.08	W.M.	1
13	III	61.63	61.78	IV	1
14	II	65.38	65.09	III	1
15	V	58.10	58.48	V	0
16	X	70.48	70.33	I	1
17	I	66.65	66.28	II	1
18	X	67.92	67.33	II	2
19	I	65.09	65.28	III	2
20	I	66.74	66.97	II	1
21	III	60.33	60.27	V	2
22	I	65.61	65.31	III	2
23	II	58.91	59.02	V	3
24	I	62.28	62.17	IV	3
25	II	58.48	59.03	V	3
26	I	61.86	61.66	IV	3
27	I	65.84	65.71	III	2
28	II	59.56	59.31	V	3
29	I	56.95	56.84	W.M.	5
30	I	58.32	57.91	V	4

Discussion

Table 3 above shows the results obtained through grading solid content at the weigh-in centres by the hand parakh method, compared with results achieved in the laboratory. Grading by the hand parakh method is classified into eight categories; each grade, class or category has a range of three degrees. Opium with a solid content of less than 58 per cent is termed a "water mix". Categories start in the ascending order from there. The classification is represented below:

Sample number	*Grade*	*Consistency (percentage)*		
1	XXX	79	80	81
2	XX	76	77	78
3	X	73	74	75
4	I	70	71	72
5	II	67	68	69
6	III	64	65	66
7	IV	61	62	63
8	V	58	59	60

Careful study of table 3 discloses the inherent fault in the existing practice of field determination of moisture. Since the hand parakh method is not a scientific means of estimation, there is a range of variation between the hand parakh mode of measurement and the two oven methods. The table lists samples for which there is no variation between the two measurements and samples which vary as high as five grades. There seems to be no pattern in the variation between the two results, thereby confirming the arbitrariness of the method of field estimation. In general, however, the results of the field assessment are found to be on the higher side and, con-sequently, recoveries must be made from the cultivators. Since estimation by means of electric oven is a very time- consuming process, the final payment to cultivators may not be made for a considerably long time. The reduction in the final stock of opium from the initial assessment may be anywhere between 5 and 35 per cent, and any delay in the final assessment affects the functioning of the opium industry.

Given all the demerits in the existing system, a need to overhaul the system has been strongly felt for some time. Many modern instrumental techniques are being used for the rapid and precise determination of various parameters of commercial importance in grains, wood, cereals, pulses, oil seeds, rubber latex etc. These parameters, which determine the quality and hence commercial value of agricultural produce, are oil content, fat content and moisture. The principles used in these determinations include:

(*a*) Near infra-red spectrometry [1-3];

(*b*) Density;

(*c*) Dielectric constant [4-6];

(*d*) Low resolution nuclear magnetic spectrometry [7].

Apart from these instrumental techniques, titrimetric methods, such as Karl Fischer, or a distillation method, such as Dean and Stark, are also available for moisture determination. Infra-red moisture balances are also quite popular methods.

Use of these techniques in regard to opium has been tried for the estimation of loss on drying. However, none of the techniques have been found to yield satisfactory results. The reason for such a lack of response to these techniques seems to lie in the very nature of opium.

Opium, a dark viscous latex, forms a surface crust or scum upon exposure to air. This phenomenon brings about a variation in consistency at different points on the surface area and in different layers of the sample. Use of the near infra-red (NIR) technique in such a situation gives a constantly changing loss on drying value which does not stabilize or show any reproducibility or repeatability owing to variation in constant composition.

Use of density as loss on drying parameter does not yield satisfactory results owing to the development of air pockets, temperature sensitivity and a calibration problem arising from variations in the composition of samples.

Use of a simple instrument for the measurement of dielectric constant followed by its correlation to loss on drying again does not work because of similar problems. On the other hand, measurement of dielectric constant through the principle of time domain reflectometry showed slight improvisation. A great deal of research, however, needs to be undertaken before this technique can be adopted.

Preliminary work on the estimation of moisture in opium was carried out using low resolution pulsed nuclear magnetic resonance (NMR). This technique was not pursued further since, besides the exorbitant cost of the instrument, the operation of NMR, which requires a stabilized magnetic field, cannot be accomplished at a weigh-in centre. The supply of electricity is also quite erratic in summer, the opium harvest season. Thus, since estimation by NMR cannot be adopted for field tests, this technique loses its applicability.

The Karl Fischer method [8-9] cannot be applied because of the higher moisture content of opium, whereas the Dean and Stark method [10] is time-consuming and does not fulfil the objectives of this search. Similarly, use of an infra-red moisture analyser has a restricted application since only one sample can be run at one time.

The advantages of using a microwave oven are as follows: rapidity of estimation and economy of time, manpower, energy and money. The time required for drying and cooling in a microwave oven is 20 minutes as opposed to 5 hours in a conventional electric oven. The quantity of the sample required is small (02-1.0 grams), compared to the large and specific quantum (100 grains, i.e., 6.47988 grams) required for the conventional method using an electric oven. The energy requirement is also very nominal. For one set of eight samples run in triplicate, 0.2 kilowatts energy is consumed in a microwave oven, compared with a requirement of 8 kilowatts for the same set in an electric oven. Microwave ovens are very cheap in comparison with the other, more sophisticated instruments and are easily affordable at a large number of opium weigh-in centres during the season. The instruments used in NIR and NMR

techniques, or the instrument based on time domain reflectometry, cost not less than US$ 28,000 per set in India, whereas the cost of one microwave oven is about US$ 690, comparable to the cost of one electric oven which is about US$ 418. The operation of the microwave oven is simple and does not require highly skilled staff. In the laboratory, this can easily substitute for the electric oven method in the measurement of consistency since the results are reproducible.

The authors trained the staff of the Government Opium and Alkaloid Works, Ghazipur, Uttar Pradesh, India, to utilize the microwave ovens in determining the consistency of opium so that a simultaneous changeover may be brought about throughout the country.

Conclusion

Based on the simplicity, reproducibility and rapidity of the consistency results, the microwave ovens may be successfully used to replace the hand parakh method adopted in the field, as well as the electric ovens used in the laboratories.

Switching over from the hand parakh method to the use of microwave ovens would assist rapid payment to the Indian opium cultivators, who have had to depend on arbitrary measurement through the age-old hand parakh system, and the proposed switch over in the laboratories would save a lot of energy, time and manpower.

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