

Drug Information Systems, Early Warning, and New Drug Trends: Can Drug Monitoring Systems Become More Sensitive to Emerging Trends in Drug Consumption?

Paul Griffiths,^{1,*} Louisa Vingoe,¹ Neil Hunt,² Jane Mounteney,³ and Richard Hartnoll⁴

¹ *National Addiction Centre, UK*

² *Invicta Community Care NHS Trust, UK*

³ *Institute for the Study of Drug Dependence, UK*

⁴ *European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), Lisbon, Portugal*

ABSTRACT

Drug Information Systems (DIS) are called upon to provide an early warning of emerging trends in drug use. However, little theoretical attention is directed toward exploring conceptual issues in this area. In this paper a typology of existing DIS is offered. Among the features that distinguish DIS are their structure (human network or organization systems) and the range of information sources used. Indicators of drug use can be placed on a continuum of sensitivity ranging from leading edge indicators to lagged indicators.

*To whom correspondence should be addressed at his present address: UNDCP, PO Box 600 A-1400, Vienna, Austria.

Sensitivity implies volatility as sensitive indicators also react to fluctuations that do not become trends. DIS conventionally are largely reliant upon lagged indicators. What is required are DIS that combine a critical information processing function with the ongoing systematic collection of data from a range of data sources. [Translations are provided in the International Abstracts Section of this issue.]

Key words. Indicators; Monitoring; Early warning; Trends; Diffusion; Surveillance

INTRODUCTION

The foundation on which the public health response to illicit drug use is built is that interventions, be they legislative, preventative, or harm reductionist, are only likely to be effective if they are based on a sound knowledge base. To this end, resources have been invested in developing drug information systems (DIS) tasked with collecting and analyzing information on the use of illicit substances. While commonalities can be observed, no single model exists of what DIS should consist of nor what specific tasks they should perform. Rather, we find that an evolutionary process has produced a number of different beasts who often share common features but whose configuration owes as much to the sociopolitical context of conception as to an analysis of the needs of data collection. To date, little academic attention has been focused on the rationale for, or functioning of, DIS. Interest has been directed at more substantive topics, such as the calculation of prevalence estimates or the measurement of treatment demands. It is fair to say that, in this respect, DIS have often proved successful and, across a range of topics, mythological advances have been made. What is lacking is a better understanding of the conceptual basis of DIS themselves. In this paper we reflect on one particular task DIS are asked to perform, namely that of providing an early warning of the emergence of new drug trends. Such a consideration is useful in two respects. Not only is the topic itself of importance, underlying as it does much of the popular conception of why information in this area is collected at all, but also such discussions provide a vehicle for beginning a broader debate on how information systems in this area should be understood.

The central question addressed in this paper is: "Can drug monitoring systems become more sensitive to emerging trends in drug consumption?" This question has always been important to those concerned with the collec-

tion of information on drug use, and many DIS actually incorporate the words "early warning" in their titles. Today, however, this issue has become critical. It is worth reflecting briefly upon why this is the case. The first, and perhaps the most fundamental, reason is that it has become increasingly apparent that DIS have performed poorly in this respect. When considering retrospectively many of the important changes that have occurred in drug consumption patterns, rarely have information systems provided an "early warning." Typically, DIS only began responding to new patterns of drug consumption after public and media disquiet prompted action. It is salutary to note, by the end of the 1980s, across the European Union, both explicit and implicit references to ecstasy (MDMA) use had become common place in popular music, youth publications, and the fashion industry. While few young people were unaware of the existence of this "new" drug, information sources available to guide a policy response remained poor to nonexistent.

It is not only the recent failing of DIS to provide an early warning of changes in consumption patterns that has prompted the current interest in this topic. In the EU, as noted by Mahajan and Muller (1994), the creation of a unified market is associated with the faster diffusion of new ideas, products, and technologies. Patterns of drug consumption appear to be as influenced by these changes as much as other areas of human activity. Globally, developments in the travel and information technology industries now mean that the communication of new ideas takes place both more quickly and to a wider constituency than has ever previously been the case. The entertainment industry has benefited particularly from these developments, and young people are now rapidly informed to some extent of emerging youth subcultures regardless of where they originate. Arguably these factors provide the conditions for new patterns of drug use to transcend national borders far more quickly than previously has been the case. These changes have occurred at a time when many countries are concerned about an increase in prevalence of drug consumption among young people, and where the social and health costs of drug use are becoming more fully understood. Against this background, it is perhaps not surprising that there is interest in developing epidemiological systems that are able to provide an early warning of problems to come. In this paper we explore the difficulties associated with such an endeavor and make suggestions for how this task might be accomplished. This discourse is based on ongoing work conducted under the auspices of the European Monitoring Centre on Drugs and Drug Addiction (EMCDDA) to explore the feasibility of European data collection strategies at local, national, and EU level becoming more sensitive to emerging trends in drug consumption.

WHY ARE NEW DRUG TRENDS DIFFICULT TO DETECT?

Even when the population is known and the parameters of interest are clear, collecting information on illicit drug use is not an easy task. The hidden and stigmatized nature of drug consumption makes investigation difficult, and the wide range of substances involved and variations in consumption patterns mean problems of definition abound. DIS have usually been developed around the measurement of one or more key indicators of drug use, and interest has tended to focus on the more deleterious consumption patterns, namely drug injection and the use of opiates and cocaine. Considerable efforts have been directed toward improving methodology in these areas, and advances have been made. One need only reflect on the difficulties encountered in developing instruments for recording treatment contact to realize that even monitoring the known behavior of drug consumers is methodologically challenging. By definition, the identification of new drug trends requires information to be collected on behaviors that have previously been unidentified.

Most ongoing data collection strategies rely on the repeated use of standardized measures. Even when a new behavior is occurring among a known population of drug users, such as those attending treatment, information will often not be collected simply because no existing routine questions or codes cover the topic. When the behavior in question occurs in a new population of drug consumers or one with which contact is limited, then even greater difficulties are evident. As the prevalence of drug use has increased, so too has the variation in the kinds of populations that use illicit substances. For example, the overlap between populations of heroin injectors, recreational ecstasy users, and those using steroids in gymnasias may be minimal. Even those qualitative researchers who may have developed good links with existing hidden populations of drug consumers may be poorly placed to identify new patterns of drug use that occur in different social milieus.

It is a truism to say that the main reason why new drug trends are difficult to detect is that the behavior is occurring outside of an area that is currently monitored or where it is difficult to monitor. A number of substance-specific or population-specific factors are likely to be important here. These are summarized in Table 1.

Later in this paper, two case studies are presented which explore the performance of different information sources in respect of two recent "drug epidemics" in the UK: the rise in heroin chasing (smoking) that occurred during the late 1970s and early 1980s, and the growth in the use of ecstasy

Table 1
Factors Likely to Impede Detection of New Drug Trends

Substance specific factors:

- A newly developed substance or a substance that has previously not been used for its psychoactive properties becomes popular
- A new preparation of a substance becomes available or a substance that has a previous history of use but has ceased to be commonly consumed becomes popular once more
- A substance is used in a new way (route of administration)

Population specific factors:

- Use occurs among a social group who have previously not been associated with drug consumption
 - Use occurs among a group in a society to which access by nongroup members is limited or difficult, such as certain professional groups or ethnic minority groups
 - Use of the substance is not accompanied (in the short term, at least) by serious consequences that cause the individual to become 'visible' to existing monitoring systems (i.e., accidents, deaths, treatment attendance, etc.)
 - Use occurs in a context in which drug use has not previously been associated with (rural communities, sports clubs, etc.)
 - Use occurs among newly arrived or transient populations (refugees, migrants, tourists, etc.)
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that occurred in the late 1980s and early 1990s. In both cases the poor performance of monitoring systems in detecting these changes at an early stage can be seen as stemming from the fact that the use of a new drug, or changes in the typical route of drug administration, was accompanied by a change in the social characteristics of the drug-using population.

Difficulties in collecting information on patterns of drug use that emerge outside of currently monitored areas are clearly evident. This does not mean, however, that no information is available on new drug consumption patterns or that seeking to improve the function of DIS in this respect is not worthwhile. The underlying assumption of those seeking to improve methodology in this area is that information on new drug trends often exists but is not collated or evaluated. This is, in some respect, because current analysis is overreliant on existing data sources. Good epidemiological practice relies on the systematic collection of information in a standardized form. Information on emerging patterns of drug use are by definition unlikely to fulfill the criteria for inclusion in such information sets. As such, data that does exist about new drug trends are likely to remain "trapped" and are not available to inform policy development. The ability to identify new drug trends at an earlier stage is likely, therefore, to be dependent on the following three things:

- Being able to collect information from existing data sources on new drug consumption patterns

- Being able to collect information from new or poorly developed data sources on new drug consumption patterns
- Developing a system that allows information from existing data sources or new data sources to be efficiently collated, evaluated, and disseminated

The very concept of a separate "early warning system" itself may be unhelpful in understanding how better information on emerging trends may be collated. It can be argued that the very concept of an "early warning system" is neither sensitive to the nature of epidemiological inquiry, the phenomena of interest, or the practical concerns of those who have information needs in this area. The model on which this idea is based is a static one of observation-response: a new pattern of drug use is discovered, the implications for public health made apparent, and then a suitable response is developed. However, data on new drug trends are unlikely to be available in a form that makes such a model appropriate. Rather, the question should be reformulated. What is required is to make existing DIS more sensitive to new trends in drug consumption? This is likely to involve a critical process in which information from a range of different sources is evaluated, new information needs identified, and trends monitored over time. DIS that can achieve these functions are likely to provide policymakers with a more accurate guide to current patterns of drug use, and it may be possible to make better predictions about the extent of future problems. This is, in essence, the central task of any DIS. As such, attention should be directed toward improving the sensitivity of existing systems rather than the creation of an independent early warning system.

A number of reasons make the concept of "early warning" unhelpful to a conceptual analysis of how DIS can respond to the need to be more sensitive to emerging trends in drug consumption. New patterns of drug use develop over time, and there is no logical imperative that any emerging pattern of use will necessarily become established and spread. Later in this paper, theoretical models that can offer some guidance to what features of a new pattern of use may lead to successful diffusion are discussed. It is fair to say, however, that the predictive power of such an approach remains weak, and in the final analysis only continuous monitoring over time is likely to allow the diffusion of a new consumption pattern to be tracked. If the "early warning" model of information collection in this area is taken literally, the question arises "at what point is a phenomenon of significant concern to issue a warning?"

Given that good data on the existence of a new pattern of use are only likely to be available after it has become established, that any system that repeatedly raises concern about future problems that do not come to frui-

tion is rapidly likely to lose credibility, and that publicizing a new pattern of drug use may even increase the propensity for it to become established, then caution is likely to be appropriate to any pronouncement in this area. Such caution is at odds with providing information rapidly. Again, this leads to the conclusion that an early warning function needs to be incorporated within the wider concerns of a DIS, in which the ongoing collection and analysis of data of varying quality forms part of an ongoing process of investigation. Such an approach does not mean that the needs of information consumers are ignored. Rather, a regular process of review can determine what is known about current patterns of drug consumption, what appears to be the underlying trends, and what implications there are for interventions. It is worth reflecting that the early identification of a possible emerging trend is likely to require the collection of more thorough information so that an informed response can be developed, rather than immediately triggering responses which may prove ineffective or counterproductive in the longer term.

In some response, monitoring trends in drug consumption has much in common with the analysis of trends in consumer and economic markets. In both cases, indirect multi-indicator models are utilized, definitional problems abound, and information sources are often slow or of questionable accuracy. A cynical observer might also comment on the fact that the failings of such information systems are as pronounced as their successes. In both cases, arguably partly as a response to such criticisms, there is need by those involved to emphasize the scientific nature of their endeavor. This may be necessary to add legitimacy to what must often seem to the uninformed as complicated and abstract activities, the utility of which is unclear. However, such an emphasis can mean that it is forgotten that the information collected can only be interpreted with reference to the social and political context of its collection. What constitutes "early" or a "significant trends" rests as much on value judgments as it does on any intrinsic aspect of the data itself.

The technical definition of a trend is: movement in the values of a variable over time. Thus, the task for drug epidemiologists is to distinguish random or structural fluctuations from changes attributed to a trend. For example, like unemployment rates, treatment demands may fall in the summer regardless of the fact that the underlying trend is increasing. While such an analysis may be explored with relative ease within the confines of a laboratory, it is a more complicated matter to explore human behavior in a real world setting. However, this is often where trend data are utilized. In some respects the distinction between a trend and fluctuation is as dependent on the observer as it is on the observation. It is dependent on the time range considered and on the factors that are of interest to the

observer. A local trend for instance may be important in a consideration of what is happening at a local level, but may be regarded as a fluctuation at a national or international level of analysis. Similarly, if we restrict our analysis to a time series of 1 year, trends may be observable that appear as fluctuations if viewed from the perspective of a decade.

Such arguments may appear academic to the business of informing the development of effective health-care interventions by providing good sources of information, but they do illustrate the point that we can, by definition, only talk about trends in respect of a given temporal frame of reference. In addition, it suggests that different information sets are not necessarily required to answer different questions. In the example given above, rises over a year are compatible with a general fall over a 10-year period. Whether the trend is increasing or decreasing depends on the length of the time series considered. However, different information consumers may be interested in changes occurring over different time periods. For example, a rapid local rise in heroin use would be important to those responsible for providing services for this group, even if it could be shown that over a longer period of time, and nationally, heroin use was on the decline. Information systems should be able to meet the needs of different information consumers. In terms of monitoring trends, much of the data may remain the same, and it is only the question asked, the time period considered, and the analysis that is undertaken that differs.

When dedicated early warning systems of drug information systems that have an early warning function are considered, the issue of the time frame in which the trend is located is of importance. If we are looking at trends over a 10-year period, then early detection is likely to mean something very different than if a shorter period is considered. In every case, however, the task is to improve the sensitivity of the system so that changes are more rapidly detected regardless of the temporal frame of reference.

One problem inherent to an information system designed to identify new trends at an early stage is that of the danger of raising false alarms. Any system that repeatedly does so is liable to lose credibility to such an extent that its preservation is likely to be called into question. It is also inefficient to direct scarce resources in pursuit of information on behaviors that are unlikely ever to become established. As such, we may seek to limit the extent to which information systems are "alarmist," while at same time allowing the possibility of future trends that may have alarming consequences to be assessed.

As stated above, there is no logical imperative to suggest that just because a behavior is increasing over time it will continue to do so. However, public health responses need to adopt a cautiously pessimistic perspective. Contingency plans, at least, need to be prepared for the

worst-case scenario. However, that said, even contingency planning absorbs scarce resources. No information system is sustainable which regularly triggers activity which proves, with hindsight, to be unnecessary. An interesting paradox, therefore, lies at the heart of attempts to design more sensitive drug information systems. Moves toward increased sensitivity require a perspective toward a smaller time frame in order to begin detecting the behavior as near as possible to the point when it becomes observable. Such a narrowing of perspective implies that the predictive power of the observation becomes more volatile. Not only does sensitivity allow the identification of behaviors that will become significant, it also implies that, increasingly, systems record behaviors which will not. If such data are not treated with the scepticism they merit, then the DIS is likely to be alarmist as it continuously identifies potential new trends that never become realized. Critical, then, is not merely the ability to identify new behaviors at an early stage, but to evaluate their likely importance and track their development.

SOCIOPOLITICAL INFLUENCES ON THE SCIENTIFIC STUDY OF NEW DRUG TRENDS

As has been described, the technical problems associated with detecting new drugs trends are considerable. However, the scientific task is further complicated by the sociopolitical context within which this activity occurs. This can lead to external processes which may direct the focus of attention which such a project, act to increase or diminish the importance (and resources) attached to the monitoring of new drug trends, and even shape the data that are generated.

Perhaps most obviously, the "drugs issue" is highly politicized and generates a constantly fluctuating cause for public concern. Within this discourse, the mass media play a prominent role. In a study that examined agenda-setting within the United States, interactions between "the president, the press, and the public" have been shown to be complex (Gonzenbach, 1991). A number of effects arise, such as an influence of the press on public opinion and vice versa, and the way that the President both follows and can form public opinion. The level of concern and amount of media coverage may, in turn, influence both the resources for the monitoring of drug trends generally, or a particular new drug, and the perception of its priority.

The public may perceive new drug trends as a threat requiring a political response. Populist approaches to dealing with a new threat, posed by use of a novel drug or an increased trend in drug use, may confer political benefit.

Political advantage may conceivably be gained by magnifying the perception of such a threat as a distraction from other issues. Cohen's (1973) classic work on folk-devils and moral panics, and Friedman's (1998) more recent discussion of the scapegoating of drug users illustrate such a process. Pressure to minimize the perceived prevalence, and threat, from a new drug trend may also arise if the political response conflicts with economic or foreign policy objectives. Any resulting influences on either press or academic attention may itself act to reify a new trend by acting on public awareness and in the production of "social facts." In this way, positive feedback effects may themselves shape drug trends—a point to which we return below.

Changes in patterns of drug use, and associated drug policy, also influence the allocation of substantial resources spent by enforcement agencies, health services and, to a lesser extent, academic researchers. Each of these groups will have an interest in the occurrence and size of new drug trends and may lobby accordingly. New forms of drug use may justify the development of new treatment services or increased spending on drug interdiction.

The addition of a new drug to users' repertoires may also justify increased research spending in order to gain a better understanding of the associated health hazards. Within the study of new drug trends, academic disagreement regarding the terminology used may even be illustrative of underlying political processes concerning prohibitionary and libertarian forces. A possible example concerns dispute over the use of the term "normalization" (with its evident connotations for the policy response) to describe drug trends within scientific papers (Parker and Measham, 1994; Shiner and Newburn, 1997). This suggests a need for caution regarding any assumption that academic discourse is neutral.

Aside from political considerations, it is possible that epidemiology itself may spuriously influence "social facts" such as new drug trends (*Lancet* editorial, 1993). The epidemiological gaze may act to increase recognition and reporting of a problem or the extent to which problems are attributed to it. This phenomenon can be seen as a consequence of a positive feedback system that magnifies inputs. Coincidentally, within this editorial, which considers epidemiology generally, the example of good reporting provided involves a study that found an unexpectedly high level of fatal myocardial infarction among young women using psychotropic drugs (Thorogood et al., 1992). This latter finding was reported with suitable qualifications to the findings, rather than in more sensational terms. Similar findings were reported by Cohen who noted, in 1971, the importance of reporting systems in causing deviancy amplification (in this case, arrest data in causing more concern about cannabis consumption leading to

increased resources being directed at interdiction activity and a subsequent rise in arrests, regardless of the underlying consumption levels).

These brief examples are illustrative of the wider problems that can surround the development of systems for detecting new drug trends. The monitoring of new drug trends needs to be sensitive to these factors and should seek ways to take account of such influences within the considerable noise that already surrounds drug-use data. DIS, and those who work within them, should at least be aware that they are not neutral observers of social change.

DRUG INFORMATION SYSTEMS: MODELS AND APPROACHES TO IDENTIFYING NEW TRENDS

To explore how DIS have addressed the problem of early warning, information systems from around the world were reviewed. Table 2 contains a list of those systems that were identified.

Table 2

Drug Information Systems Identified for the Purposes of This Study

Antenna Drugs and Gambling (Amsterdam, The Netherlands)
Canadian Community Epidemiology Network on Drug Use -CCENDU (Canada)
CAN Regional Reporting System (Sweden)
Community Epidemiology Work Group -CEWG (USA)
Drug Abuse Warning Network -DAWN (USA)
Drugs Information Monitoring System—DIMS (The Netherlands)
European Monitoring Centre for Drugs and Drug Addiction—EMCDDA Reporting Network (Lisbon, Portugal)
Epidemiological Surveillance System of Addictions—SISVEA (Mexico)
Illicit Drug Reporting System (Australia)
Inter-American Drug Abuse Control Commission CICAD Surveillance System in Central America, Panama and the Dominican Republic
International Epidemiology Work Group—IEWG (USA)
Maryland Drug Early Warning System (Maryland DEWS)
Multi City Network on Drug Misuse Trends (Europe)
Sistema Nacional de Informacion Sobre Drogas CONACE (Chile)
Outbreak Investigation Audit Model (UK)
Pulse Check (USA)
Rotterdam Drug Monitoring System—DMS (Rotterdam, The Netherlands)
Scania Information Network on Drugs (Sweden)
Sistema Estatal de Informacion Sobre Toxicomanias—SEIT (Spain)
South African Community Epidemiology Network on Drug Use -SACENDU (South Africa)
South East Asian Multi City Epidemiology Work Groups—AMCEWG (Asia)
WHO: Rapid Assessment Methodology (World Health Organization)

For the purposes of this report, a simple definition of a DIS was developed allowing the variety of organizations concerned with information collection in this area to be included in the analysis. A DIS was defined as any system that seeks to understand patterns of drug use by analyzing data from one or more sources. On a simple conceptual level, a DIS can be seen as consisting of three parts: a) data sources; b) a formal or informal system for the analysis, discussion, and/or dissemination of data; and c) data about consumers who implicitly or explicitly define the parameters of inquiry.

A number of problems become apparent when the production of a typology of information systems in this area is attempted. Not only do a large number of systems exist, they are also designed to fulfill a wide variety of purposes. Systems range from those devised with one or more specific information need in mind, to others whose remit appears much broader and that aim to collect information on drug use in general. While some DIS are configured around definitive protocols with clearly defined aims and information sources, others consist of ad-hoc groupings of individuals who may discuss a broad range of topics and meet on an irregular basis.

Furthermore, for a variety of reasons, DIS develop and change over time. This sometimes results in the stated goals and objectives of the system being poorly reflected in current activities and, in some cases, the original remit has been expanded to such an extent that it appears to globally embrace all areas of drug epidemiology. A common problem with most systems, from the point of view of a reviewer, is that they are primarily concerned with output. This focus on the data produced often results in a scarcity of published information on the operational details of the system or evaluation of the strengths and weaknesses of the methodologies employed.

Despite these difficulties, a classification can be developed which broadly distinguishes between systems according to a number of key conceptual, methodological, and organizational approaches. These features have been selected because they are likely to relate directly or indirectly to the issues of detecting changes in drug consumption patterns in a timely fashion. However, it should be noted that this typology is not strict. Rather, general features can be identified that differ between information systems.

The following features can be used to distinguish between DIS in relation to the tracking of new drug trends.

Operational Level. The operational level can be defined in relation to the geographical and political location of the information system, e.g., local information systems, city level systems, national and international systems. In one respect the level of the information system can be seen to correspond to the location of the information consumer whose needs the system serves. Although there is no intrinsic reason why DIS should not be located across

operational levels, and indeed there may be positive advantages in doing so, the majority of systems appear to be designed to work only horizontally (i.e. at one operational level).

Structure. Broadly two types of DIS organizational structures occur, namely "organizational systems" and "human networks." Systems usually consist of a structure for the management and analysis of a defined set of data. Within this structure, different elements perform distinct roles. Thus, DAWN (the system used for collecting emergency room data in the United States) can be seen to have a clearly defined structure. Networks, on the other hand, are configured from a range of individuals or of organizations represented by individuals. Members of the network are generally chosen to bring either general or scientific knowledge or expertise to the DIS. Information flow tends to be far less rigid within networks, with different members bringing information or analytical comment in accordance with their specific background or expertise. Although some networks, such as the Pompidou Group Multi-City Study Network, will expect members to produce data in a standardized format, in general, networks tend to adopt a more unstructured approach.

Function. DIS exist to fulfill a myriad of information needs. Among these is the implicitly or explicitly stated goal to collect information on new drug trends. The timely collection of information on emerging patterns of drug use is seen as important for improving the opportunity to develop policies that minimize the public health or other negative impact of new patterns of drug use. This "early warning" role is often central to the DIS rationale for existence and may even be included in the system's name (e.g., DAWN, European EWS, etc). However, despite this, the majority of information systems, while being by definition concerned with trends, are required to produce information for other purposes. Such DIS can be described as having an Early Warning Function rather than being a dedicated Early Warning System. Alternatively, some DIS are conceived and developed as dedicated EWS and limit their remit to this purpose only.

Range of Data Sources. Many DIS are configured around the collection and recording of one or more clearly defined indicators of drug consumption. Such systems can be considered "closed" as they do not routinely extend their consideration to new data sources. Alternatively, a DIS may be largely unstructured by collecting and analyzing whenever data are available and appear pertinent to the question under investigation. This approach appears more common among human networks than organization systems. Advantages pertain to both approaches. DIS with "open" data sources can more critically discuss changes by reflection on a wider and more diverse

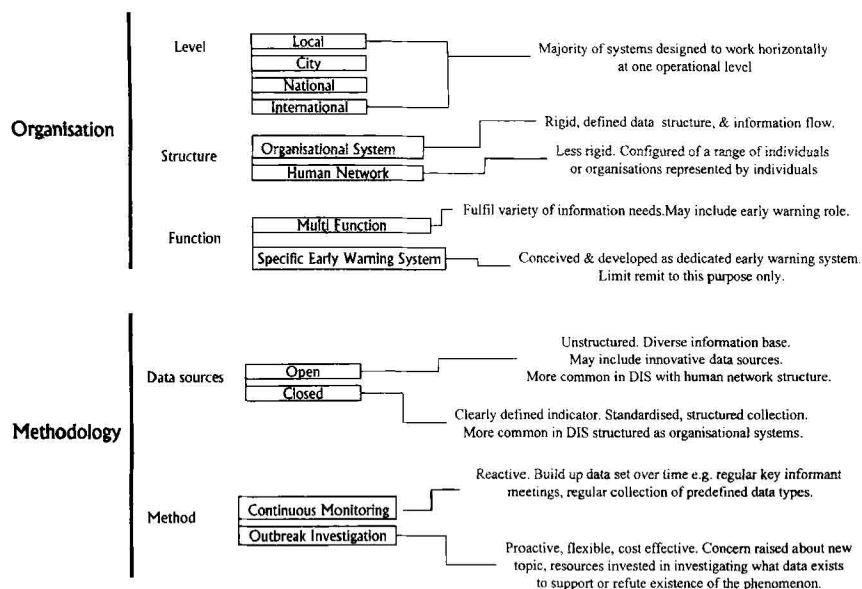


Fig. 1. Conceptual model of drug information systems (DIS).

information base; however, such information may be poor and the absence of time series data derived from a standardized methodology makes reflecting on change more difficult. Alternatively, DIS that rely solely on closed data sets may be unaware of important changes that are not currently reflected in their core data set. Such systems also appear to find it difficult to adapt to change when it is required. The revision of structured data collection methodologies is time consuming, and considerable resistance may stem from the concern that comparability with previously collected data will be lost. These concerns need to be balanced against the need to revise data collection strategies to take into account the information needs of monitoring new patterns of use. While it is possible for a DIS to utilize both open and closed data sources, this appears to be rarely done in practice. (See Fig. 1.)

Investigation Method. Two methodological approaches can be observed by which DIS seek to collect information on new drug trends. The first and most commonly adopted approach is to build up a data set over time by the continuous monitoring of data sources or by reports from individuals or organizations responsible for monitoring some aspects of the illicit drug problem. In the most unstructured form this might constitute a regular meeting of key informants, but is more often characterized by the

regular collection of predefined data types. An alternative approach (but one which could be profitably used in tandem) is that of "outbreak investigation." In this model, once concern has been raised about a new topic, be it from any source, resources are invested in investigating what data exist to support or refute the existence of the phenomenon. The advantage of such an approach is that it is flexible and cost-effective, only requiring resources when operational. Again, while there is no reason why both approaches cannot be used together by a DIS, this rarely occurs.

The above typology is not rigid but nevertheless distinguishes some key differences between systems. It is helpful in terms of reflecting on how systems have attempted to deal with the problem of collecting information on drug consumption trends and in moving to a more conceptual analysis of what components are likely to be important in an ideal system for identifying new trends. To some extent, all the DIS reviewed can be seen as responding in a rational fashion to needs of data collection in this area. Differences identified stem primarily from the context in which they operate. In crude terms, open, flexible, and sensitive systems, which utilize data of varying quality and where subsequently reliability is often poor, can be contrasted with structured, slow, and rigid systems where the reliable tracking of indicators over time is possible. Such a contrast, while to some extent observable, is unhelpful. An ideal DIS system should strive to combine both these approaches. There is no reason why the ongoing analysis of data collected according to agreed structures cannot be combined with a consideration of more anecdotal or less-developed data sources. Similarly, ongoing data collection can be supplemented by outbreak investigation procedures. If DIS are to be more sensitive to emerging trends, the aim must be to synthesize data from a range of sources to inform an ongoing debate on what is currently happening to patterns of drug consumption and on what information is needed to confirm or refute suggestions of what may be happening.

HOW HAVE DIS PREVIOUSLY PERFORMED IN IDENTIFYING NEW DRUG TRENDS?

If sensitivity is defined as the ability to utilize the information available at any given time, then, by reflecting on known historical changes in consumption patterns, the performance of information systems can be evaluated. In particular, those sources of information which were available but not utilized can be identified. Two case studies were undertaken with the objective of providing a retrospective account of the ability of UK information sources to detect emerging trends (note—full details of these can be found elsewhere—Mounteney et al., in preparation). Summarizes are pro-

vided here of how information sources performed with respect to: a) the emergence of heroin smoking or chasing by young people in late 1970s; b) the emergence of ecstasy (MDMA) on the UK drug scene in the 1980s.

Two approaches were used to identify the pertinent information sources:

1. A bibliographic search was undertaken in the Institute for the Study of Drug Dependence library (the largest specialist drugs information library in the UK) in order to identify early literature pertaining to ecstasy and to heroin smoking in the UK. The library collects scientific literature on drug use, grey literature including internal reports, where available, and monitors press reports on drug use. The search included a review of newspaper cuttings and coroners reports. It was not possible to identify the role played by television and radio in the reporting of either trend.
2. A range of experts in the UK drugs field were approached and asked for their views, recollections, and data on the early stages of both trends. In addition, those organizations responsible for compiling standard indicator data (treatment demands, arrests, seizures, etc.), such as the Regional Drug Misuse Databases and Home Office Statistics Division, were approached to check detailed records and publication dates.

In using the above methodology, the focus was on when information on new trends entered the public arena in written form rather than when the information first came to the notice of any particular individual or agency. For example, regarding seizure data, a code existed for ecstasy from 1986, and clearly small seizures were being made and recorded from this date onward. However, it was not until 1992 that data showing ecstasy seizures came into the public arena via the *Home Office Statistical Bulletin*. Prior to 1992, ecstasy seizure data were "trapped" and unavailable for specialist consideration. Attempting to decrease this time lag between the data collection and reporting for both ongoing monitoring systems and research studies is a critical issue for improving the sensitivity of DIS and is discussed later.

HEROIN CASE STUDY

The beginning of the UK's "heroin epidemic" (Griffiths et al., 1994; Strang et al., 1997a) can be traced to the mid-1970s. While small numbers of "new heroin users" may have been using at this time, by the early 1980s the problem had become pronounced and in some deprived inner city areas

heroin use had become endemic. These new heroin users were predominantly young, working-class people who were smoking heroin by a practice known as "chasing the dragon." In terms of early warning indicators, this requires identifying sources which picked up on: a) a new younger group of heroin users; and b) a new route of administration, i.e., smoking. In the words of Parker et al. (1987) in their retrospective account of the development of the new heroin epidemic of the 1980s in Wirral: "We can now see that it all began in 1979." Certainly, with hindsight, the pieces of the jigsaw can be assembled to show strong signs of the impending new trend, although this was not apparent at the time.

Individual data sources for the late 1970s and early 1980s highlight an increasing amount of smokable heroin entering the UK following the fall of the Shah of Iran in 1979. Iranian heroin had been entering the UK before this time and was probably observable from around 1975. This heroin was in a base form which, unlike other heroin preparations, is particularly suitable for smoking (Huizer, 1987; Strang et al., 1997b). In spite of well-documented increases in the amounts of heroin seized by Customs from 1977 onward and the increase in addicts noticed during the same period, this was accompanied by only minimal reporting of changes in the way in which the drug was used. While retrospective studies suggest 1978 was the "watershed year" when cheap smoking efficient heroin became widely available in the UK, it was not until 1980 that we documented a commentary of this new phenomenon. The first accounts of an increase in heroin smoking were found in a London listing magazine widely read by young people (*Time Out*) (Clark, 1980) rather than in the scientific or specialist literature. This article suggested that a new pattern of drug use, "chasing the dragon," had developed, could be traced back to Iranian student circles since 1975, and that smoking heroin was now becoming increasingly socially acceptable in a way that had been previously unthinkable.

Detailed reading of drug treatment agency annual reports demonstrates that, by 1982–1983, individual drug agencies were at least beginning to be aware of new young working-class heroin chasers. The *Community Drug Project* (a small London voluntary, street drugs agency) *Annual Report 1982–83* reports: "A picture emerges of the easy availability of heroin on the streets, of its use spreading to a younger age group." However, such documents containing a few anecdotal remarks were not widely available or picked up by a wider audience. Increasingly during this period, references are found to heroin smoking in "underground" and student publications, e.g., 1983 *Scag*—a crude photo story about heroin use was produced by students at Northchurch/Schooling & Culture Project. From this period on we increasingly find reports, often sensationalist, appearing in the national and local press. In 1983, two research studies were found that make mention

of this new group in the gray literature, although this information was not widely disseminated until some considerable time later. It is worth noting that Parker's study in Wirral (published in 1988) finds, retrospectively, that a range of local professionals had information on the increase in young heroin smokers, but that this data stayed trapped within their respective agencies or groups. By 1984 the epidemic hit the headlines in the local and national press with a focus on Wirral and South London housing estates. The (confidential) *Drugs Branch Inspectorate Annual Report* for this year reports increased heroin smoking by young people from three national regions, and by 1985 the UK Government funded the, subsequently much derided, "Heroin Screws You Up" campaign representing one of the first policy responses to the epidemic. While fieldwork took place earlier, it was not until 1986–87 that sociological and ethnographic studies came to be published; notable examples include studies by Parker et al. (1987), Pearson et al. (1986), and Gossop et al. (1988).

ECSTASY CASE STUDY

Anecdotal reports from ecstasy users and ex-users suggest that the drug was being imported and used by small groups of young people in London and the South East of England during 1984. Prior to this, some limited use had occurred, and accounts suggest that, among members of the music and fashion industry, use probably started around 1981 (Griffiths et al., 1997). As a "preventive" measure, MDMA and related analogs were banned in the UK in 1977, long before any significant use occurred.

In terms of early warning, formal and informal reports in the years prior to 1990 are of greatest interest. Very little was written about ecstasy prior to the summer of 1988 (subsequently known as the "summer of love"). In this year, large unregulated dance events, called "acid house parties" or "raves," were being held across Southern England. By 1988, many young people would at least be aware of the existence of both the drug and the associated music and fashion, even if they had no personal experiences of either.

Between 1985 and 1988, reports of ecstasy occurred sporadically in magazines read by young people. The first mention of ecstasy use in the UK appeared in September 1985 in the October edition of *The Face*, a popular lifestyle and music magazine (Nasmyth, 1985). The article was entitled "MDMA we're all crazy now" and discussed the arrival of the drug from the United States and detailed an unnamed Londoner's experience of trying the drug. In December 1985, the Bristol University student magazine *The Heckler* published the findings of a student lifestyle survey which, among its findings, reported that 3 out of 100 respondents had tried

ecstasy (Smilg, 1985). An article in the style magazine *The Face* in 1986 discussed the purity and effects of ecstasy, describing the drug as a fashionable "yuppie" drug for the middle classes (Nasmyth, 1986).

While these early reports on ecstasy use were often neutral in content, subsequent articles that began appearing in both the national and local press were more alarmist and sensational in nature. In January 1986 a report in *The South Wales Echo* mentioning a seizure of tablets plus the distribution of pamphlets extolling the virtues of ecstasy in Cardiff night clubs (Horton, 1986). Later that year, *The Daily Telegraph* (national daily newspaper) described the drug as the "latest narcotic menace." The only other pre-1988 mention of ecstasy from an official source comes from the *Home Office Forensic Science Service 1986 Annual Report* which makes passing reference to isolated seizures, concluding "apart from isolated seizures of bromo-STP and MDMA, there has been no sign of the designer drug problem" (Cobb, 1986).

During and after 1988 the national press continued to report on the rave scene and drug use, and the first reports of ecstasy-related deaths appeared in *The Star* newspaper in 1988 (*The Star*, 1988). From this period on, "drug-crazed raves" became an ongoing theme for the tabloid press. In terms of official sources, unpublished coroners reports provided data on ecstasy-linked deaths in young people from 1988 onward, and the Office of Population Census Statistics registration of deaths also first mentions ecstasy in this year (The Stationary Office, 1988). In the summer of 1988, specialist drug agencies and the press began to take notice of and report on ecstasy. Release (a national voluntary drugs agency) issued a press release on ecstasy in July 1988 (Release, 1988). This was followed by a few reports in other specialist magazines throughout the summer. September 1988 saw the publication of the *Drugs Branch Inspectorate Annual Report 1987*, which stated that one of the principle features of the drug scene during 1987 was "a renewed interest in LSD, coupled with experimentation with relatively recent entrants to the market, such as MDMA (ecstasy)" (Home Office, 1988). With regard to research reports, the first mention of ecstasy was in a national survey by Wrangler/Gallup which was conducted and reported in 1989 (Gallup, 1989). The survey found that less than 1% of young people had tried the drug. In 1990 an article appeared in the *British Journal of Addiction* (Davis and Ditton, 1990) detailing data from 1989 from Scottish drugs agencies stating that, in their opinion, there was increased use and availability of ecstasy. In May 1990 the Home Office Forensic Science Service report on ecstasy showed seizure data to have increased from 4 seizures in 1985 to 577 seizures in 1989. The year 1991 saw the publication of a study (Cogans, 1991) undertaken in 1988 suggesting that 1% of a sample of Scottish 13-16 year olds had used ecstasy. The repeat

measure survey of drug use in British schools (Balding, 1996) listed ecstasy as a separate drug for the first time in 1991 and reported 4% of 15–16 year olds in the study had tried ecstasy. Police seizures first reported MDMA in their figures in 1989. However, these data were only included in the *1991 Annual Bulletin*, which was not actually published until September 1992. This year also saw the publication of a Health Education Authority (HEA) household survey plus a second Gallup/Wrangler survey reporting ecstasy use among young people (Gallup, 1992). By 1994 the *Department of Health Statistical Bulletin*, which provides an overview of data from the Regional Drug Misuse Databases including treatment episodes where ecstasy is primary or secondary drug of use, became available (Department of Health, 1994).

In summary, information sources were available on these new patterns of use but they were either not collected, nor interpreted, nor disseminated, or not disseminated in a timely fashion. In both cases, if the policy response was driven by information, then it was from reports in the popular press, whose portrayal of the problem was often both sensationalist and inaccurate, rather than from a considered analysis of the epidemiological data. By the time research studies had been commissioned, undertaken, and reports appeared in scientific journals, a considerable period of time had elapsed.

If each information sources is considered in turn, the following appraisal of the sensitivity of data sources can be made.

The Youth Press, Investigative Journalism and Tabloid Sensationalism. In both case studies the first published accounts of the emerging trends can be found in articles by journalists in the youth/style culture press. These accounts are one-off and appear substantially in advance of other reports of the trends. In-depth articles by investigative journalists within the quality press appear a couple of years later alongside lighter, more sensationalist reports in the popular press.

Specialist Agency Reports—annual and research reports. The next group of references to the emerging trends appear within specialist drug agency annual reports. These are initially noted as professional's observations on changes within their client group or reported by their client group. These professional observations tend to be concealed within annual reports which have a very limited circulation. Simultaneously, one or two research projects working directly with users and drug agencies picked up on the patterns of use. References can be found in reports to funding bodies or in internal documents that are not widely available and may consist of only passing comments in longer documents. Research teams in particular are often reluctant to release results before studies are completed and journal submissions made. National agencies tended to report on trends to a wide

professional audience only once the trends have become reasonably well established.

Market Research/Local Surveys. It is interesting to note that both ecstasy use and heroin smoking were picked up fairly early on by a few ad hoc local surveys, usually employing relative simple methodologies. While scientific rigor in these exercises was lacking, both their simplicity and perhaps because they were not intended as serious research studies meant that they rapidly become available in the public domain.

Routine Indicator Data Sources. On the whole, the more routine data sources discussed below were slow in reporting on the new trends. However, in the case of heroin smoking, one or two of the routine UK data sources reported fairly rapidly on aspects of the emerging trend. For example, the Home Office Forensic Service reported the availability of new smokable heroin in the UK while the Addicts Index showed an increase in the number of younger people notified as heroin users. However, the importance of these data were not appreciated at the time as the data were not placed in wider analytical context and it is only in retrospect that the importance of this information can be noted.

Enforcement Sources—Arrests and Seizures. There is a considerable time lag of 2 to 3 years between the collection of Home Office arrests and seizure data and its publication. Reports from the Drugs Branch Inspectorate contain timely and reasonably reliable police “intelligence” reports; however, issues of confidentiality meant this information was not disseminated.

National Surveys. With the exception of market research studies, surveys have proved to be particularly slow in identifying new trends. The reasons for this are twofold:

1. The appearance of a new drug requires the addition of new questions/codes. Those completing repeat measures surveys are often reluctant to make changes in instrument design. It is costly to collect survey data and there can be resistance to inquiring into low frequency events of uncertain importance. Alternatively, those responsible for survey design may simply be unaware of the need to include new questions.
2. The time lag between data collection and reporting of findings tends to be lengthy, e.g., up to 2 years in the case of the British Crime Survey.

Treatment Attendance Databases. UK databases were designed for monitoring purposes and, as such, they do not have the built-in sensitivity required to detect and report rapidly on new drug trends. As with surveys, the development of new codes takes time, so databases represent a blunt

instrument when it comes to detecting new drugs or uncoded routes of administration. In general terms, treatment attendance can be considered as a "lagged indicator" of the incidence of new drug use as a considerable interval often exists between first use of a drug and the development of problems requiring formal treatment interventions. Furthermore, some patterns of drug use rarely result in treatment attendance. Consequently, drawing inferences about the general population from treatment data is unreliable.

Sociological and Ethnographic Research. With the exception of the research projects mentioned above, most ethnographic and field studies proved very slow in reporting on the new trends, although the quality and reliability of the data provided were very high compared to many other sources. In general, these studies were commissioned after a new trend had been identified, with the purpose of exploring, in more depth, what was actually going on. In most cases there was an additional gap of 2 or more years between the fieldwork taking place and the publication of findings. While researchers in the field were often aware of the existence of new patterns of use relatively early on, no forum existed for the dissemination of this information.

LEADING EDGE INDICATORS AND LAGGED INDICATORS

The case studies reviewed above suggest that DIS should attempt to incorporate new information sources in their analysis. The term "indicator" is commonly used with respect to information sources on patterns of drug use. Two factors are important to this definition. First, the term emphasizes that the information only indicates what is happening in the wider unknown and hidden population of drug users. It, therefore, cannot be taken as a direct measure and must be interpreted in relation to the methodological problems inherent in its construction. Multi-indicator models have been adopted as it is assumed that models built upon data from a number of indicators better represent the "real" pattern of drug use and compensate for problems inherent in any individual data source (Hartnoll, 1997). Second, an indicator consists not only of the raw data, but also a set of agreed rules and procedures for the recording and compiling of the data. Thus, an indicator on "first treatment demand" is interpreted in respect of a set of agreed definitions and categories.

As argued above, information sources are differentially efficient in terms of the lag in reaction time to the emergence of a new pattern of drug use. Indicators can, therefore, be placed on a continuum of efficiency from

“lagged” to “leading edge.” Treatment attendance can be viewed as a classic lagged indicator. It has been estimated that a heroin user will typically access treatment provision around 4 years after the first use of the drug. A rise in treatment attendance data, therefore, is likely to reflect the patterns of new drug use occurring 3 or 4 years ago rather than reflecting contemporary new use. Most developed indicators of drug consumption can be considered lagged to some extent. What is required is development work on leading edge indicators (LEI) which would provide earlier commencement of analytical discussion on changing consumption patterns or development of new patterns. Such indicators might include media and cultural monitoring, incorporating information from panels of known drug users or key informant data. This requires more than simply including anecdotal accounts of new drug-use patterns in information systems. As with other data sources, methodological solutions are required to direct how such data sources should be collected and collated. Such information will often be poor in terms of their long-term predictive validity, and this may be one reason why so little attention has been paid to the systematic collection of data from these types of information sources. However, weaknesses exist in all information sources in this area, and all indicators can be seen to perform poorly in some respect. The task for an integrated DIS is to balance the strengths of one information source against the weaknesses in others. The fact that the use of LEI may often raise more questions than provide answers should be seen as a strength, rather than a weakness, of these kind of information sources.

TOWARD MORE THEORETICALLY BASED STUDY OF NEW DRUG TRENDS

This paper has been largely concerned with the practical development and performance of DIS. It is also necessary to briefly consider if theoretical models of how new patterns of drug use develop can be helpful in ensuring the sensitivity of DIS. It must be said, however, that there is an evident gap in the theoretical development of models for monitoring new drug trends. The dominant approach, namely trend analysis, is descriptive rather than explanatory and is based on the use of various types of indicator data as discussed elsewhere in this paper. The limitations to this approach with regard to identifying emerging patterns of use have already been described. That said, Turner and Miller (1997) have suggested how such sources might be enhanced, and it will remain important to continue developing and improving systems for collecting and analyzing such data sets.

One theoretical framework for understanding whether, and how, some new product or technological process is adopted is provided by diffusion of innovation theory (Rogers, 1995). This theory has been widely applied to the study of new technologies, some of which relate to health behaviors, such as family planning practice (Berelson and Freedman, 1964). Diffusion of innovation theory has previously been proposed as a basis for understanding and developing interventions within the substance misuse field (Ferrence, 1994). There is also evidence that the adoption of new drug trends follows patterns and processes that are consistent with general theory in this area (Golub and Johnson, 1996).

Diffusion of innovation theory identifies a classic S-shaped curve that describes the process by which a successful innovation is adopted. The theory provides a framework for understanding:

- The different social roles that are relevant to the diffusion process such as “innovator”; “early-adopter”; or “change-agent.”
- The innovation-decision process through which the adopter of a new drug would move, i.e., knowledge, persuasion, decision, implementation, and confirmation
- Attributes of innovations that affect the likelihood that they will be adopted, e.g., compatibility, trialability, and observability

Rogers (1995) also discussed various approaches that can be used to help predict the potential for adoption of an innovation. For example, extrapolating from the rate of adoption of similar innovations or investigating the acceptability of an innovation in its prediffusion stages. These suggest the basis for a framework within which fluctuations that may indicate the beginning of a larger trend could more systematically be assessed.

A preliminary task will be to improve the collection of *leading-edge indicators* to which diffusion of innovation theory can be applied. As well as guiding the assessment of data, diffusion theory may also provide a framework for identifying LEIs because of the way it specifies the relevant roles and conditions for adoption of an innovation. The eventual task would involve systematically mapping the theory onto drug use in order to answer questions such as:

- In which social spheres do we find innovators and early adopters of psychoactive substances?
- What communication systems and cultural reference points are relevant?

One of the few attempts to theorize drug trends has been produced by Johnston (1991), who discussed three phases of the North American drug

epidemic since the 1960s—expansion, maintenance, and decline. He proposed five conditions for the expansion of an epidemic:

1. Awareness of a drug and its psychoactive potential
2. Access. The drug must be available. In the case of illegal drugs, social/friendship networks are critically important sources
3. Motivation. The drug must hold some allure or promise such as satisfying curiosity, conferring status, symbolizing a rejection of adult values, etc.
4. Reassurance is necessary that the risks are acceptable and do not outweigh the benefits
5. Willingness to violate social norms, influenced by the perceived risks of a substance, peer approval, legal status of the drug, etc.

He also identified four public roles that influence these:

- a) Proponents, such as Timothy Leary
- b) Reassurers, such as academics/experts who publicly consider the safety of a drug, and drug licensing authorities who permit clinical use of the substance and signal that a drug is safe to some degree
- c) Public role models, such as individuals in the entertainment industry or sport who may exemplify positive and negative aspects of using a drug
- d) Antagonists, those who publicly oppose use of the substance and may have either a deterrent or an unintended endorsing effect, e.g., Richard Nixon who enabled antiestablishment values to be expressed through drug use

Resemblances between the conditions and roles identified in Johnston's formulation and diffusion of innovation theory are noteworthy, and give further reason to suppose that diffusion of innovation theory may provide a practical basis for assessing fluctuations in drug use.

Other than the occasional "natural experiment," such as the passing of new legislation, an experimental approach is not feasible for understanding many of the processes relevant to the further theorization of drug trends. The problems of studying hidden behavior greatly increase the difficulties for any empirical approach. Methodological developments that may eventually enhance our capacity to theorize drug trends concern the use of computer simulation. One way to view drug trends is to see them as emergent phenomena with a complex system, i.e., a *complexity theory* perspective. Although there is some tradition of using system dynamics models for the study of drug use (Homer 1993), the ability to study social processes using more computationally demanding multiagent models has recently increased. Epstein and Axtell's (1996) *sugarscape* provides an accessible illustration of

the use of this approach in the exploration of economic and epidemiological questions. Multiagent models are appropriate for the study of complex social systems (Gilbert and Doran, 1994; Gilbert and Conte, 1995). Such agent-based simulations allow bottom-up modeling using simulated societies and may prove to be a productive way of further developing theory to explain why and when new drug trends emerge.

INTEGRATED DRUG INFORMATION SYSTEM

It is easy to be either overly optimistic or pessimistic when addressing the question posed at the beginning of this paper: "Can drug information systems become more sensitive to changing drug consumption patterns?" Some commentators appear to suggest that new systems can be put in place that will allow policymakers to respond rapidly to potential drug problems before they emerge, while others would suggest that this is a task better suited to sages rather than scientists, and that investing resources in this area is unlikely to be productive.

Neither of these responses is adequate. While the concept of "early warning," when expressed in its crudest form, may be neither helpful to developing responses to changing drug consumption patterns nor sensitive to the methodological problems of working in this area, this does not mean that the sensitivity of information systems cannot be improved. This task is likely to be both challenging and time-consuming and, in this way, does not differ from other scientific endeavors concerned with understanding the nature of illicit drug consumption. Our purpose here has been to attempt to locate the policy-driven discussion on the need for more timely information systems within a broader conceptual framework of the role of the organization of data collection in this area. This approach leads us to the conclusion that what is required is an *integrated information system* in which data from different sources are collected and evaluated in an ongoing dialogue between information providers and consumers. The purpose of such a process is to identify not only what is known about the current consumption of illicit drug use, but also what information is required to support the future development of effective policy and interventions. Such an integrated information system will need to incorporate data from sources that are presently poorly developed. To criticize such data sources for their inherent weaknesses is to miss the point. Their task is to serve as an alarm bell that drug consumption patterns may be changing and thereby bring about both the collection of more structured data sets and discussions on what might be appropriate responses far earlier than is presently the case.

SELECTED GLOSSARY

Complexity Theory - A developing field of study that is concerned with understanding the way that higher level (macro) phenomena emerge from interactions of multiple, lower level (micro) elements of a system and their reciprocal effects.

Continuous Monitoring - Methodological approach of DIS which involves building up a data set over time by the continuous monitoring of data sources or reports from individuals or organizations responsible for monitoring some aspects of the illicit drug problem, e.g., treatment demand reporting, regular meeting of key informants, regular collection of predefined data types.

Diffusion of Innovation Theory - Theoretical descriptive model of how new "innovations" (products, ideas, etc.) spread through populations over time.

Drug Indicator or Indicator - Can be used to describe any data source on drug use together with a set of agreed rules for recording and reporting to measure drug-use prevalence or incidence. Typical indicators include; first treatment demand, all treatment demands, drug seizure, drug arrest, drug-related deaths, survey data, price and purity information, drug-related medical emergencies, etc. The term "indicator" is employed to emphasize the point that the data are not a direct measure of drug use in the general population. Thus, treatment demands may be indirectly related to wider patterns of drug use but cannot be assumed to directly represent the wider and unknown patterns of drug use found in society. Even probability surveys of the general population are considered indirect indicators of actual prevalence rates and corresponding patterns of use, as methodological problems inherent in their design do not allow data to be taken on face value.

Drug Information System (DIS) - Any system that seeks to understand patterns of drug use by analyzing data from one or more data sources. In simple terms, an information system consists of: a) data source(s), b) a system for the analysis and/or dissemination of data, c) data consumers.

Early Warning System (EWS) - Term commonly used without precision. For the purposes of this report it is taken as a drug information system (DIS) designed specifically for the purposes of identifying changes at an early stage only. There is a general assumption that attention is focused on changes that have implications for policy or interventions or other public health concerns. It may be focused on one particular drug-related concern such as HIV infection. The assumption that EWS are primarily

interested in changes that have some importance in terms of generating a response implies the analytical function of the DIS is a necessary contingent.

Early Warning Function (EWF) - While some drug information systems are dedicated to responding rapidly to changes in patterns of drug use (i.e., an EWS), this it does not necessarily imply that a broader DIS can not also incorporate this function as one part of its overall operational goals. In this model a DIS would have an "early warning function" without being a dedicated "early warning system."

Human Networks - Configured from a range of individuals or organizations represented by individuals. Members are chosen to bring either general or scientific knowledge or expertise to the DIS. In general, networks adopt an unstructured approach with flexible information flow. Different members bring information or analytical comment in accordance with their specific background or expertise

Lagged Indicator - Term used to describe an indicator that has a structural and pronounced time lag in terms of reporting drug incidence. Treatment demands are a classic lagged indicator as individuals typically consume illicit substance for several years before approaching treatment services. Data of treatment demands reflects incidence levels and therefore "new trends" occurring some years prior to their collection. Should be viewed as indicating a position on a continuum rather than an explicit category, and it may vary by drug type and geographical and temporal location.

Leading Edge Indicator (LEI) - Any indicator that can be considered particularly sensitive to change, i.e., those indicators that respond first to changes in drug consumption patterns (drug incidence). This sensitivity by definition is associated with volatility. As such, LEIs may be unreliable in the medium term if viewed in isolation from other data sources.

Multi-Indicator Model - Term used to describe a common method for modeling patterns of drug use that utilizes and contrasts two or more different indicators of drug consumption. It is assumed that the use of multiple indicators mitigates for the inadequacies of any individual indicator and that multiple indicators plotted over time therefore give a better picture of the underlying trend.

Operational Level of DIS - Geographical and political location of the information system, e.g., local information systems, city level systems, national and international systems. The level of the information system can be seen to correspond to the location of the information consumer whose needs the system serves. The majority of systems appear to be designed to work horizontally at one operational level. There is no inherent reason why this should be the case.

Outbreak Investigation Model - Conceptual model of proactive data collection method which seeks to collect information to confirm or refute reports (anecdotal or otherwise) of a significant change in drug consumption patterns by actively "investigating" what information is available which may include anecdotal accounts, secondary analysis of existing data, or dedicated research activity.

Trend - Movement in one direction of the values of a variable over a period of time (time series data). To be contrasted with "fluctuations" which are movements in time series data that are unrelated to a long-term trend. In regard to trends in drug consumption, this distinction may be subjective and context governed.

Trend Analysis - Descriptive rather than explanatory analysis that seeks to explain the observed movement in one or more sets of time series indicator data.

SOME USEFUL CONTACT INFORMATION

Antenna Drugs and Gambling
Dirk Korf
University of Amsterdam
Bonger Institute of Criminology
PO Box 1030, 1000 BA Amsterdam, Netherlands
E-mail: korf@jur.uva.nl

Canadian Community Epidemiology Network on Drug Use—CCENDU
Canadian Centre of Substance Abuse
75 Albert Street, Suite 300, Ottawa, ON K1P 5E7, Canada
Telephone: + +1 613 235-4018
FAX: + +1 613 235-8101
Website: www.ccsa.ca

Community Epidemiology Work Group—CEWG
National Institute on Drug Abuse
5600 Fishers Lane, Rockville, MD 20857, USA

Drug Abuse Warning Network—DAWN
SAMHSA Office of Applied Statistics
5600 Fishers Lane, Rockville, MD 20857, USA
3603 Lodgehaven Circle
Gainesville, GA 30506, USA
Website: www.samhsa.gov/oas/dawn

European Monitoring Centre for Drugs and Drug Addiction EMCDDA Reporting Network
Rua Cruz de Santa Apolonia 23/25
1100 Lisboa, Portugal

Illicit Drug Reporting System (Australia)
National Drug & Alcohol Research Centre
University of New South Wales
Sydney 2052, Australia
Telephone: + 61 2 9398 9333
FAX: + 61 2 9399 7143
E-mail: NDARC@unsw.edu.au

Inter-American Drug Abuse Control Commission CICAD Surveillance System in Central
America, Panama and the Dominican Republic
1889 F Street NW, Washington, DC 20006-4499, USA

International Epidemiology Work Group—IEWG
National Institute on Drug Abuse
5600 Fishers Lane, Rockville, MD 20857, USA

Maryland Drug Early Warning System
Website: www.cesar.umd.edu/dews

Multi City Network on Drug Misuse Trends (Europe)
Pompidou Group
Council of Europe
67075 Strasbourg cedex, France

Sistema Nacional de Informacion Sobre Drogas CONACE
National Council of Drug Control
Interior Ministry, Chile
Website: www.conace.cl

Outbreak Investigation Audit Model (UK)
Home Office
Police Research Group
50 Queen Anne's Gate, London SW1H 9AT, UK

Pulse Check (USA)
Office of National Drug Control Policy
750 17th Street NW, Eighth Floor, Washington, DC 20503, USA

South African Community Epidemiology Network on Drug Use—SACENDU
National Urbanisation & Health Research Programme, Medical Research Council
PO Box 19070
Tygerberg 7505, South Africa
Telephone: + + 27 21 938 0350
FAX: + + 27 21 938 0342
E-mail: mlowrie@eagle.mrc.ac.za
Website: www.mrc.ac.za/urban/mhsas1.htm

South East Asian Multi City Epidemiology Work Groups AMCEWG
National Centre for Drug Research
Universiti sains Malaysia
Penang, Malaysia

WHO: Rapid Assessment Methodology (World Health Organisation)
Programme on Substance Abuse
Division of Mental Health and Prevention of Substance Abuse
World Health Organisation
20 Avenue Appia, CH-1211 Geneva 27, Switzerland
Telephone: + + 41 22 791 21 11
FAX: + + 41 22 791 4851
E-mail: balla@who.ch

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THE AUTHORS

Paul Griffiths has worked at the national Addiction Centre in London since 1988. Research interests have included exploring patterns of drug use in community settings and factors associated with transitions in route of drug administration. Over the last 5 years he has been a UK representative to the Council of Europe (Pompidou Group), drug epidemiology group. Recent work has increasingly focused on drug epidemiological issues, such as exploring the use of amphetamine-type stimulants in the EU. He has acted as a consultant to both phases of the work of the joint Pompidou group/UNDCP project to develop a drug monitoring system in Central and Eastern Europe. In 1999 he joined the United Nations Drug Control Programme as senior epidemiologist.

Louisa Vingoe has a B.Sc. in Experimental Psychology from the University of Sussex, an M.Sc. in Psychology and Health from the University of Stirling, and an M.Sc. in Clinical and Public Health Aspects of Addiction from the Institute of Psychiatry, London. She has worked as a researcher at the National Addiction Centre in London since completing her studies. Research interests include psychological aspects of addiction, dual diagnosis, and drug epidemiology. Current research interests have included changing patterns of synthetic drug use in Europe, drug overdose, and evaluating the effectiveness of needle and syringe distribution schemes.

Neil Hunt is Research and Audit manager for Invicta Community Care NHS Trust, Kent, UK, and an Honorary Research Worker at the National Addiction Centre, Institute of Psychiatry. He is a Masters Graduate in Social Research and is currently studying for his Ph.D. (University of Surrey). His doctoral work involves the application of complexity theory to the modeling of drug trends using agent-based computer simulations of illicit drug consumption. He has managed and participated in a range of studies concerning the health of injecting drug users and young people's drug use. He has recently coauthored a comprehensive guide to harm reduction practice *The Safer Injecting Briefing*, Liverpool: HIT.

Jane Mounteney is Head of Research and Development at the Institute for the Study of Drug Dependence (ISDD), 32 Loman St., London SE1 OEE. She has been working in the field of drug policy research and development for the last 6 years. Particular research interests include drug education and prevention, social care plus the development of drug information, and early warning systems.

Richard Hartnoll studied psychology and philosophy at the Queens' College, Oxford, and subsequently criminology at the Institute of Criminology, Cambridge. He has worked as a researcher in the drug field since 1972, initially in London, and subsequently in Barcelona and Lisbon. His research interests cover a wide range of epidemiological methods and indicators at local, national, and international level as well as qualitative and quantitative studies of hidden populations, drug markets, drug policies, and interventions, including evaluations of heroin maintenance, help-seeking, and outreach. He is currently Head of the Department of Epidemiology at the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) in Lisbon.