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A Ratio Estimation Method for Determining the Prevalence of Cocaine Use

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This paper presents an approach to estimating the prevalence of cocaine use, based upon a new ratio estimation technique. This method can be applied to random samples of overlapping populations for which no sampling frames exist. When the ratio estimation method is applied to the two study samples (drawn from populations of people using cocaine and people using heroin) the ratio of cocaine users to heroin users (*C*/*H*) was 1.55, with a 95% confidence interval of ±0.48. Such estimates should be applied with caution. However, if used with reference to national estimates of about 75 000 heroin users, application of the present estimate suggests that there may be about 116 000 cocaine users in the UK.

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People who use illicit drugs are, for obvious reasons, a largely hidden population and it is difficult to obtain valid estimates of the size of this population. Various research methods have been used for this purpose. In the United States a national household survey is conducted regularly, providing valuable information about patterns and trends in drug taking. No such survey exists in the UK, where estimates are often based on data drawn from secondary indicator sources, institutional and professional authorities, and from indigenous informants (Wiebel, 1990). Among the secondary indicators used for such purposes are admission records from casualty departments, coroners' reports, the Home Office Addicts Index, treatment admissions for drug dependence, prescription tracking systems, data on arrests and seizures, and laboratory analyses of controlled substances (Ghodse, 1977; Hartnoll *et al*, 1985; Das Gupta, 1990).

Estimates using a 'capture–recapture' method (Andima *et al*, 1973) have been made in the UK by Hartnoll *et al* (1985). This is one method which can appropriately be used when no sampling frame exists, though it does presume the availability of at least two independent samples of the same hidden population. While the capture–recapture method has provided useful information for the development of services, the true independence of the samples that have been used (e.g. arrest and treatment samples) is doubtful – as the authors themselves acknowledge.

Opiate abuse has been more widely investigated than other forms of illict drug use, and estimates of the scale of opiate use are available and are frequently cited (Advisory Council on the Misuse of Drugs, 1988; Gossop & Grant, 1990).

Cocaine has recently become more widely available in the UK, as in many other countries. This can be inferred from the increases in seizures of cocaine by police and by customs and excise, while street prices and purity have remained largely unchanged (Strang *et al*, 1993). UK customs seizures increased from 27 kg in 1981 to 1078 kg in 1991, and 2250 kg in 1992. There has also been more awareness of the social, psychological and health problems associated with cocaine (Gossop, 1987; Strang & Edwards, 1989). However, despite concern about cocaine, no satisfactory estimates are available regarding the prevalence of cocaine abuse in the UK. The figures on opiate addiction in the Home Office Addicts Index provide a useful (albeit imperfect) indicator of the extent of the problem, but notifications of cocaine addiction to the Addicts Index are so infrequent as to be of little use in estimating the prevalence of the use of this drug; cocaine is identified as the drug of addiction for only 5% of current notifications to the Home Office.

The ratio estimation method

In this paper we present an approach to estimating the prevalence of cocaine use which is based upon a new ratio estimation technique. This method can be applied to random samples of overlapping populations for which no sampling frames exist. In the present demonstration of the method, our two samples are drawn from populations of people using cocaine and people using heroin.

We wish to obtain an estimate of the prevalence of the use of one drug (cocaine). If the number of people who use a particular drug (in this case, heroin) can be estimated, and if some people use both of these drugs (i.e. overlapping populations), then the relative prevalence of cocaine use may be estimated by obtaining a random sample of heroin users, another random sample of cocaine users, and using the proportion of each sample who use either one or both of these drugs as a basis for inferring the size of the unknown population using the drug (cocaine).

The ratio of cocaine users to heroin users [C/H] in the general population may be calculated as follows:

$$\left[\frac{H_C}{H}\right]\times\left[\frac{C}{C_H}\right]=\frac{C}{H}$$

because $H_C = C_H$ where H is the number of people using heroin; C is the number of people using cocaine; H_C is the number of heroin users who use cocaine and is equal to C_H, the number of cocaine users who use heroin. To estimate C/H, two independent samples are used; H_C/H is estimated from one, and C/C_H from the other.

A ratio estimate of cocaine prevalence

Two samples of drug users were recruited on the basis of their current use of either heroin or cocaine. In the absence of sampling frames, these were obtained by means of contact methods, and were intended to approximate simple random samples. The samples comprised 408 heroin users and 150 cocaine users. The difference in sample sizes was due to funding restriction and not to the relative difficulty of recruiting one or other group of drug users. Both samples are sufficiently large to permit reasonable confidence in the application of the method and the difference in sample sizes does not affect the validity of the calculation.

These subjects were recruited in a wide range of settings in the south London area. Subjects were approached and interviewed by Privileged Access Interview (PAI) teams. Interviewers were recruited for their ability to obtain access to a broad sweep of drug users in a local community. Information was collected by means of a structured interview which was constructed for the purposes of this study and all interviewers were trained to administer the instrument. All interviews were tape recorded and checked for reliability and validity.

In the heroin sample of the 408 users, 385 had used heroin during the previous month and 143 of these had also used cocaine in the previous month. In the cocaine sample, of the 150 people who had used cocaine in the previous month 36 had also used heroin in the previous month. When the ratio estimation formula is applied to our heroin sample (H) and our cocaine sample (C), we obtain the following result:

$$\frac{143}{385}\times\frac{150}{36}=1.55$$

Therefore, when the ratio estimation method is applied to the two samples obtained in this study the ratio of cocaine users to heroin users $C/H = 1.55$. The variance of the ratio estimate (obtained by the standard formula for the variance of a ratio of two proportions) is 0.061, and the 95% confidence interval for the ratio is ± 0.48.

Mean ages were 28 years for the heroin sample and 27 years for the cocaine sample. The majority of subjects in both samples were men (62% of those using heroin and 58% of those using cocaine). People using cocaine were more likely to be in employment at the time of the interview (43%) compared with those using heroin (24%). The mean age for first use of heroin among those in the heroin sample was 19, and the mean age for first use of cocaine among those in the cocaine sample was 20. The people using heroin were more likely to have had some contact with a drug treatment service (58% compared with 25%) and to be currently in treatment (50% compared with 21%). There were no differences in these demographic and drug-using variables between the two subsamples who were using *both* heroin and cocaine. There was no significant difference between these subsamples in terms of percentage of subjects who had *ever* attended a drug treatment service: drug clinic

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(52% H_C; 53% C_H); street agency (50% H_C; 52% C_H); needle exchange (61% H_C; 51% C_H), nor in terms of *current* attendance at any drug treatment agency (55% H_C; 56% C_H).

Discussion

The main purpose of this paper is to describe a new method of estimating the prevalence of illicit drug use. A separate but equally interesting issue involves the application of this ratio estimation method to two samples of drug users in order to obtain a specific prevalence ratio for cocaine users. The ratio estimation method can be used in this way with samples of users of any two drugs where overlapping use occurs. Where the prevalence of one of the drugs is known or can be estimated, prevalence estimates can be made for the second drug.

The validity of this method requires that the two samples should be as representative as possible of their respective populations. The samples should be drawn from a broad range of different heroin- and cocaine-using groups in order that they should approach as closely as possible random samples. In particular, subjects should be representative of the full spectrum of users of that drug and not merely the more problematic or dependent users (who may be more easily accessible). Sampling procedures should certainly avoid reliance upon agency samples, since such subjects are known to be more likely to use opiates, to be more severely dependent, or to have other problems. These requirements imply that the drug users who fall into the 'overlap' category, using both heroin and cocaine (H_C and C_H), should be comparable in terms of their demographic characteristics and patterns of drug taking. Where significant differences are found between the characteristics of these two sub-samples, this would suggest that at least one of the samples had not been randomly sampled, and this would therefore raise serious doubt about the validity of the ratio estimate.

In the present application of the ratio estimation method, both of these requirements have been met. Subjects were drawn from many different settings; the majority were not in contact with any treatment agency, and many had never attended any treatment agency. The two sub-samples (those using both heroin and cocaine) are similar in terms of demographics, drug-taking patterns, and treatment attendance, and may be regarded as two random samples of the same group (users of both heroin and cocaine).

The results obtained from this application of the ratio estimation method suggest that there may be about 50% more cocaine users than heroin users. In the absence of any such previous calculations, this ratio estimate provides a good starting point for discussion of the prevalence of cocaine use in the UK. There are, however, several reasons to exercise caution in interpreting this result. Firstly, even the most carefully planned research procedure can only be expected to achieve an approximation to a truly representative sample. The best that the researcher can do is seek to avoid the important and known biases. The application of this method to other samples may be expected to produce a range of results. It is through the compilation of repeated estimates that the overall picture will emerge.

The two samples used in the present calculation were drawn from south London and this ratio estimate is, therefore, most appropriate to the estimation of cocaine prevalence in the south London or greater London area. There is known to be considerable geographical variation in drug distribution and drug-taking patterns in the UK, and this estimate should be applied with caution to the country as a whole. However, if this ratio estimate is applied to the generally accepted national figure of at least 75 000 heroin users (Advisory Council on the Misuse of Drugs, 1988; Gossop & Grant, 1990) our results suggest that there are about 116 000 cocaine users. Taking into account the 95% confidence interval, we infer that there may be from 80 000–152 000 cocaine users in the UK.

Methodological concerns may be raised about the specific samples used in any such calculation. However, the use of the ratio estimation *method* remains generally valid. It provides an interesting and low-resource method of estimating the size of otherwise hidden drug-using populations. In the absence of any existing figures for cocaine use in the UK, our present calculation provides a useful starting point for discussion.

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Cannabis Consumption as a Prognostic Factor in Schizophrenia

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Data were analysed from 62 schizophrenic patients between 18 and 30 years of age, treated at the community mental health centres in Navarra, who had relapsed and then completed a one-year follow-up study. Factors influencing the course of illness during follow-up were: continuing cannabis consumption; previous cannabis intake; non-compliance with treatment; and stress.

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Many authors have described a higher drug consumption by psychiatric patients compared with the overall population. Excluding alcohol and tobacco, cannabis is the drug most frequently used by patients with psychiatric disorders (Shearn & Fitz, 1972). Moreover, a greater consumption of cannabis has been observed in schizophrenic patients compared with other psychiatric patients (Tsuang *et al*, 1982).

In a study of relapse of schizophrenia, Herz & Melville (1980) found that 20% of all schizophrenic patients had abused alcohol or other drugs. Barbee *et al* (1989) found that almost 50% of schizophrenic patients admitted to the emergency department of a general hospital had abused alcohol or other drugs, mainly cannabis. Brady & Gasto (1989) reported a 36% incidence of drug abuse in a study performed with 35 in-patients with acute psychotic symptoms, of whom 25% were schizophrenic.

There is controversy over the aetiological role of cannabis in schizophrenia (Andreasson *et al*, 1989; Negrete, 1989), while there is more agreement on the effect of cannabis on an existing psychosis (as a precipitant of relapse, or aggravating or modifying symptoms) (Knudsen & Vilmar, 1984; Negrete *et al*, 1986; Negrete, 1989; Turner & Tsuang, 1990). Three possible mechanisms are suggested:

(a) symptom exacerbation by direct effect on mental processes
(b) development of a toxic psychosis overlapping with schizophrenic symptoms
(c) neutralisation of antipsychotic medication because of central dopaminergic and anti-cholinergic effects of cannabis.

This study assesses the importance of cannabis consumption as a short-term prognostic factor in schizophrenia.

Method

The inclusion criteria were: a diagnosis of schizophrenia and a relapse fulfilling DSM-III criteria (American Psychiatric Association, 1980) in the study period; age at onset over 16 years; and present age between 18 and 30 years. The presence of residual schizophrenia (DSM-III) was an exclusion criterion.