Prevalence of problematic and injecting drug use for Drug Action Team areas in England

Martin Frisher, Heath Heatlie and Mathew Hickman

Abstract

Background National and local monitoring of policies on illicit drug use requires information on the number of problematic drug users in a country. This article reports the findings from a study that estimated the number of problematic and injecting drug users for all Drug Action Teams (DATs) in England for 2001.

Methods The Multiple Indicator Method (MIM) is a statistical technique for using aggregated data to estimate numbers of drug users across a large number of areas. The MIM was used to combine eight indicators available for all DATs, with prevalence estimates available from a small number of DATs. The indicators were drug possession and supply offences, arrest referrals, people recorded in drug treatment databases, methadone prescriptions, drug-related hospital episodes, drug-related deaths and DATs’ Townsend score. The latter is a measure of material deprivation. A three-stage process involved, (i) factor analysis of the drug indicators, (ii) regression linking factor scores to known prevalence estimates and (iii) imputation of estimates to all other DATs.

Results Factor analysis yielded two statistically significant factors underlying the drug indicators in 150 DATs in England. The estimated prevalence rate of problematic drug use in the DATs varied from 0.2 to 1.5 per cent of the population. The estimated average number of problematic drug users per DAT was 1943 (standard deviation = 1300). The estimated average number of injecting drug users per DAT was 627 (standard deviation = 572). The estimates for England in 2001 were 287 670 (population rate = 0.64 per cent) problem drug users, and 93 185 (population rate = 0.23 per cent) injecting drug users.

Conclusions Although the model cannot take account of specific local factors, the results are likely to be accurate in areas that do not have these idiosyncrasies. The estimated prevalence figures provide a basis for all DATs to assess their contact rates with problematic and injecting drug users.

Keywords: prevalence, drug dependence, data analysis, statistical, regional health planning, spatial distribution

Introduction

Estimates of the prevalence of problem drug use in the UK are a key piece of evidence for monitoring of the national drug strategy.1 Before this study, few Drug Action Teams (DATs) had estimates for their area. Without this information, DATs are unable to assess whether they are meeting the national target for drug users in drug treatment programmes. The target is to increase participation by 55 per cent by 2004 and 100 per cent by 2008, compared to a 1998/99 baseline. Although population surveys conducted in private households have been used to estimate levels of drug use, they are likely to under-represent problematic and injecting drug use for a variety of reasons. People who are problematic drug users may be less likely to (a) live in households that are sampled by population surveys, (b) respond to population surveys or (c) self-report use of drugs that are perceived to be considered to be problematic.2

In 1998, a study commissioned by The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) concluded that the Multiple Indicator Method (MIM) was a potentially valid method for estimating the prevalence of illicit drug use.3 In contrast to surveying a population about their experience of drug use, the MIM is a form of synthetic estimation, which has been widely used in the United States since the 1970s.4 Synthetic estimation aims to determine the relationship (usually linear) between a drug indicator (e.g. drug-related deaths) and the number of known problem drug users (prevalence). The latter is usually derived from overlaps between individuals appearing on three or more lists of known drug users. When this relationship is established in a number of areas where prevalence is known (anchor points), it can be transferred to other areas where only the indicators are available to impute the number of problem drug users. In synthetic estimation, estimates have been derived using a single estimate and indicator. For example, the number of opiate users in Australia were imputed from information prevalence of opiate use in New South Wales, and the number and proportion of overdose deaths in New South Wales and the rest of

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The MIM seeks to analyse the relationship between numerous drug indicators before establishing the relationship with known prevalence estimates in several anchor point areas.

The MIM has previously been used to produce prevalence estimates for the UK, France and Italy. For the UK study, estimates were obtained for 1996 but only by Regional Health Authority areas and with anchor point estimates that did not have a uniform definition. This study is more ambitious in seeking to estimate prevalence for the 149 DATs in England based on uniformly defined anchor points.

Method

The MIM consists of the following steps.

- Obtain a range of indicators of problem drug use for all DAT areas.
- Obtain estimates of the number of problematic and injecting drug users in selected areas (the anchor points areas). Prevalence estimates were obtained for 2001 and 2002.
- Obtain estimates of the number of problematic and injecting drug users in 2001 for 23 English DATs. Through pilot studies funded by the Home Office and for sites selected on the basis that it was likely that there was a large enough population of problem drug users to estimate, and three or more large data sources (N > 100) were available for the indirect estimation.
- Convert indicators and prevalence estimates into rates per 100 000 population and then standardize (i.e. divide the difference between the value and the mean by the standard deviation) in order that each variable has equal weighting in the analysis.
- Use principal component methods to determine the number of factors underlying the indicator correlation matrix.
- Regress the factor scores on the prevalence estimates using least squares estimation for the anchor areas, and apply the regression equation to the areas without prevalence estimates.

Drug indicators

The primary data source for drug indicators was the UK Home Office that at the time of this study collated DAT data using a standard template. From the template, three indicators were obtained: (i) number of offences involving possession of controlled drugs; (ii) number of offences involving supply of controlled drugs; (iii) number of adults entering drug treatment services.

An additional DAT indicator, arrest referrals, (iv) was obtained from the Home Office for the period April 2001 to March 2002. Arrest referral is a scheme conducted in police custody suites from the Home Office that at the time of this study collated DAT data using a standard template. From the template, three indicators were obtained for 2001 were available for 23 English DATs, through pilot studies funded by the Home Office and for sites selected on the basis that it was likely that there was a large enough population of problem drug users to estimate, and three or more large data sources (N > 100) were available for the indirect estimation.

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Hospital Episode Statistics (HES) data were obtained on all patients admitted to hospital (as either a day case or as an ordinary admission) with a primary diagnosis of substance use (ICD-10: F11–F19) (v). Drug-related deaths (vi) were provided by the Office of National Statistics based on their analysis of death certificates. Townsend scores (vii), which is an index of material deprivation, were derived for all DATs. The final indicator was the number of methadone prescriptions dispensed from community pharmacies (viii) based on Prescription Pricing Authority (PPA), Prescribing Analysis and Cost (PACT) data from April 2001 to March 2002.

Cross-area estimation

The primary geographical unit for this study is the DAT. However, a problem with using these areas for investigation is that some useful data sources relate to geographical areas that are not coterminous with DAT areas. The use of a Geographical Information System (GIS) can be used to overcome this problem. The technique used is referred to as ‘cross-area estimation’. This technique converts one set of area unit data to apply to another set. Cross-area estimation therefore allows data from areas that are non-coterminous areas to DATs to be reaggregated by DATs. In this study, cross-area estimation was only used for the volume of prescribed methadone. These data are available for primary care trust (PCT) areas that are generally smaller than DATs.

Missing data

There were no missing data for four of the eight indicators. For arrest referrals, there were no data for three DATs, for adults in treatment there were no data for 31 DATs, for supply of controlled drugs there were no data for 16 DATs and for possession of controlled drugs there were no data for 14 DATs. Missing data points were replaced by the national average of each indicator for the analysis.

Prevalence estimates in anchor point areas

Prevalence estimates for problematic and injecting drug users in 2001 were available for 23 English DATs. All estimates were derived using the capture–recapture method (CRM). The definitions of drug use in all of these CRM studies and therefore for the estimates in this study are

Problematic drug user: Someone who has injected any drug in the previous 4 weeks.

Problematic drug user: Someone who has injected (any drug) or used an opiate, or used a benzodiazepine or used crack-cocaine. All drugs refer to illicit use within the previous 4 weeks.

Factor analysis

Factor analysis aims to identify underlying factors that explain the pattern of correlations within a set of observed variables. Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of manifest variables. In this study, the principal components method was used to form linear combinations of the observed variables. The first principal component is the combination that accounts for the largest amount of variance in the sample. Successive components explain progressively smaller portions of the total sample variance and all are uncorrelated with each other. To decide how
many factors are needed to represent the data, reference is made
to the Eigenvalue. (The Eigenvalue is the variance explained by
a factor.) One good rule of thumb for determining the number
of factors is the ‘Eigenvalue greater than 1’ criteria. Where fac-
tors are identified, it is up to the researchers to decide what this
factor actually represents. To obtain factor scores for each
DAT, missing values were replaced by the variable mean. The
analysis was conducted using SPSS.

Regression analysis

All 149 DATs in England were entered into the analysis (City
of London and Hackney were combined into a single unit
because of the small size of the City DAT). The independent
variables were factor 1 and factor 2, and the dependent varia-
tives were the standardized prevalence estimates in anchor point
areas for (i) problematic drug use and (ii) injecting drug use.
The goodness of fit was measured by $R^2$ which is the variance
in the anchor points explained by the independent variables
(factors 1 and 2).

Confidence intervals

The issue of statistical confidence intervals has hampered drug
prevalence estimation studies. Further, the uncertainty expressed
in the confidence interval only refers to statistical uncertainty. De
Angelis and Hickman have shown that for one form of indirect
estimation model, uncertainty can be far greater than statistical
uncertainty. Based on the available data (i.e. factor scores and
anchor point estimates), the regression analysis provides an
estimate of how the factor scores relate to prevalence in all areas.
Based on the sample estimates, a range of values were calculated,
that within a designated likelihood, include the true population
value. The dispersal of the anchor point estimates in relation to
the MIM estimates result in fairly wide confidence intervals, par-
ticularly for injecting drug use. For the current analysis, 50 and
90 per cent confidence intervals are provided. Although these
intervals are wide, it is also important to recognize that before
this study the vast majority of DATs had no estimate of prob-
lematic or injecting drug use. The figures provided here therefore
represent a considerable advance on prior knowledge, and at this
stage, it may be prudent to use the mean estimates for each DAT.

Maps of problematic and injecting drug use

Each spatial unit is filled with a shade that represents the data
for that area. The maps shown here have used a graduated
shade, the lighter colours represent lower values, whereas the
darker shades represent higher values. Maps have been pro-
tuced to show both absolute numbers and the prevalence. The
maps here have used the equal interval method, which given
that drug misuse prevalence is negatively skewed, emphasize the
smaller number of DATs with high prevalence data compared to
the low prevalence areas.

Results

As anticipated, many of indicators were significantly asso-
ciated ($p < .05$) with each other. Table 1 summarizes, for
example, that drug possession offences were significantly
associated with supply offences, arrest referrals, people receiv-
ing drug treatment, DAT Townsend score and drug-related
deaths. From the pattern of correlations summarized in Table
1, factor analysis indicated that there were two factors associ-
ated with the drug indicators (both with Eigenvalues >1). Fac-
tor 1 (accounting for 38 per cent of the variance) was related
to criminal justice indicators as well as Townsend score and
drug treatment. The second factor (accounting for 14 per cent
of the variance) related to hospital episodes, methadone and
deaths.

Using factors 1 and 2 as predictor variables, the regression
model explained 32 per cent of the variance for the problematic
anchor points and 70 per cent for the injecting anchor points.
While Fig. 1 shows that there is a reasonable association between
the factors and the anchor point estimates in most areas, there
were also a number of outliers. London (point 1) and Manches-
ter (point 5) have much higher observed prevalence (derived
from the capture–recapture studies) than would be anticipated
from their factor scores, whereas Liverpool (point 4) and Trafford

| Table 1 | Correlations between drug indicators in 149 Drug Action Teams (DATs) |
|------------------------|------------------------|------------------------|
| High loadings on factor 1 | High loadings on factor 2 | |
| Possession offences | Supply offences | Arrest referrals | People in drug treatment | Townsend score | Methadone prescriptions | Hospital episodes | Deaths |
| 1 | 0.64 | 0.44 | 0.48 | 0.29 | 0.15 | 0.07 | 0.18 |
| Supply offences | 0.64 | 1 | 0.36 | 0.43 | 0.36 | 0.39 | 0.15 | 0.30 |
| Arrest referrals | 0.44 | 0.36 | 1 | 0.47 | 0.33 | 0.21 | 0.10 | 0.26 |
| People in drug treatment | 0.48 | 0.43 | 0.47 | 1 | 0.49 | 0.23 | 0.10 | 0.29 |
| Townsend score | 0.29 | 0.36 | 0.33 | 0.49 | 1 | 0.25 | 0.16 | 0.23 |
| Methadone prescriptions | 0.15 | 0.39 | 0.21 | 0.23 | 0.25 | 1 | 0.14 | 0.22 |
| In-patient hospital episodes | 0.07 | 0.15 | 0.10 | 0.10 | 0.16 | 0.14 | 1 | 0.21 |
| Drug-related deaths | 0.18 | 0.30 | 0.26 | 0.29 | 0.23 | 0.22 | 0.21 | 1 |

Values in boldface type indicate $p < .05$. 

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point 11) have much lower observed prevalence than would be anticipated from their factor scores.

These data mean that MIM estimates may vary from the anchor points where factor scores are lower or higher than might be anticipated from the known prevalence data.

In view of the large number of DATs, MIM estimates, factor and indicator scores were divided into ten deciles. Those in decile 1 have scores in the lowest 10 per cent, those in decile 10 have estimates in the highest 10 per cent. Table 2 shows that although each DAT is assigned to a particular decile for problematic drug use, they may vary considerably in terms of individual indicators. In decile 1, for example, Bracknell Forest has one of the lowest rates of problematic drug use in England. This is reflected in the low level of hospital episodes (decile 1) and methadone prescribing (decile 2), but in this area there were a relatively high level of drug supply offences (decile 6) and drug possession offences (decile 8). Numbers of problematic and injecting drug users are displayed in the maps shown in Figs 2 and 3. Equivalent graphs for prevalence rates are available on request from the authors.

The average number of estimated problematic drug users per DAT is 1943 (standard deviation = 1300), therefore, 68 per cent

Figure 1 Relationship between anchor point prevalence estimates (x axis) and Multiple Indicator Method (MIM) problematic drug-use estimates (y axis).

Table 2 Sample Drug Action Team (DAT) data from each of the 10 deciles of problematic drug use (rate per 100 000)

<table>
<thead>
<tr>
<th>Name</th>
<th>Problematic rate: decile</th>
<th>Injecting rate: decile</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Possession</th>
<th>Supply</th>
<th>Arrest referral</th>
<th>People in drug treatment</th>
<th>Townsend score</th>
<th>Deaths</th>
<th>HES</th>
<th>Methadone prescriptions</th>
</tr>
</thead>
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<tr>
<td>Bracknell Forest</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>8</td>
<td>6</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>–</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Harrow</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Thurrock</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>3</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Dorset</td>
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<td>1</td>
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<td>1</td>
<td>1</td>
<td>7</td>
<td>1</td>
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<tr>
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<td>5</td>
<td>8</td>
<td>2</td>
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<td>9</td>
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<tr>
<td>Calderdale</td>
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<td>8</td>
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<tr>
<td>Torbay</td>
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<td>9</td>
<td>9</td>
<td>9</td>
<td>3</td>
<td>10</td>
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<td>Bath and Somerset</td>
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<td>7</td>
<td>8</td>
<td>7</td>
<td>–</td>
<td>5</td>
<td>7</td>
<td>1</td>
<td>9</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Kingston on Hull</td>
<td>9</td>
<td>9</td>
<td>7</td>
<td>10</td>
<td>6</td>
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<td>3</td>
<td>–</td>
<td>9</td>
<td>9</td>
<td>3</td>
<td>10</td>
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<tr>
<td>Rochdale</td>
<td>10</td>
<td>10</td>
<td>2</td>
<td>10</td>
<td>4</td>
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<td>3</td>
<td>7</td>
<td>8</td>
<td>10</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

– , represents missing data; HES, Hospital Episode Statistics
The estimated number of problematic drug users for England in 2001 was 287,670 (0.6 per cent of the total population (TP); 1.1 per cent aged 15–54). The 90 and 50 per cent confidence intervals for problem drug use are 174,117–401,224 (0.4–0.9 per cent TP; 0.7–1.6 per cent aged 15–54) and 244,140–331,201 (0.5–0.7 per cent TP; 1–1.3 per cent aged 15–54).

The estimated number of injecting drug users for England in 2001 was 93,185 (0.2 per cent of the TP; 0.4 per cent aged 15–54). The 90 and 50 per cent confidence intervals for injecting drug use are 21,372–164,333 (0.05–0.35 per cent TP; 0.08–0.64 per cent aged 15–54) and 65,253–120,452 (0.14–0.26 per cent TP; 0.25–0.47 per cent aged 15–54).

Discussion

Main finding of this study

Factor analyses indicated that two factors were associated with the eight drug indicators that were used in the MIM estimation procedure. The regression model explained 32 per cent of the variance for the problematic anchor points and 70 per cent for the injecting anchor points. Based on the relationships identified in the anchor point areas, the MIM indicates that the number of problematic/injecting drug users for England in 2001...
was 287,670/93,185. The average number of estimated problematic/injecting drug users per DAT is 1943/627.

**What is already known on this topic**

Before this study, few DATs had estimates for their area. In 1996, the MIM was used in England, but estimates were only obtained for Regional Health Authority areas and with anchor point estimates that did not have a uniform definition.7

**Limitations of this study**

The anchor points are themselves estimates each with their own uncertainty. If there are errors in the anchor points, these will be reflected in the MIM estimates. The key assumption of the MIM is that the relationship between prevalence and the predictors in the calibration sample is transferable to all other areas. In this study, the association between the indicators and number of problem drug users is limited as all the prevalence estimates came from urban areas. We recognize that in some areas the relationship between drug indicators and prevalence may not fit the general pattern, and these estimates need to be interpreted cautiously and ideally corroborated with local data.

Another limitation of this study is that the types of drug use estimated were not drug specific. Future studies may be able to take advantage of developments in the recording of criminal justice and treatment contacts with drug users. As these contacts now often record the specific drug involved, it should be possible to develop drug-specific estimates using the MIM. This would, however, require some local estimates, using capture-recapture or other methods, of these types of drug use.

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**Figure 3** Estimated number of injecting drug users in English Drug Action Teams (DATs), 2001, based on the F12 Multiple Indicator Method (MIM) model.
What this study adds

This study drew on an extensive data set to estimate the prevalence of problematic and injecting drug use for all DATs in England. The study utilized anchor point estimates from 13 areas and drug indicator data from a wide variety of sources. The regression models based on two factors, derived from factor analysis, accounted for 32 and 70 per cent of the variance of problematic and injecting drug use estimates, respectively. The fact that the injecting estimates have a higher correlation with the indicators may reflect the fact that many indicators more closely reflect more severe forms of drug use. An advantage of using the factor scores is that they eliminate some of the random variability in the indicators.

The MIM can be used to update reports using existing surveillance systems without the need for extensive new data collection to estimate prevalence on each occasion, at least over a 1- or 2-year period. To improve the precision of the MIM an expanded number of local prevalence estimation estimates for anchor points from a wider range of rural and urban geographical areas would be desirable. In relation to England, the DAT level estimates afford an opportunity for policy makers to assess the degree to which drug users are engaged with treatment services and the criminal justice system.

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