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# Assessing Hidden Problematic Drug Use in The North West of England

## Capture - Recapture Analysis

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In addition to national systems for monitoring problematic drug use, the North West has developed a series of new drug databases for enhanced surveillance (Birtles and Bellis, 2000; University of Manchester and Liverpool John Moores University, 2000; Hardi, Hounscome and Bellis, 2000). These extend monitoring of use beyond specialist treatment services to include users of low threshold services (e.g. syringe exchange schemes) and contacts with judicial agencies such as police, probation and prisons. Alone, these systems cannot measure the total number of problematic drug users resident in any area. However, by using capture-recapture techniques here we have used enhanced surveillance data to estimate the total number of problematic users across a range of North West areas. Results suggest disproportionate concentrations of problematic drug users in large metropolitan areas (e.g. Liverpool and Manchester) with rates as high as 33 and 37 per 1,000 population respectively (ages 15-44). Levels of use are considerably higher in males (overall 44 per 1,000 males c.v. 12 per 1,000 females; age 15-44). However, when considering younger problematic users (15-24) a different picture emerges. Areas such as Bolton and Sefton have lower overall levels of problematic drug use than nearby Manchester and Liverpool but have equal or higher rates of problematic use in the younger age groups. A possible explanation for this includes a longer history of drug use in the metropolitan areas with newer epidemics in surrounding areas, consistent with observations regarding relative incidence of problem drug use (Millar, 1999; Millar et al., 2000). Overall measures of problematic use in the North West are essential for targeting existing services, planning new services and monitoring progress with the national drugs strategy. This study helps highlight the scale of treatment provision needed to accommodate initiatives which direct drug users away from judicial systems and towards specialist treatment.

## INTRODUCTION

In April 1998, the British Government published its ten year anti-drug strategy *Tackling Drugs to Build a Better Britain*. Importantly, the strategy outlined a strong focus on treatment and prevention, in contrast to a previously more punitive response to drug use problems. The four key elements of the strategy are: to reduce the proportion of young people taking drugs, protect communities from the consequences of drugs, enable problematic drug users to access treatment and reduce the availability of drugs on the streets (Department of Health, 1998). However, identifying the effectiveness of the strategy requires epidemiological information on drug use beyond that currently collected by national and regional drug monitoring systems. For instance, a key objective of the strategy is to *reduce the proportion of people under 25 reporting use of illegal drugs in the last month and previous year*. Monitoring this proportion requires measuring not only the number of young people in contact with drug services but also the number using drugs throughout the community. Here, we make use of data modelling techniques (capture-recapture: Cormack, 1989) and enhanced drug surveillance systems (developed in the North West) to access the full extent of problematic drug use in selected North West Health/Local Authorities.

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## Basic National Monitoring

In 1990-1991, the Department of Health established the National Drug Misuse Database (DMD) to record the number of individuals contacting health services and requiring treatment for problematic drug use (Donmall, 1990). This system was designed to measure new treatment demands, hence data include only those individuals who are either new contacts to services or who re-contact services after a break of at least six months and has been validated in the North West (Crabbe et al., 1999). Consequently, DMD underestimates the total number of individuals attending services and does not measure drug use in the wider population. However, the DMD constitutes the only national drug database currently available and, as it collects unique client identifiers (initials, date of birth, sex and geographical location), DMD data can be combined with other data sources to provide a fuller picture of drug use. A new national DMD will be launched in 2001, which will provide measures of treatment prevalence and treatment outcome and will include additional modules to gather data from alternative sources, such as syringe exchange schemes (Donmall et al., 2000).

## Enhanced Monitoring Systems

To address some of the shortfalls in the national monitoring system Health Authorities in the North West have commissioned enhanced drug monitoring systems. Merseyside and Cheshire in 1996 established the Prevalence and Outcomes database to record (on a calendar year basis) all individuals in contact with drug services, the treatment each person received and the outcomes of the treatment (Birtles and Bellis, 2000). This complemented existing additional data-sets already monitoring drug users contacting pharmacy and agency based syringe exchange schemes. In 1997 the Merseyside Inter-Agency Database was established adding data on drug users in prison, on probation or individuals arrested for drug related crimes to the total data-set. As a result, in 1998 instead of information on 2,725 individuals from the DMD for Merseyside and Cheshire, epidemiological information was actually available on 7,835 individuals for the same time period (Birtles and Bellis, 1999).

In Greater Manchester, Lancashire and South Cumbria, DMD treatment data on drug misuse have also been complemented with information from other sources. Information on offenders with drug problems, irrespective of offence type, have been provided by police surgeons in parts of Greater Manchester since the system's inception. In 1992 and 1994 respectively, epidemiological data on attendees at syringe exchange schemes and similar information on drug users arriving at local prisons was added to routine DMD data collection. In partnership with Greater Manchester Probation Service (GMPS), these data-sets have been combined with offender data-sets on drug misuse, derived from pre-sentence reports since 1993 (Millar and McFarlane,

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1998). As a result, the combined monitoring systems in the North West provide some of the most comprehensive data on drug users contacting, not just specialist drug agencies, but also a variety of judicial services and low threshold services. These data still fall short of measuring the total population of problematic drug users resident in each Health Authority. However, modelling techniques for combining these different databases now allow estimates of the total number of problematic drug users (in and out of contact with services) to be made.

### **Capture-Recapture Analysis**

Capture-recapture (CR) analysis enables an estimation of the number of individuals within a given population in situations where it is often impossible to conduct a straightforward count. The methodology was originally applied to animal studies (Begon, 1979) but more recently the technique has been used to estimate the size of human populations with conditions such as diabetes (Ismail et al., 1999), whooping cough (Devine et al., 1998), tuberculosis (Tocque et al., unpublished) and drug misuse (Squire et al., 1995; Bloor et al., 1991; Hickman et al., 1999). For people, the technique requires multiple databases all potentially capable of capturing (i.e. recording) the same individuals suffering from the same condition. The pattern of overlap between databases can, using log-linear modelling (Cormack, 1989), be used to estimate the additional number of individuals with that condition who do not appear on any of the databases. Usually, estimating the size of the drug-using population is no easy task with the illegality and stigmatisation of drugs demanding covert use. Consequently, CR is ideally suited to, and has been applied successfully to, the study of this population (Hay and McKeganey, 1996).

Using the enhanced databases developed in the North West it is now possible to undertake CR for certain Health/Local Authorities. Overlap (i.e. the same individual appearing on more than one database) can be calculated as all data systems record initials, dates of birth, sex and some geographical information for each drug user. The CR analysis can then be undertaken using a combination of SPSS (Norussis, 1993) and Generalised Linear Interactive Modelling (GLIM: Francis et al., 1993) statistical software. Those requiring more information on the statistical basis for the technique (CR using log-linear modelling) are referred to 'Estimating the Size of a Closed Population' (Bishop et al., 1995).

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## METHODS

For each CR analysis a minimum of three independent data sources are usually required in each Health/Local Authority. To estimate the total population of problematic drug users the data sources that were used are given in Table 1 and details of the data sources in Box 1.

**Table 1: The Data Sources Used in Capture-Recapture Analyses in Each Geographical Area.**

Area	Date-sets Used in Capture-Recapture Analyses						
	DTA <sup>*</sup>	ASES <sup>**</sup>	PSES <sup>***</sup>	A&E <sup>****</sup>	Police	Probation	Prison
Bolton LA	ai	i			a	a	i
Manchester HA	ai	i		a		a	i
Liverpool HA	ai	i	i		a	a	
Sefton HA	a				a	a	
St. Helens & Knowsley HA	a				a	a	
Wirral HA	a				a	a	

<sup>\*</sup>Drug Treatment Agencies, <sup>\*\*</sup>Agency Syringe Exchange Scheme, <sup>\*\*\*</sup>Pharmacy Syringe Exchange Scheme, <sup>\*\*\*\*</sup>Accident and Emergency, a=Used for all problematic drug users i=Used for injector drug user estimates

Individuals were considered to be 'problematic drug users' if:

- they were reported by any Drug Treatment Agency;
- attended syringe exchange schemes with the exception of steroid users;
- were reported from other data sources as users of heroin, methadone or cocaine or crack cocaine. Individuals using only cannabis, ecstasy, amphetamine and steroids were eliminated from the study.

For the purposes of analysis, any individuals below the age of 15 or aged 45 and over were removed from the data-sets as too little data were available at these extremes for accurate modelling. The majority of problem drug users fall between the ages of 15 and 44 years (92.3% of the total data-set) and therefore these restrictions had little effect on the overall analyses. The number of individuals included in the final data-sets are given in Tables 2 and 3 and categorised by age, sex, reporting agency type and geographical area of report.

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## Box 1: Agencies and Databases used in Analyses

For Manchester and Bolton, data cover the calendar year 1997, for Liverpool 1998 and for Sefton, St. Helens and Knowsley and Wirral 1999. Choice of year was dictated by the most recent set of data-sets available and suitable for Capture-recapture.

**1. Drug Treatment Agencies** include statutory and voluntary drug agencies such as Drug Dependency Clinics, Community Drugs Teams and Residential Rehabilitation Centres. For Merseyside Health Authorities these data were provided from the Prevalence and Outcomes Database (Birtles and Bellis, 1999 and 2000). For Manchester and Bolton Health Authorities data were provided from the DMD (Donmall, 1990).

**2. Police Data-sets** in this case include only those individuals arrested for a drug crime for Merseyside Health Authorities. Primarily, these include reports of possession, supply and possession with the intent to supply. For Merseyside Health Authorities these data were taken from the IAD (Hardi, Hounscome and Bellis, 1999 and 2000). Bolton and Manchester data were from police surgeons and so, in addition to individuals arrested for a drug possession or supply offence, data include those arrested for other crimes but identified as having a drug problem. For Manchester and Bolton, these data were from the DMD (Donmall, 1990).

**3. Probation** comprise reports of individuals currently in contact with the Probation Service and who have disclosed a drug problem. In Manchester and Bolton these data are provided via GMPS systems (Millar and McFarlane, 1998). In Merseyside the data were from the IAD (Hardi, Hounscome and Bellis, 1999 and 2000).

**4. Accident and Emergency** recorded data on any admission where the clinician considered drug misuse to be a factor. These data are from an unpublished research study by the Emergency Medicine Department at Manchester Royal Infirmary\* and the Drug Misuse Research Unit and covers only the Manchester area.

**5. Pharmacy Syringe Exchange Scheme** recorded individuals whom had attended the pharmacy to receive or return injecting equipment. Data only cover Merseyside authorities and are from the Prevalence and Outcomes data-set.

**6. Agency Syringe Exchange Scheme** collect data on individuals whom had accessed the agency to collect new and hand in used injecting equipment, and gives clients advice and counselling. In Merseyside, 16 agency based syringe exchange schemes submitted data for both 1998 and 1999. Data for Merseyside authorities are from the Prevalence and Outcomes data system. Data for Manchester and Bolton are from the DMD enhanced syringe exchange scheme surveillance module (DMD-NES).

**7. The Prison Service** report to the DMD those prisoners who disclose drug problems at 'reception' or during a sentence. Reports of Manchester and Bolton residents from two male prisons, Strangeways and Hindley Young Offenders Institution, were used in this study.

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**Table 2: Number and Age Range of Male and Female Drug Users Reported by Each Geographical Area: All Data Sources.**

Area			Sex		Age		
	Year	Total	Male	Female	15-24	25-45	Mean Age
Bolton	1997	1307	1051 (80.4%)	256 (19.6%)	632 (48.4%)	675 (51.6%)	26
Manchester	1997	2771	2227 (80.4%)	544 (19.6%)	838 (30.5%)	1909 (69.5%)	28
Liverpool	1998	2607	1820 (69.8%)	787 (30.2%)	467 (17.9%)	2140 (82.1%)	28
Sefton	1999	1310	929 (70.9%)	381 (29.1%)	196 (15%)	1114 (85%)	31
St. Helens & Knowsley	1999	1761	1415 (80.4%)	346 (19.6%)	407 (23.1%)	1354 (76.9%)	29
Wirral	1999	2735	2045 (74.8%)	690 (25.2%)	361 (13.2%)	2374 (86.8%)	31

**Table 3: Number and Age Range of Male and Female Drug Users Included in the Final Data-Sets by Each Service: All Geographical Areas.**

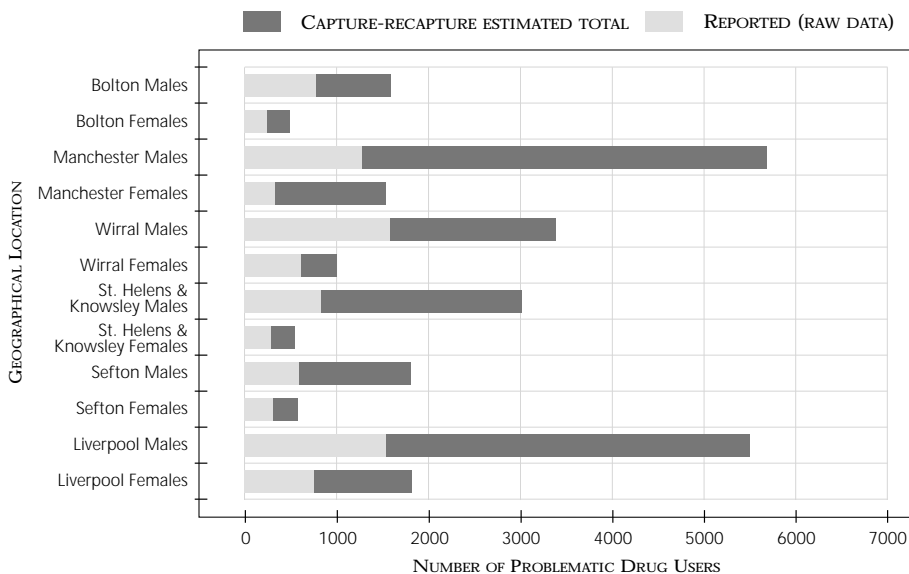
Agency Type	Sex		Age		
	Male	Female	15-24	25-45	Mean Age
DTA <sup>*</sup>	4459 (68.5%)	2047 (31.5%)	1214 (18.7%)	5292 (81.3%)	29
Probation	1697 (81.8%)	378 (18.2%)	733 (35.3%)	1342 (64.7%)	28
Police	534 (83.6%)	105 (16.4%)	243 (38%)	396 (62%)	28
ASES <sup>**</sup>	1653 (80.3%)	405 (19.7%)	572 (27.8%)	1486 (72.2%)	28
PSES <sup>***</sup>	1118 (82.6%)	236 (17.4%)	212 (15.7%)	1141 (84.3%)	30
A&E <sup>****</sup>	206 (70.1%)	88 (29.9%)	93 (34.4%)	177 (65.6%)	28
Prison	415 (100%)	N/A	131 (31.6%)	284 (68.4%)	28

<sup>\*</sup>Drug Treatment Agencies, <sup>\*\*</sup>Agency Syringe Exchange Scheme, <sup>\*\*\*</sup>Pharmacy Syringe Exchange Scheme, <sup>\*\*\*\*</sup>Accident and Emergency.

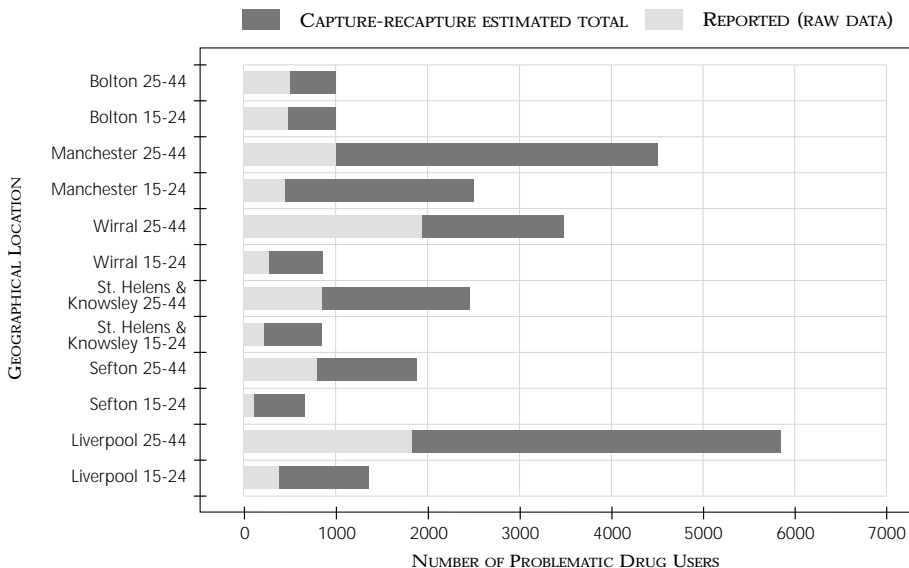
## RESULTS

Capture-recapture estimates for all problematic drug users are presented in Figure 1 (by sex) and Figure 2 (by age group) broken down by geographical area. Figure 3 provides estimates of injectors only. Data provided in all figures of this report have been generated using reliable models, each model being a good fit to the known data.

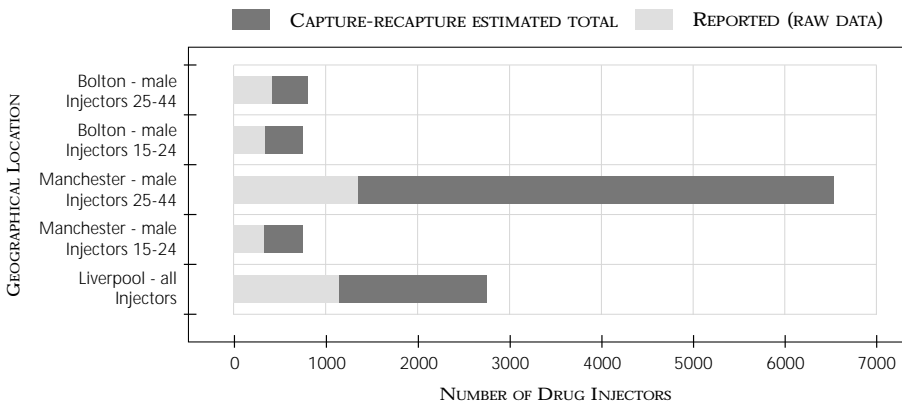
**Figure 1: Number of Reported Problematic Drug Users and Estimated Total of Problematic Drug Users (by sex).**



**Figure 2: Number of Reported Problematic Drug Users and Estimated Total of Problematic Drug Users (by age group).**



**Figure 3: Number of Reported Drug Injectors and Estimated Total of Drug Injectors (by age group).**



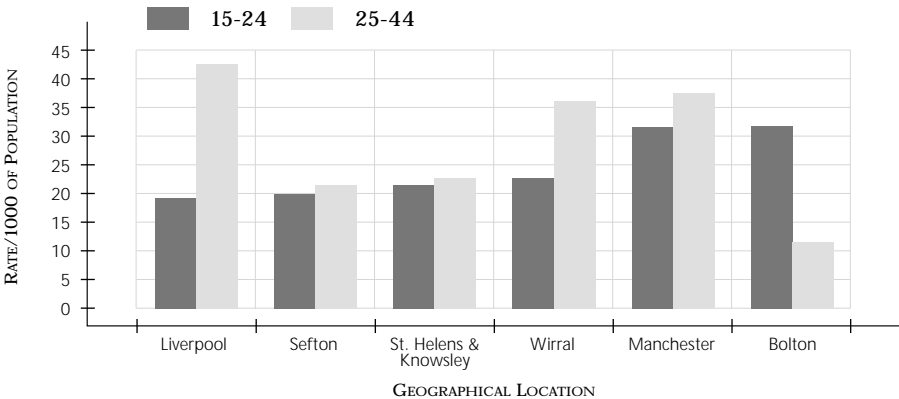
Estimated total numbers of problematic drug users range from 1,983 in Bolton to 7,220 in Manchester. The proportion of the total represented by the hidden population ranges from 49.3% in Wirral to 79.9% in Manchester. Both raw data and CR identified far greater numbers of male drug users than females (Female to Male ratio: raw 1:3.2, CR 1:3.7). Across geographical areas CR estimates identified a range in Female to Male ratios from 1:3.2 in Liverpool to 1:6.0 in St. Helens and Knowsley.

To correct for differences in sizes and populations of geographical areas, rates of problem drug user per 1,000 of population were calculated. These results are given in Table 4 and Figure 4. As expected the CR rate of drug use among females (overall 12.2 per 1,000 of population) is considerably lower than the rate of drug use among males (overall 43.5 per 1,000 of population).

**Table 4: Estimated Rates of Problematic Drug Users Per 1,000 of Population.**

Area	Problematic User per 1,000 of population				
	All	Females	Males	15-24	25-44
Bolton LA	18	8	27	32	12
Manchester HA	37	16	56	32	37
Liverpool HA	33	17	52	19	43
Sefton HA	22	10	33	20	22
St. Helens & Knowsley HA	24	7	42	22	23
Wirral HA	33	15	51	23	36

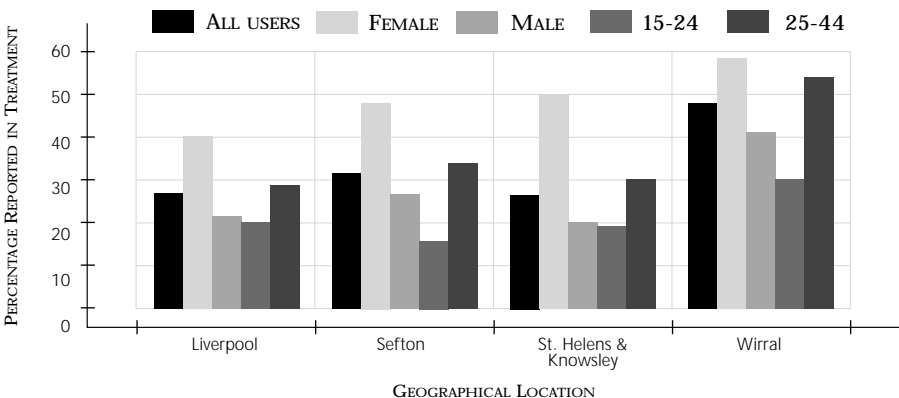
**Figure 4: Estimated Rate of Drug Users Aged Under 25 and Over 25 Per 1,000 of Population.**



For all drug users (15-44) rates per 1,000 ranged from 18 per 1,000 in Bolton to 37 per 1,000 in Manchester. Males (15-44) provided the highest population rates with rates from 27 per 1,000 in Bolton to 56 per 1,000 in Manchester.

In order to assess the proportion of the problematic drug using population in treatment, the proportion of the total CR estimates (for each geographical area) represented by reports from treatment agencies was calculated (Figure 5). Considering only Merseyside areas, 32% (5,479/17,096) of problematic drug users were in treatment. The figure ranged considerably from 26.2% in St. Helens and Knowsley to 46.5% in Wirral.

**Figure 5: Percentage of Estimated Total of Problematic Drug Users Reported in Treatment.**



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## DISCUSSION

Developing appropriate drug services, targeting effective prevention strategies and monitoring progress towards the objectives of the ten year drugs strategy (Department of Health, 1998) all require information on drug users not just in contact with services but throughout the wider community. Capture-recapture offers one method of monitoring this population and provides important perspectives on the hidden demography of drug users, their penetration into treatment services and consequently, the needs for further service and prevention development. The analyses presented here are some of the first attempts in the UK to use CR on routinely collected data-sets and to demonstrate that this methodology can be implemented as part of routine monitoring systems. More specifically the analyses highlight a number of hitherto hidden demographic features of drug use in the North West.

### **Overall Levels of Problematic Drug Use**

On raw data reports, areas such as the Wirral (2,735 reports), Manchester (2,771 reports) and Liverpool (2,607 reports) appear to have relatively similar numbers of drug users. However, CR analysis provides a significantly different picture. The large metropolitan areas of Manchester and Liverpool actually have much greater levels of hidden drug use (see Figure 1) resulting in total numbers of problematic drug users as high as 7,220 and 7,121 respectively (age 15-44). When corrected for population size CR estimates for Manchester and Liverpool provide a remarkably similar picture with 37 and 33 problematic drug users per 1,000 population (aged 15-44) respectively (see Table 4). Sefton and St Helens and Knowsley appear to have substantially lower levels of 22 and 24 problematic drug users per 1,000 population (aged 15-44) respectively and Bolton has 18 (see Table 4). However, while these overall figures provide a useful measure of the number of problematic drug users, analysis by age group offers further insight into how drug problems are developing.

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## Estimates by Age Group

Previous work (Millar, 1999; Millar et al., 2000) has examined temporal changes in the incidence of drug problems and age-specific population rates across the Greater Manchester conurbation in order to provide an 'early warning' of changes in the prevalence of drug problems. That analysis indicates clear geographical variation in the onset of 'epidemic' phases of drug misuse: whilst a minority of areas, such as Manchester, exhibit stable incidence over the past decade, many such as Bolton, exhibit epidemic phases during the nineties. Areas in the latter category will continue to experience increases in the prevalence of drug problems as the 'new' drug misusing population ages and until the rate at which users join and leave the population reaches equilibrium. The CR estimates reveal findings that are highly consistent with this earlier work.

CR estimates by age group (15-24, 25-44) show a very different pattern from overall CR figures. When expressed as population rates drug use is just as high in the younger age groups of Manchester and Bolton (both 32 drug users per 1,000 population) despite large differences in the overall rates. Similarly although Liverpool had higher overall rates of problematic drug use than surrounding areas, it has lower rates in the younger 15-24 age group than Sefton, St Helens and Knowsley and Wirral Health Authorities (see Table 4 and Figure 4). This is consistent with much older epidemics of drug use in the larger metropolitan areas. In other words areas such as Sefton and Bolton are still experiencing growth in the younger age groups of drug users with relatively fewer drug users having yet progressed through to the 25-44 age group. In contrast, Manchester and Liverpool have experienced drug problems for a longer period and consequently the rates of drug use in the older age categories are higher having built up over some time. Another contributing factor could be the migration of established drug users into larger metropolitan areas later in their drug use career. Further research would be needed to identify the strength of these effects.

One of the four elements of the Government's strategy is to reduce the proportion of people under 25 reporting use of illegal drugs and in particular heroin. These figures reveal proportionally a greater percentage of unknown drug users aged under 25 than over 25 (68.7% unknown 15-24 and 61.2% unknown 25-44). Drug users do not tend to see their drug taking as problematic in the first few years of use and only contact services at a later date. When considering the proportion of drug users known specifically to specialist drug treatment services (not including those known to syringe exchange schemes or the judicial agencies) the differences are even more dramatic with 21.3% of the estimated total of the 15-24 year age group reported by services compared to 35.3% of the 25-44 year age group (Merseyside areas only).

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## Male and Female levels of Problematic Use

Consistently across all areas the CR estimates indicate much higher levels of problematic drug use by males. Population rates for females were always below 20 problematic drug users per 1,000 population and in St Helens and Knowsley and Bolton rates fell below 10, while for males, levels went above 50 per 1,000 population in three Health Authorities (see Table 4). Surprisingly however, estimates suggest proportionally fewer females are in the hidden population of users. This was particularly true of the Merseyside Health Authorities. Furthermore, when the number of problematic drug users in treatment is expressed as a proportion of the CR estimated total (only possible in Merseyside), it appears that a greater proportion of female drug users are already in contact with specialist drug treatment services. Overall, in Merseyside only, 47.1% of the female drug users were in contact with treatment services compared to 27.3% of males (see also Figure 5). Contrary to some concerns this would suggest that treatment services are not more difficult to access by females.

## Levels of Injecting Drug Use

Different data-sets had to be combined in order to give population estimations for levels of injecting drug use and estimates may be less reliable as they rely on individuals accurately identifying themselves as recent injectors in each data-set. Estimates of injecting drug use for Manchester and Bolton were unreliably high probably as a result of non-disclosure of injecting status by the prison sample. Consequently, figures for Manchester and Bolton have been excluded from this paper. In Liverpool estimates appear more stable with the proportion of all problematic drug users accounted for by injectors being 38.7% (2755/7121). Despite unreliably high estimates for injecting in Manchester and Bolton, differences relative to Liverpool may be important with the proportion of injecting problematic drug use being lower than in Manchester and Bolton. The differences between areas may indicate important differences in the behaviour of problematic drug users resident in different geographical areas with those in the Liverpool area being significantly less likely to inject. Data from the annual reports of the North West Drug Misuse Database would support this difference with Liverpool reporting a greater proportion of non-injecting problematic drug users (University of Manchester and Liverpool John Moores University, 1999 and 2000).

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## CONCLUSIONS

A series of programmes have been put in place in order to redirect problematic drug users from judicial systems in treatment services, for example the Arrest Referral Scheme (Home Office Circular, 2000) and Drug Treatment and Testing Orders (The Crime and Disorder Act, 1998). Through such measures the Government aims to reduce the number of individuals denied immediate access to treatment and increase the proportion of drug users in treatment programmes. However, planning for the required changes in treatment services and monitoring their effectiveness requires intelligence which can currently be provided only through CR analysis. Results presented here indicate that the majority of problematic drug users are not in treatment (Figure 5) and consequently any measures to tackle drug use problems must either increase substantially the size of services or target efforts at younger age groups either before problems begin or at least at the early stages of problematic use. Currently the proportion of young drug users in contact with services is considerably lower than that in the 25-44 age group. Services aimed at the 15-24 age group would begin to redress the imbalance identified here and, if successful, ultimately reduce drug use levels in older ages. Any such initiatives in the North West or elsewhere could be assessed using similar CR techniques to those employed in this study.

Here, we have established that CR techniques can be successfully used to add substantial value to routinely collected drug use data. The full extent of the intelligence that can be gleaned from CR will require the addition of larger prospective studies. However, even within existing systems some ongoing measures of; the required capacity of treatment services, the need to target certain groups (e.g. 15-24 ages) and measurement of progress towards national targets appears achievable.

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# Assessing Hidden Problematic Drug Use in The North West of England

## Capture - Recapture Analysis

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