

Prevalence of Problem Heroin Use in Northern Ireland

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Table of Contents

	Page
Introduction	5
Heroin Use: Forms, Routes of Administration and Purity	8
Generating Estimates of the Number of Drug Users	12
Methodology	19
Results	26
Discussion	34
Recommendations	38
References	40
Appendices	48

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Executive Summary

Estimates of the number of drug users within a particular geographic region and at a particular point in time can be useful for planning and implementing various interventions that can be used to address drug misuse. Estimates can provide guidance on more effective allocation of resources such as treatment expenditures (Larson and Bammer, 1996; Reuter, 1993) and estimates that are collected over time can alert policy makers to important trends in drug misuse (Stimson and Judd, 1997) so that resources can be reallocated more effectively.

The purpose of this study was to provide estimates of the number of *problem heroin users* in Northern Ireland during the 12-month period, 1 November 2000 to 31 October 2001. In the present study, the phrase “problem heroin use” was defined as “[heroin] use resulting in social, psychological, physical or legal problems associated with dependence, intoxication or regular consumption” (British Medical Association, 1997: 38). This definition did not necessarily include individuals who were dependent on heroin during the study period; dependence does not necessarily imply problem heroin use. Additionally, considerably higher estimates would have been generated had the research sought to estimate the number of “heroin users” as opposed to the number of “problem heroin users.” During the study period, for example, some heroin users may not have experienced psychological, physical or legal problems associated with heroin use. “Controlled” heroin users (i.e., persons who manage heroin use over a period of several years without developing significant problems associated with such use) probably were excluded from the research. Additionally, individuals who were in the early stages of a heroin career and had not yet experienced significant problems with the drug also were not represented among the “problem heroin users” described in the research.

The present study used three methodological techniques to generate estimates of the number of problem heroin users in Northern Ireland. Each technique utilised the number of known users to estimate the hidden population of problem heroin users. These techniques included capture-recapture methodology, a mortality multiplier and an Addicts Index multiplier.

The capture-recapture approach is the most sophisticated technique for estimating the total (known and unknown) population of drug users and the technique has been recommended by the European Monitoring Centre for Drugs and Drug Addiction. However, all three approaches have both strengths and limitations and these issues are discussed in the full report.

The capture-recapture approach indicated that there were approximately 828 problem heroin users in Northern Ireland during the period, 1 November 2000 and 31 October 2001. The 95% confidence interval suggested that the range

of problem heroin users during this time period was between 695 and 1018. These figures implied that between 36% and 52% of problem heroin users had been in drug treatment during the 12-month study period. The two multiplier approaches were based on research conducted largely in England in the 1980s and it is not known whether these techniques are appropriate for use in Northern Ireland during the time period of the study. Nevertheless, the Addicts Index multiplier indicated a total of 1265 problem heroin users in Northern Ireland between 1 November 2000 and 31 October 2001. The mortality multiplier approach suggested that there were between 1050 and 2100 (midpoint = 1400) problem heroin users in Northern Ireland for the calendar year 2000 (data were not available for the 12-month period described above).

Additional data were analysed for heroin users who entered drug treatment in Northern Ireland between 1 November 2000 and 31 October 2001. These data showed considerable geographic differences with respect to problem heroin users. Specifically, Ballymena treatment sites had clients who were more likely to be male, younger, and with a history of drug injection, compared to other sites. Other areas, and in particular Belfast, had higher numbers of heroin users who had never injected, and who most likely were recent initiates of the drug.

Based on these estimates as well as other findings described in the full report, the following recommendations were made:

1. Drug policy decisions that have occurred elsewhere (e.g., Edinburgh, Wirral) should be carefully reviewed. For instance, it is now believed that only a few heroin users resided in Wirral in the early 1980s. Within six years, the number rose to approximately 4,000 (Parker, Bury, and Egginton, 1998). In the cities of Glasgow and Edinburgh, different policy approaches were taken initially with respect to heroin use and injection. The implications of those decisions also differed. A careful review of those decisions might provide knowledge on how to avoid the mistakes that other policy makers have made with respect to problem heroin use.
2. This report produced baseline estimates of problem heroin use in Northern Ireland and these estimates might be useful for comparing with estimates derived in the future. However, unless additional research is conducted with heroin users in Northern Ireland (e.g., studies of users who are not in contact with services), researchers involved in estimation work in the future will face the same difficulties in terms of data availability and limitations.
3. Information provided to the Northern Ireland Drug Misuse Database has great potential. In particular, data on first treatment exposure have epidemiological importance and would be quite useful for monitoring trends. Agencies should be strongly encouraged to provide accurate data to the Northern Ireland Drug Misuse Database on a regular basis. Fuller participation would allow for drug misuse data to be evaluated with ease. In sum, a treatment monitoring system is extremely important. Service delivery is equally important, however, completing forms can interfere with service delivery. The conflict between monitoring goals and service

delivery objectives must be resolved. To the outsider, one cannot survive without the other.

4. The Addicts Index should remain as a register in Northern Ireland, at least until other monitoring systems are validated. Despite criticism of the notification data, if the appropriate multiplier could be determined in Northern Ireland *and* validated periodically, this method might represent an inexpensive way to monitor the population of problem heroin users. Research might investigate how physicians, in particular, make judgements about “suspected” and “known” addiction.
5. Howard Parker argued that many professional staff who work with heroin users in addiction services in Britain, lack the appropriate training for dealing with this population (Dean, 1999: 1947). He cautioned that there could be a “crisis” in the delivery of treatment services as a result of insufficient training and inadequate auditing systems. The present study identified 361 problem heroin users, aged 15-54 who had contact with treatment services during the 12-month study period. The present research did not specifically examine knowledge of heroin addiction and training needs of treatment staff in Northern Ireland. Findings from such research, however, would be beneficial for treatment staff, policymakers, as well as heroin users in need of treatment. It is recommended that research be conducted that examines staff training needs with respect to heroin addiction among clients.
6. Although the purpose of this study addressed problem heroin use in Northern Ireland, policy makers should consider the importance of research into the use of benzodiazepines. In reviewing hospital in-patient data for this study, the researcher observed dozens of hospital admissions for benzodiazepine use during the 12-month study period. Some of these cases involved opioid dependence as well. Future research should focus on the use of benzodiazepines in Northern Ireland. It is possible that two broad categories of “problem” benzodiazepine users reside in Northern Ireland. In the first group, we would expect to find individuals whose licit or illicit use of the drug at some stage progressed to dependence. Benzodiazepines might represent the drug of choice for this group. A second group might be comprised of persons who are either regular users of or dependent on both benzodiazepines and opiates. Other evidence has found comparatively high rates of benzodiazepine use in Northern Ireland (Heather, McCarthy, and Luce, 2001; Stika et al., 1974). Research should address the linkages between benzodiazepine use and the wider political conflict.

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Introduction

As recently as the early 1990s, public acknowledgement and media reports of heroin use in Northern Ireland were sparse. This lack of attention mirrored official indicators of the demand for heroin which suggested that – unlike its neighbours – Northern Ireland had not produced drug user sub-cultures in which heroin was the drug of choice.

Heroin was discovered in the late 19th century, and similar to other Western nations, it is likely that the drug has been available on this island since that time. Clearly there were pockets of heroin users in the 1980s, and perhaps during the previous decade. A total of 35 persons were officially registered as “drug addicts” in 1985 and most of those persons were notified as heroin users (cited in Murray, 1994). Research conducted in 1997-1999 revealed that one current injector had first used heroin in 1981 – and that event had occurred in Northern Ireland (McElrath, 2001). Another respondent recalled the existence of a very small and close-knit group of users who resided in Belfast in the late 1960s. Thus, various bits of evidence suggest the possibility that several sub-cultures of heroin users resided in Northern Ireland during the 1970s and 1980s but their existence as well as any difficulties that they were facing, probably were masked by the wider political conflict.¹ Semi-historical research would now be needed to uncover heroin use and the lifestyles of users during that era.

In O’Neill’s 1995 case study of out-of-treatment drug users, respondents reported that a heroin or injecting *culture* in Northern Ireland had at that time, not surfaced in the region. Those perceptions might have been accurate. Limited acknowledgement of heroin use appeared to enter the Northern Ireland public domain in the mid-1990s, shortly after the 1994 ceasefires – coincidentally or not. The emergence of a “heroin problem” was probably first observed by astute community workers, users themselves, and relatives of users. Official data on heroin demand, such as the Northern Ireland Register of Addicts (also known as the Addicts Index) and police seizures, are considered to be “lagged” indicators, and would fail to show major increases for several months.

A total of 78 persons appeared as registered heroin addicts in Northern Ireland during 1997. Shortly after the 1997 Register was published, media reported what was perceived to be the first heroin-specific fatality in Northern Ireland (Thornton, 1998).² The number of persons notified for heroin continued to increase in the late 1990s and reached 233 in 2000.

¹ Evidence also suggests that tranquillisers were the drug of choice during this era. In a comparison study of several European countries, King et al. (1982) found that the rate of tranquilliser prescriptions per adult population in Northern Ireland ranked second among the list of countries studied.

² Several heroin users, however, expressed surprise at what was claimed to be the first death due to heroin (McElrath, unpublished data, available upon request).

Similar to other public health and official indicators of drug misuse, the [former] United Kingdom Addicts Index³, of which the Northern Ireland Index was once a part, tended to underestimate the number of heroin addicts (Mott, 1994). The degree of accuracy of the Register in Northern Ireland is unknown. In 1991, a health official claimed that physician compliance was high in Northern Ireland (Murray, 1994). It may have been, however, the degree to which heroin users sought treatment and the extent to which physicians, in particular, were able to identify “addicts,” remains unknown. This issue has been explored with *heroin users*, however, several heroin users have reported that they either were unaware of, or are uncertain as to whether they have been notified to the Register (McElrath, 2001).

In the years 2000 and 2001, several media reports provided estimates of the number of “heroin addicts” in Northern Ireland. These estimates have ranged from 1000 to 1500 in Ballymena alone (*Irish News*, 2000; Yankova, 2000) to 2000 in Northern Ireland (Moore, 2001). In 1999, key professionals in Bangor estimated that there were approximately 60 “known addicts” in that area (Eastern Drugs Co-ordination Team, 1999). A study by Woodhouse et al. (2000) reported an estimate of 235-398 “heroin users” in the Ballymena area in 1999-2000.

Given the diverse range of estimates and limited research in the area, the present study uses multiple methods in order to provide estimates of the prevalence of problem heroin use in Northern Ireland.

Prevalence and Drug Policy

In general, prevalence of drug misuse refers to the proportion of a given population that has used a particular drug and is often expressed as a rate. Estimates can be calculated for various categories of drug users and for particular time periods (e.g., lifetime, last year, last month). Stimson and Judd (1997) observed that historically, policies relating to problem drug use have often failed to consider prevalence estimates. In recent years, however, funding bodies within some governments have shown interest in obtaining estimates of the number of problem drug users within cities, regions or countries. For example, studies of the prevalence of drug misuse have been conducted in various locales within Scotland (Frischer, 1997; Hay and McKeganey, 1996), England (Brugha et al., 1998; Hickman et al., 1999) and the south of Ireland (Comiskey, 2001).

Estimates are important for planning, implementing, and revising various interventions that might be used to address problem drug misuse. In line with recent government drug strategies, estimates of the number of problem drug users can form part of the evidence upon which drug policy must now be

³ The United Kingdom Addicts Index closed in May 1997, largely because several Regional Drugs Misuses Databases were implemented (see Methodology Section). The Northern Ireland Addicts Index continues.

based (Hay, McKeganey, and Hutchinson, 2001). Estimates can provide guidance on more effective allocation of resources (Reuter, 1993). In particular, estimates of “problem drug use,” including heroin use, can influence treatment expenditures, as treatment agencies generally tend to provide services to “problem drug users” (Reuter, 1993). In some regions, such as the Australian Capital Territory, estimates of the number of heroin users were deemed necessary in order to inform policymakers of the need for substitute prescribing (Larson and Bammer, 1996).

In the 1980s, estimates that suggested large numbers of injecting drug users (IDUs) in England and Scotland, as well as growing concerns about HIV prevalence among this group, contributed to the implementation of several pilot needle exchange schemes (Stimson, 1995). Estimates also have assisted with calculating the associated costs of problem drug misuse, including costs relating to the health, social and economic status of the individual, costs associated with treating people, and costs incurred by the legal system (Mark et al., 2001; Stimson and Judd, 1997). Moreover, prevalence estimates that are collected over time can alert policy makers to important trends in drug misuse (Stimson and Judd, 1997) so that resources can be reallocated more effectively.

Heroin Use: Forms, Routes of Administration and Purity

The most available form of heroin, the common routes of administration, as well as the purity of heroin within a particular time and space all can influence the degree to which use becomes problematic. Moreover, these three factors are often inter-related and can vary considerably across and within cultures. Therefore research that seeks to estimate the number of problem drug users should consider and address each of these factors, with reference to the geographic region to which the estimates apply.

Forms of Heroin and Routes of Administration

Heroin can be ingested through different methods, e.g., injecting, “chasing,” other ways of smoking, snorting/sniffing. The way in which the drug is consumed has several implications for the health and possibly, treatment needs, of an individual. Strang et al. (2001) discussed the three different forms of heroin that have been available in the United Kingdom⁴ in recent years. These forms have included pharmaceutical (i.e., diamorphine), white, and brown heroin. Both diamorphine and white heroin (the latter has historically derived from South East Asia) take the form of hydrochloride *salt*. In contrast, brown heroin (historically deriving from South West Asia) exists in *base* form, making it more suitable for smoking or “chasing” the drug. Brown heroin may indeed be injected, but typically it must first be converted (e.g., by mixing the drug with citric acid) from base to salt form (see also, Scott et al., 2000). In their study of 104 opiate users in receipt of methadone maintenance at one London clinic in 1999, Strang et al. (2001) observed that 94.2% of study participants had used brown heroin during the most recent injection experience.

Some evidence suggests that brown heroin may be the form of heroin that is most readily available in Northern Ireland. For example, in-depth interviews with 43 heroin users between the years 1997 and 1999 found that brown heroin was the form most often used at *initiation* into heroin use and some respondents reported using brown heroin in Northern Ireland as early as 1983 (McElrath, 2001).⁵ In that study, respondents were asked about their *most recent use* of heroin for which nearly all of the individuals reported that brown heroin had been used. Although a few respondents reported that they had tried diamorphine, in most instances, this form was not readily available in Northern Ireland. That study was based on a qualitative design so that the degree to which the findings can be generalised to the population of heroin users in Northern Ireland is not known. The findings, however, are consistent with information on seizures of heroin by police in the mid- to late-1990s

⁴ Considerable reading of the drug misuse literature suggests that scholars who refer to the “United Kingdom” really mean England, England and Wales, or England, Wales and Scotland. Northern Ireland is nearly always excluded from studies that claim to examine drug misuse in the “UK.” In this particular piece of work, although the authors made reference to the “UK,” Northern Ireland was not mentioned at all.

⁵ The full report did not include a section on the forms of heroin used by the respondents. These data are available by request.

(personal correspondence, Drugs Squad, Police Service of Northern Ireland). Taken together, this information suggests (but does not confirm) that brown heroin represents the form that is most available in Northern Ireland. The implications of this availability would suggest that chasing heroin is a viable option for some users in Northern Ireland.

Hall, Lynskey and Degenhardt (2000) suggested that chasing heroin can work to reduce the probability of nonfatal and fatal overdose among heroin users. In areas where smoking cultures have emerged and when chasers represent a large proportion of heroin users, indicators such as hospital admissions as well as mortality data may fail to reveal high numbers of heroin users.⁶ These and many other indicators might be more likely to reflect heroin injectors rather than other users whose route of administration is through other means.

Purity

High purity heroin is one factor that is believed to be related to the major increase in heroin use in England and Wales in the 1980s (Power, 1994). The purity of heroin can be associated with routes of administering the drug. High purity heroin can allow for the drug to be smoked or chased rather than injected, thus, attracting people who might avoid injecting because they disdain it or because they wish to avoid the risks of infectious disease through various injection behaviours. An increase in purity could signal an increase in users, with new users preferring initially to chase the drug. A return to lower purity heroin could actually lead chasers to inject the drug, as it is likely that injection would be needed to feel the effects of low purity heroin. Although chasing heroin is an “effective” way of consuming heroin (Hendriks et al., 2001), it is less so than through injection. Mo and Way (1966) estimated that smoking heroin was approximately 40% as effective as injecting the substance. In other words, when low purity heroin is smoked rather than injected, it is generally more difficult for users to achieve satisfaction with the drug’s effects.

In recent years, purity levels of heroin have increased in several countries, e.g., Australia, United States. Moreover, heroin consumed through non-injection methods appears to be associated with high purity levels of heroin. For example, Frank (2000) described heroin purity levels in New York City from 1973 to 1998. The average purity of heroin in the 1970s was roughly 5% but by 1988, purity levels had reached approximately 35%. Drastic increases were recorded in the 1990s during which time the purity of heroin in that city exceeded 60%. Frank noted also that intranasal use of heroin increased from 25% of treatment admissions in 1988 to 59% in 1998.

A recent study in Cabramatta (a suburban area of Sydney), found that the average purity of street-level heroin was 66% (Maher, Swift, & Dawson, 2001). Although purity levels in that study ranged from 20-100%, a purity of 50% or more was observed in 85% of the samples analysed for that study.

⁶ Individual tolerance level represents another important factor that can contribute to the probability of overdose.

Purity levels of heroin by European country in the year 2000 ranged from less than 20% in Germany and Greece to over 60% in Denmark. For that year, the average purity of heroin in the south of Ireland and in the United Kingdom was approximately 35-40% (European Monitoring Centre for Drugs and Drug Addiction, 2000).⁷ Studies of users' reports of heroin purity in Northern Ireland are rare, however, one study found that users' perceptions of purity varied considerably and those data were collected in 1997-1999 (McElrath, 2001).⁸ Moreover, due to tolerance, "regular" users of heroin are at times unable to distinguish between various levels of purity.

Purity levels of heroin seized in Northern Ireland were provided to the researcher by the Crime Analyst Section, Police Service of Northern Ireland.⁹ A total of six seizures of heroin were made during the 12-month period, 1 November 2000 and 31 October 2001.¹⁰ One of the six seizures included four separate quantities, for a total of nine separate quantities during the 12-month period. The quantity of heroin that was seized ranged from .10 (i.e., one-tenth of a gram) to 1000.50 grams (approximately one kilogram). The purity levels of the nine quantities ranged from 36% (one-tenth of a gram) to 85% (1.92 grams). The average purity level was 66% and only one of the seized quantities had a purity level of less than 57%. Three of the quantities were in the amounts of 1.92 grams or less. Assuming that amounts of two grams or less would reflect street retail purity, these three quantities had an average purity level of 63%. The number of heroin seizures during the 12-month period were small, thus it is difficult to draw conclusions from these figures. However, if these levels are in any way representative of the purity of "street" purchases of heroin in Northern Ireland, the levels would be considered comparable to purity levels documented in some countries, and high in comparison to purity levels recorded elsewhere. Additionally, high purity heroin could be one important factor that contributes to the development or expansion of a heroin culture.

High purity heroin can have several implications for users. Agar and Reisinger (1999: 370) observed that:

"When a new wave of higher quality heroin hits the markets, it first solves an addict's problems rather than causing them."

Thus, when purity is high (and assuming availability is either constant or increasing) we might expect to find *fewer* people attending drug treatment or

⁷ Purity rates calculated from seizures by police as well as Customs, can depend on the sampling method, i.e., the criteria used to select samples of seized drugs for testing.

⁸ These data were not included in the full report. The information is available upon request.

⁹ Unlike several countries, heroin seizures in Northern Ireland are made largely by the police rather than by Customs officials (personal communication, Drug Squad, Police Service of Northern Ireland).

¹⁰ Prevalence estimates of problem heroin use reported in this study were based on this time frame. See the section on Methodology.

services, *fewer* people in contact with physicians, but possibly *higher* rates of hospital admissions as people increase their risk for overdose.¹¹ However, one study examined nine-year trends and found that purity of heroin was not significantly related to mortality (Risser et al., 2000).

¹¹ In Baltimore, Maryland (USA), an increase in the number of hospital emergency room heroin mentions coincided with an increase in heroin purity (Agar, 1998: 928). Risk for overdose, however, also depends upon individual tolerance levels.

Generating Estimates of the Number of Drug Users

There are several methods that can be used to generate estimates of the number of drug users within the population. All of these methods have strengths, as well as weaknesses. In the paragraphs that follow, these methods are briefly described, and their usefulness in generating estimates in Northern Ireland is discussed.

Surveys

Several European countries have undertaken self-report surveys of the general population in order to estimate the prevalence of drug misuse (European Monitoring Centre for Drugs and Drug Addiction, 1998). Some survey approaches focus entirely on the issue of drug misuse, whereas other surveys incorporate drug misuse questions within a broader context (e.g., crime or victimisation). Scholars have questioned the degree to which self-report surveys can provide valid data on drug misuse (Frischer et al., 2001). Moreover, self-reports may be less valid for some drug categories (e.g., heroin) than others, and may miss segments of the population that could be disproportionately involved in drug misuse (e.g., non-political prisoners, university students). These factors are likely to produce an underestimate of the prevalence of drug misuse, particularly for certain drugs as well as drug injection.

Multi-source Enumeration

Enumeration consists of counting the number of drug users who are identified in a particular region during a specified period of time. The phrase “multi-source enumeration” is used to describe counts of users identified by several sources. This approach has been used successfully in the United Kingdom, most notably by Hartnoll and colleagues (1985a) in their *Drug Indicator Project*. For a multi-source enumeration, agencies are asked to list all users (often by drug use category) with whom they had contact during a particular time frame. Individual identifiers assist with the clarification of duplicates. A crucial part of this approach involves tracing and identifying drug users who have not been in contact with agencies, i.e., hidden users. Multi-source enumeration is less feasible in large geographic areas. Authors of a recent report restated the value of Hartnoll’s work, noting that the methodological approach still is of relevance today (European Monitoring Centre for Drugs and Drug Addiction, 1999b). Multi-enumeration might be useful in Northern Ireland, particularly at the local level (e.g., Ballymena and Bangor). However, the approach requires a considerable investment in time and resources in order to identify less visible users, i.e., persons who have not been in contact with agencies.

Mortality Multiplier Method

Multipliers have been applied to mortality data as a means of estimating the overall prevalence of problem heroin users or “addicts” within a given region.

This approach was used by Frank et al. (1978) to estimate the size of the “addict” population in New York. Drawing on earlier studies from Britain, Hartnoll (1985b) concluded that between 10 and 20 per 1000 addicts died annually. This mortality rate of 1-2% pertained to opioid injecting addicts who had attended National Health Services hospitals and clinics. Scholars from the United Kingdom have appeared to concur that 1-2% of opioid injectors die annually (Ghodse et al., 1995; Oppenheimer et al., 1994).

Mortality data are limited in several ways. First, in some cases in which heroin use is the primary cause of death, the actual *recorded* cause of death may differ (Frischer et al., 2001), e.g., the death may be recorded as respiratory failure (European Monitoring Centre for Drugs and Drug Addiction, 1999a). This misclassification could represent an oversight or error on the part of the “coder,” could reflect the professional opinion of the coder, or could be used in order to protect the deceased and surviving family members from stigma attached to drug user identities. Second, the annual total of heroin-related deaths may include individuals who had used the drug for the first time. This type of case would present difficulties for research that relied on mortality data to estimate the number of “problem heroin users.” A third limitation is that mortality data exclude important information, for example, treatment experience, the frequency of drug use just prior to death, as well as the circumstances leading up to death (Hall, Lynskey, and Degenhardt, 2000).

Within a particular geographic region, fatal overdoses for which heroin is implicated can be influenced by the purity of heroin, other drugs (including alcohol) used in combination with heroin, the proportion of injectors within the heroin using population, as well as major fluctuations in the availability of heroin. For example, Shane and Darke (1999) examined the number of heroin-related deaths over time and found that in general, increases in fatal overdoses were associated with increases in the purity of heroin, although purity alone could not account for the pattern of heroin overdoses observed in the study. Other research has confirmed the finding that high-purity heroin is only one of many factors that can contribute to drug-related deaths (Maher, Swift, and Dawson, 2001). Researchers also have found that in several heroin-related deaths, victims had consumed morphine, alcohol and/or benzodiazepines in addition to heroin just prior to death (Darke and Ross, 1999; Gerostamoulos, Staikos, and Drummer, 2001; Risser et al., 2000).¹²

Route of administration can also affect the risk of fatal heroin overdose. Of the 176 heroin-related fatal overdoses that were examined from South West Sydney, the available data suggested that only one individual had consumed heroin through smoking shortly before death (Darke and Ross, 1999).¹³ However, the proportion of heroin smokers in the population of heroin users must be known in order to examine in full, the effect of route of administration on fatal overdose.

¹² Injecting heroin in combination with other drugs also has been found to be associated with non-fatal overdoses (Taylor, Frischer, and Goldberg, 1996).

¹³ In a London sample, 31% of heroin injectors reporting a *non-fatal* heroin overdose compared to only 2% of non-injectors (Gossop et al., 1996).

Although injectors are at greater risk for heroin-related death, “no route of administration can provide immunity to overdose” (Maher, Swift and Dawson, 2001: 441). Moreover, overdoses for which heroin is the primary cause, can occur among both frequent and occasional users (European Monitoring Centre for Drugs and Drug Addiction, 1999a). Indeed, some authors have suggested that occasional users of heroin are more at risk for fatal overdose than regular users because the former have not developed tolerance (Gerostamoulos, Staikos, and Drummer, 2001).

Multipliers using Treatment Data

Treatment data can be used to estimate the total population of problem drug users. For instance, a report issued by the European Monitoring Centre on Drugs and Drug Addiction (1999a: 18-20) showed that the total population can be determined by the following:

$$T = B/C$$

Where: T = Total population of problem drug users
B = Number of problem drug users in treatment
C = Estimated in-treatment rate

This calculation is limited in that the accuracy of the number of users in treatment often is not known. Frischer et al. (2001) drew from two previous studies conducted in London and Dundee to calculate C, and suggested a figure of 25%. However, the concept “in-treatment” is difficult to define and measure. For example, a user might inquire about a treatment program, enrol for a week or less, after which s/he loses contact with treatment staff. Decisions must be made with regard to the length of contact in determining what it means to be treated so that the same definition is used across treatment sites. At times, central registers can assist with the application of shared definitions.

The treatment-demographic method is another way to estimate the number of problem drug users (Frischer et al. 2001: 1469). This approach uses the following formula:

$$T = A \times B$$

Where: T = Total population of problem drug users
A = Number of people entering treatment for the first time
B = Average length of problematic drug use

Frischer et al. (2001: 1469) estimated an eight-year period as the “mean duration of problematic opiate use.” Those authors cautioned that figures pertaining to first treatment as well as the length of time for which opiate use is problematic, can both be inaccurate.

Addicts Index Multiplier

Prior to its closure in 1997, the number of notifications to the Home Office Addicts Index were at times multiplied to produce a prevalence estimate for a given area. Hartnoll et al. (1985b) estimated that in 1983 the number of addicts known to the Home Office underestimated the true number by a factor of five. Reviews of earlier research (e.g., Pattison et al., 1982) supported this figure although in some regions, higher factors were reported (Ditton and Sperits, 1981). Clearly, we might expect to find geographic variations in terms of the choice of the appropriate multiplier for the Addicts Index.

Key Informant Methodology

Methods which rely on the perceptions of key informants have been used to examine heroin use at the local level. This approach utilises persons who are familiar with the drug scene of interest (e.g., staff in various agencies, outreach workers), asks detailed questions of them, and collates the information systematically. Parker, Bury and Egginton (1998) used this methodology to examine heroin “outbreaks” among young people in several areas of England and Wales. This method assumes that people who have access to or are in contact with drug users through employment can ascertain the extent of drug misuse within their areas. In an earlier study by Parker and his colleagues (1988), various local professionals had knowledge about young heroin smokers within their respective geographic areas, but this knowledge went untapped until after an outbreak had occurred. Commenting on the heroin scenes in Baltimore, Maryland (USA), Agar and Reisinger (1999: 372) noted that:

“the local, anecdotal data proved the most accurate and timely, not only picking up the new pattern [of heroin use] but also outlining contexts and persons who were creating it, though the outlines were superficial and oversimplified.”

Peer Nomination

Nomination approaches rely on drug users to provide information about other users within their social networks. Information can include the number of people who are using within a social network, the extent to which others are engaged in risk behaviours for infectious disease, and the number of friends and acquaintances who have been in contact with treatment services. A study in New York State used nomination methods to estimate the percentage of heroin users in treatment (New York State Office of Alcoholism and Substance Abuse Services, 1997). Qualitative interviews were conducted with approximately 1,000 heroin users from 12 communities. Respondents were asked about the treatment experiences of their friends and acquaintances. From those reports, it was estimated that 24% of heroin users were in treatment at the time of the study. This figure was then applied to the known number of heroin users in the treatment register in order to provide an estimate of the total number of heroin users in the region. Taylor (1997)

described the validity of this approach and noted its usefulness for the development of multipliers for use with subsequent estimates.

Capture-recapture methods

Capture-recapture methodology has proven to be a useful tool for estimating the number of elements in a hidden population. Its use in the field of ecology has a long history whereby studies have sought to estimate fish and wildlife populations. The method is easily illustrated with a population of fish (European Monitoring Centre for Drugs and Drug Addiction, 1998): A researcher begins by sampling a number of fish on a particular day. The fish are counted and tagged and returned to the population. A second sample is taken the following day, and the researcher notes the total count, as well as the number of previously tagged fish that were caught in the second sample. Capture-recapture methodology is then used to provide an estimate of the hidden population (i.e., the number of fish that were *not* caught on either day) based on the total number of fish caught on both days, and the overlap (i.e., the number of fish that were caught in both samples). The hidden population is then added to the number of known fish to provide an estimate the total population.

More recently, this methodological approach has been extended to other disciplines, e.g., epidemiology and demography. Within epidemiology, the phrase “appearing on a list” is used more often than “being caught in a sample” (Nanan and White, 1997). Research based on capture-recapture methods has examined counts, prevalence or incidence of various illnesses or events, including cancer (Robles et al., 1988), stroke (Taub et al., 1996), and homeless persons (Fisher et al., 1994). A report issued by the European Monitoring Centre for Drugs and Drug Addiction (1999b) provided a detailed summary of this literature. LaPorte (1994: 5) suggested that we should learn from animal ecologists who some time ago acknowledged that:

“a complete count of wildlife was impossible and quickly scrapped human demography’s goal of complete enumeration. Instead, they developed intuitive estimators of the population based on incomplete sampling...”

Citing research, he argued further that animal ecologists have long believed that “trying to count everyone is a noble but futile and expensive goal.”

For nearly two decades, capture-recapture has emerged as a primary methodological tool for estimating the prevalence of drug misuse (for example, Calkins and Aktan, 2000; Comiskey, 2001; Domingo-Salvany et al., 1995; Doscher and Woodward, 1983; Hartnoll et al., 1985b; Hay and McKeganey, 1996; Larson, Stevens and Wardlaw, 1994; Mastro et al., 1994). Moreover, the methodological approach has gained the support of the European Monitoring Centre for Drugs and Drug Addiction, which in turn has provided guidelines for local studies (1998). With respect to estimates of drug misusers, capture-recapture methodology has been used largely to address the number of drug users within a specific *local* area, e.g., city. For

example, studies have been conducted in Dublin (Comiskey, 2001), Dundee (Hay and McKeganey, 1996), urban and non-urban regions in Scotland (Hay, 2000), and Barcelona (Domingo-Salvany et al., 1995). Fewer capture-recapture studies have examined *regional* as opposed to *local* estimates. One exception would be a study conducted in Scotland whereby local estimates were derived throughout Scotland and then summed to provide a national estimate of problematic use of benzodiazepine and/or opiates (Hay, McKeganey and Hutchinson, 2001). A similar approach was used in Wales to provide a regional estimate of “serious drug users” (Wood, Bloor and Palmer, 2000). Capture-recapture requires that data sources cover a common area, and this issue can be more problematic in regional studies.

Most statistical techniques require that one or more assumptions be met prior to using a particular statistical tool. Key assumptions of capture-recapture methodology include the following: 1) independence, 2) homogeneity, and 3) closed population. Each of these assumptions is discussed below.

Independence. The capture and the recapture must be independent. This assumption requires that the appearance of an individual on one list has no effect on whether s/he appears on a second or third list. Hence, a list of prisoners generally is not used in capture-recapture studies of drug misuse prevalence because incarceration would reduce the probability of being captured on a second or third list, particularly for persons serving lengthy sentences. Thus, including a list of prisoners would violate the assumption of independence. The assumption might also be violated in a study that includes a list drawn from general practitioners (GPs) and a second list from treatment sites if GPs were referring a large number of patients to those treatment agencies.

Drawing from the ecological phrases, persons may be “trap shy” or “trap happy” (Brecht and Wickens, 1993: 240-241; Maxwell and Pullum, 2001: 258) and these patterns can violate the assumption of independence. Some heroin users may be “trap shy,” that is, they avoid arrest because a previous arrest (i.e., prior to the period under study) resulted in one of several negative consequences for the individual. Others may be “trap happy” in that they are more likely to come to the attention to the police simply because they have been arrested previously (i.e., prior to the period under study). In other words, the fact they some users are known to police increases the possibility of future contacts with police.

Researchers have suggested that the assumption of independence is critical when studies rely on two samples only. Several researchers have argued that the assumption can be relaxed in studies that incorporate three (or more) samples because dependence across samples can be ascertained through log-liner modelling strategies (Nanan and White, 1997). The estimates are then modified based on this dependence across samples.

Homogeneity. Capture-recapture methods assume that the samples represent a homogeneous group. For the present study, the assumption of homogeneity would imply that 1) characteristics and drug use patterns are

approximately the same for all problem heroin users in Northern Ireland, 2) treatment utilisation and contact with GPs are approximately the same across all problem heroin users in Northern Ireland, and 3) the probability of coming into contact with the police and the probability of arrest are approximately the same for all problem heroin users in Northern Ireland. These factors are unlikely to apply in Northern Ireland or elsewhere, thus, the assumption of homogeneity is likely to be violated. The result is heterogeneity, which can bias the estimates (Brecht and Wickens, 1993).

To illustrate, rural heroin users may be quite different than urban users in terms of access to drugs, as well as drug use patterns, e.g., frequency of use. Rural users might also have less access to drug treatment because fewer treatment programs are available in rural areas and because treatment options (i.e., modalities) might be more restricted in rural areas. Such differences could reflect a violation of the assumption of homogeneity, and this violation could lead to biased estimates. However, some researchers have suggested the possibility that rural users might alter their lifestyles by either travelling to nonrural areas where heroin can be obtained, or by choosing another drug altogether – one that is more readily available (Aitken, Brough, and Crofts, 1999).

Problems relating to heterogeneity can be diminished by stratifying the data (Maxwell and Pullum, 2001). That is, estimates can be calculated for categories of individual traits that are believed to influence the probability of appearing on any one list. Capture-recapture studies of drug misuse often stratify the data by gender and age, since it is assumed that males and older users are more likely to have contact with the agencies from which the sample lists derive.

Closed population. A closed population assumes that drug users do not flow in and out of the drug using population during the time specified by the study. For example, to be truly closed, the number of problem heroin users in the population (as opposed to the three samples) would not decrease as a result of mortality, abstinence, geographic moves. Nor should the population of problem heroin users increase as a result of geographic moves or transitions from non-use or non-problem use to problem use (Brecht and Wickens, 1993). Studies that span a lengthy time period (e.g., the number of users in a six-month or one-year period), generally are at greater risk for violating the assumption of a closed population. However, researchers have proposed that homogeneity and independence of samples represent the most important assumptions for capture-recapture studies (Domingo-Salvany, 1997) and slight in- or out-movement within the population generally will not bias the estimate (Larson and Bammer, 1996).

Three-sample capture-recapture studies use seven pieces of information in a contingency table to predict the missing value (i.e., problem heroin users who do not appear in any one of the three data sources).

Methodology

Prevalence studies of drug misuse must specify the definition of drug misuse that is used, as well as the time frame to which the estimates apply. Each of these issues is discussed below.

Definition

Defining the target group to which prevalence estimates apply appears to be a simple task, but actually is one that is fraught with difficulties (European Monitoring Centre for Drugs and Drug Addiction, 1999a). For the present study one possibility was to use the general category of “heroin users.” However, this category was viewed as too broad in that it includes occasional as well as regular users, persons who use heroin a few times during a 12-month period and persons who use heroin daily. Moreover, many of the sources from which data were drawn for this study were perhaps more likely to have contact with “problem heroin users” rather than the more general classification of “heroin users.” Similar studies conducted in other regions have faced the same problem; that is, the definition of the target group to which estimates apply generally is influenced more by the availability of data than by theoretical reasons (Hartnoll, 1999: 6).

Drawing from the British Medical Association’s definition of “problem drug use,” (1997: 38), “problem heroin use” in the present study was defined as “[heroin] use resulting in social, psychological, physical or legal problems associated with dependence, intoxication or regular consumption.” Similar to other studies (e.g., Hickman et al., 1999), clinical criteria of “drug dependence”¹⁴ could not be ascertained from most of the available data, thus, defining the target group as “persons who are dependent on heroin” was not possible.

The definition of “problem heroin use” also has its limitations. For example, general practitioners and others who have contributed to the Addicts Index may have been incorrect in their assessment of “heroin addiction.” The offence for which one is arrested, including possession of heroin, may or may not reflect “problem heroin use,” or “heroin use” at all. Finally, some authors have argued that the definition of “problem drug use” may disproportionately exclude heroin smokers (Hartnoll, 1999: 7).

Time period

For the present study, the time frame under study consisted of the 12-month period, 1 November 2000 to 31 October 2001. It would have been preferable to utilise a calendar year so that prevalence rates in Northern Ireland could be

¹⁴ Clinical criteria of drug dependence include conditions such as tolerance, withdrawal, consumption patterns that increase over time, inability to control usage, the abandonment of non-drug activities, and the unwillingness or inability to discontinue drug use even when significant health problems arise that are associated with drug use (European Monitoring Centre for Drugs and Drug Addiction, 1999a: 10-11).

compared with subsequent annual prevalence studies in the region, and compared with rates from other countries that were generated in the same calendar year. However, data from the Northern Ireland Drug Misuse Database (NI DMD) were used in this study and that system was implemented in April 2000. Similar to other regional data collection efforts, problems associated with reporting as well as delays were encountered during the first phase of implementation of the NI DMD. It was assumed that these data might be more accurate after the system had been in operation for approximately six months.

In many countries, heroin use is both rare and hidden. The methods of estimation that were discussed in the previous section all have limitations. As a result, researchers have been encouraged to use various methods for estimation and compare the results generated by these methods (Larson and Bammer, 1996).

Capture-recapture methodology served as the primary tool that was used to estimate the number of problem heroin users in Northern Ireland. Additional estimates were obtained using various multipliers. These approaches are discussed below.

Capture-Recapture Method: Sample Descriptions

For capture-recapture studies of drug misuse, it has been recommended that samples or lists be drawn from both medical/treatment agencies as well as from the legal system (Domingo-Salvany, 1997; Hickman et al., 1999). In the present study, three lists were generated from the following sources: 1) Treatment/Drug Services, 2) Addicts Index and Hospital Admissions, and 3) Arrests. From each source, the initials of the first and last name, the date of birth, and the gender were provided for each individual on the list. This information was necessary to eliminate duplicates within the same sample (e.g., a person who had come into contact with two or more treatment agencies during the study period) and to determine the number of matches across the three samples. Ethical approval for the study was granted by the Queen's University Medical Ethics Committee.¹⁵

Sample 1: Treatment/Drug Service. This list reflected combined data generated from the Regional Drugs Misuse Database and reports from voluntary and statutory drug treatment and service agencies in Northern Ireland. In 1989, Regional Drug Misuse Databases were implemented in various parts of the United Kingdom. The RDMDs reflect data on lifetime and recent use of various drugs, including heroin, as well as limited information on treatment history, injection history, and demographic data. In theory, data are provided to the RDMD by treatment agencies, physicians, and other health professionals. In practise, the degree of participation probably varies within particular regions of the United Kingdom.

¹⁵ Approval hinged on the fact that the researcher used a substitute alpha coding scheme and changed the initials of the persons who appeared on the lists. The scheme was destroyed after the matching process had been conducted.

The Northern Ireland Drug Misuse Database was established in April 2000. A total of 83 individuals who had used heroin during the 12-month time period, came into contact with one of several agencies, and were reported to the NI DMD were included in Sample 1. Additional data on individuals who presented for treatment were provided to the researcher by eight agencies (statutory and voluntary), representing twenty different treatment sites in Northern Ireland. Duplicates (i.e., individuals who were matched on initials, date of birth and gender) *within* this sample were eliminated, resulting in a total of 361 persons in the Treatment sample.

One limitation of this sample concerns the coverage rate. Although several agencies or organisations in Northern Ireland have reported that they are involved in providing services (e.g., treatment, information, counselling, training) to drug users, which might include heroin users, it is likely that the degree and diversity of services differ greatly across agencies. For the present study, two of the treatment agencies chose to not participate in the research. One of those agencies did not submit information to the NI DMD during the 12-month study period. It is possible that the agency had no contact with heroin users during the study period.¹⁶ It is also possible that agency staff chose to not participate in the NI DMD. If heroin users did come into contact with that agency during the study period *and* those persons appeared on *either* the police *or* the Addicts Index list, the final estimate would be artificially inflated, i.e., it would be higher than the true number of problem heroin users because a true overlap across samples would not have been observed. Unfortunately there is no way to check to determine whether this pattern occurred.

Another limitation concerns clients whose identities had changed during the study period (e.g., females who marry and take on the partner's second name) and clients who have misrepresented their identities (e.g., initials or date of birth). Changed or false identities can bias the estimate, depending on whether those identities appeared in the second or third sample.

Sample 2: Addicts Index/Hospital In-Patient System. The second sample included persons who were notified to the Addicts Index or who appeared in the Hospital In-Patient system during the 12-month time period of the study.

The Misuse of Drugs Act 1971 (1973 Regulations) specifies that medical practitioners have a statutory obligation to report to the Chief Medical Officer, those patients whom they suspect or have reasonable grounds to believe, are addicted to one of 14 different drugs (13 opiates and cocaine). "Addicts" are defined as those persons who "have an overwhelming desire to take a drug as a result of having taken it before" (Frischer et al., 2000: 362). Although notification is a statutory requirement, the degree of compliance among physicians in Northern Ireland is unknown. The Addicts Index is based largely on reports from GPs and Drug Addiction Units, and since 1998 the majority of

¹⁶ Staff from a separate agency responded to the data request and indicated that the agency did not have any contact with heroin users during the study period.

persons who have been notified were known or strongly suspected to have misused heroin. A total of 253 persons were notified for heroin “addiction” during the 12-month time frame used in this study.

Hospital in-patient data were provided by the Department of Health, Social Services and Public Safety, and represent the number of admissions for which heroin was listed as the primary, secondary, or sub diagnosis. Hospital admission data revealed a total of 26 cases for which individuals were admitted to hospital between 1 November 2000 and 31 October 2001. Initials of patients were not available.¹⁷ However, using two identifiers, date of birth and gender, two cases were removed from the hospital data because of suspected duplication, i.e., the two admissions matched on date of birth and gender. Of the remaining 24 cases, 10 appeared in the Addicts Index. The remaining 14 individuals from the hospital in-patient list were added to the Addicts Index data. In total, this combined list included 267 individuals after duplicates within this list were omitted.

The accuracy of this list depends upon the compliance of medical practitioners to notify individuals, and physicians’ accuracy with respect to identifying problem heroin users among patient populations. One report suggested that some physicians in Northern Ireland lack knowledge about heroin use and heroin addiction (Eastern Drugs Co-ordination Team, 1999), and perceptions among heroin users have supported this finding (McElrath, 2001).

Sample 3: Arrests. Domingo-Salvany (1997) as well as Hickman et al., (1999) recommended that capture-recapture studies of drug misuse include lists from both health and legal sources. In line with that suggestion, several authors (e.g., Brugha et al., 1998; Comiskey, 2001; Comiskey and Barry, 2001) have included arrest data compiled by police within the geographic area of interest. In the present study, the third sample included persons who were arrested for heroin offences (e.g., possession) or acquisitive crimes during the time frame of the study. Data were collated by Crime Analysts throughout Northern Ireland and provided by the Crime Analyst Section of the Police Service of Northern Ireland. This list included 118 persons who had been charged with possession of heroin, acquisitive crimes (e.g., theft, stolen goods), intent to supply, and/or possession of a Class B drug.

A report by the European Monitoring Centre for Drugs and Drug Addiction (1999a) identified the limitations of using police data for estimating the number of drug users within a geographic area. First, although arrest data can be organised categorically by the offences 1) simple possession and 2) sale, supply, or distribution of the drug, these offences do not necessarily differentiate heroin users from heroin non-using “dealers.” For example, some non-users can be arrested for possessing heroin whereas other non-users can be arrested for supplying heroin. The concern for capture-

¹⁷ Requesting the initials of patients would have required permission from several different hospitals in Northern Ireland. Unfortunately, time did not permit for this exercise to be undertaken.

recapture estimates is that these individuals would fall outside the definition (e.g., persons who are not problem heroin users or who are not heroin users at all), thus reducing the overlap between samples, and inflating the overall estimate. This issue is examined in greater detail in the Results section.

Matching

This study used three attributes (i.e., initials of first and last name, date of birth and gender) to identify duplicates within each list, and overlaps across the three lists. When two cases *within the same list* matched on all three identifiers, one of those cases was deleted. To illustrate using hypothetical data, assume KM, a female, with a date of birth of 6 September 1959 appeared in the NI DMD data for the 12-month period under study. Assume that these same *three* identifiers were provided to the researcher by a voluntary drug service agency in Belfast. Although these cases may reflect two distinct individuals within the Treatment sample, they were assumed to be the same person and one case was deleted. Thus, the total number of 361 persons in the Treatment list represents the number of different persons aged 15-54 who presented for treatment during the study period, rather than the number of cases.

Recall that the capture-recapture methodology provides estimates of the hidden population based on 1) the number of known heroin users (i.e., as identified by the three samples) and 2) the overlaps across two and three of these sources. Overlaps were determined by visible inspection of the three lists, checking for matches between initials, dates of births, and gender. This method is not error-free. For example, suppose a person whose traits are listed as *KM, 6/9/59, female* appears in the Treatment list. The same three traits appear in the list of Arrests. For this study, the assumption would have been made that *KM* appearing in one list was the same *KM* appearing in the second list.

If there indeed were two different persons with the same exact traits, the incorrect match might artificially increase the overlap and decrease the overall estimate (Brecht and Wickens, 1993). Suppose that *RZ, 5/5/82, male* appears on the Addicts Index/Hospital In-Patient list, but is incorrectly listed as *RS* on the Treatment list. The match that should have been made was not, so that the overlap between the two lists would be artificially diminished resulting in an increase in the overall estimate. A third source of error can occur within agencies from which the lists are generated. Gabriel (1997: 337) observed that “those closest to the indicators themselves will attest to the imperfection of the data.” Individuals who come into contact with these agencies may provide false identifiers or agencies may incorrectly code identifiers. Matching across lists depends greatly on the accuracy of the original data (Nanan and White, 1997). A final source of error represents mistaken entry of the data by the researcher.

Regional versus local estimates

Although capture-recapture studies of drug misuse are more commonly applied to local areas, e.g., cities, some studies have sought to use the method to generate regional estimates. Hay, McKeganey and Hutchinson (2001) provided estimates of the number of problematic users of opiates and/or benzodiazepines in Scotland. Those authors first generated estimates for each Council area, and these local estimates were then summed to obtain an estimate for Scotland as a whole. A similar strategy was used in a study of “serious drug use” in Wales (Wood, Bloor and Palmer, 2000).

For the present study, the Department of Health, Social Services and Public Safety requested regional estimates of heroin users in Northern Ireland. Capture-recapture estimates could not be ascertained at local levels because in most instances, numbers within most local areas were too small to generate accurate estimates.

An alternative approach was taken in the present study whereby data were collated locally and regionally and estimates were generated at the regional level. Researchers have cautioned that capture-recapture studies that pertain to “a wide geographic area” are more likely to include heterogeneous subgroups of drug misusers (Domingo-Salvany, 1997: 83). However, Cohen (1997: 27) noted that when “local data collection is good, and covers the most important areas of a country, national data have a chance of being of relatively sound quality.”

In the present study, all three datasets covered Northern Ireland as a whole. As a result, a violation of the assumption of homogeneous samples is a distinct possibility. Heterogeneity occurs when that assumption is violated. To illustrate, sub-groups of heroin users can engage in certain behaviours or have certain traits that increase or decrease their chances of appearing on any particular list (Duque-Portugal et al., 1994). A qualitative study of heroin users who resided largely in Belfast found that some heroin users had never presented for treatment or confided in GPs with regards to their drug use. Moreover, this pattern was observed largely among persons who identified themselves as coming from or living in middle-income households. Generalising from qualitative data is not possible, however, it is possible that problem heroin users from middle-income households were less likely to appear on any one of the three lists during the 12-month study period. A second illustration comes from the observations of a staff member from a drug service agency in Northern Ireland. He suggested that female users are less likely than males to present for treatment. He recalled that a male client once asked him about the appropriate treatment for an abscess. The staff person knew, however, that the client did not have an abscess; the staff member believed that the male client was asking the information on behalf of his injecting female partner – who was not in treatment at the time. The staff member believed that it is not women in general who avoid treatment but rather women with children, who tend to avoid contact with treatment agencies because they fear that they will lose their children as a result of

being identified as a drug user. This observation also has been documented in a qualitative study of heroin users in Northern Ireland (McElrath, 2001).

A third illustration of heterogeneity concerns treatment opportunities and treatment utilisation. Assume that “treatment opportunities” is defined in terms of both the number of treatment programs in a given geographic area (e.g., County Armagh), as well as the availability of different treatment modalities (e.g., residential, outpatient, substitute prescribing) within that area. Some research has suggested that rural users, in particular, may have fewer treatment opportunities compared to urban users (European Monitoring Centre for Drugs and Drug Addiction, 1999a). If rural users are disproportionately omitted from treatment lists, the estimate of the number of hidden heroin users in Northern Ireland will be biased in favour of urban users. This scenario would violate the capture-recapture assumption of homogeneity. However, it certainly is possible – even likely - that some users from rural areas move to more urbanised areas in part to manage their heroin use more effectively (e.g., move closer to suppliers as well as to other users). This possibility was observed among some respondents who participated in a qualitative study of heroin users (McElrath, 2001). That research found that some respondents from areas outside Belfast moved to that city to better suit drug lifestyles (similarly, other users left areas because they wanted to distance themselves from the place where they often had used heroin). Nevertheless if any of these possibilities exist as patterns in the data, heterogeneity would most likely be present and would have to be addressed.

Results

Application of Capture-Recapture

Table 1 provides the gender and age distribution from each of the three samples. The majority of persons in each sample were male (Addicts Index/Hospital In-Patient = 77%; Treatment = 78%, Arrests = 89%). The age range was similar in the Treatment and Addicts Index/Hospital In-Patient samples. For example, the average age of persons appearing on these lists was 29 years and the median was 28 years. In the arrest sample, the average age was 28 (median=28). All three samples comprised approximately the same proportion of persons aged 15 to 29 years (i.e., 58%-59%).

Additional data were collected for the Treatment sample. A total of 361 heroin users, aged 54 years old or younger, had presented at a drug service or treatment agency in Northern Ireland between 1 November 2000 and 31 October 2001. Treatment information is considered to be a “lagged” indicator of drug misuse in that “a heroin user will typically access treatment provision around 4 years after the first use of the drug” (Griffiths et al., 2000: 833). Other studies have suggested that the time between first use of heroin and first treatment is much longer. For example, a study conducted in the state of Maryland (USA) reported a mode of seven years between initiation into heroin use and first treatment entry (Agar and Reisinger, 1999). Many factors, e.g., the proportion of injectors, can influence this figure and result in variations within and across cultures. Data on first treatment entry in Northern Ireland have only recently been collected and cannot be examined here.¹⁸

Some research has shown that persons who seek treatment or other service (e.g., GP) for drug use have tended to be injectors and daily users of heroin (Robson and Bruce, 1997). However, data examined from the National Treatment Outcome Research Study (England) showed that heroin users who sought treatment, were about equally likely to consume the drug by injection as they were through chasing¹⁹ (Gossop et al., 2000). In the present study, approximately 78% of the Northern Ireland treatment sample had injected heroin (never injected = 19%, injection unknown = 3%). However, it is not known whether injection was the *preferred* route of administration for these individuals.

¹⁸ These data are collated by agencies and forwarded to the Northern Ireland Drug Misuse Database. Assuming that reports to the Database will be more complete in the future, information on first treatment entry can be an important epidemiological indicator (Hartnoll, 1986).

¹⁹ However, the authors observed several regional variations with regards to the method by which heroin was consumed.

Table 1. *Gender and Age of Problem Heroin Users by Sample*

	<u>Addicts Index/ Hospital</u>	<u>Treatment</u>	<u>Arrests</u>
% Male	77%	78%	89%
Age:			
Range	16-54	16-54	16-47
Mean	29	29	28
Median	28	28	28
15-29	59%	58%	59%
30-54	41%	42%	41%
Gender/Age:			
Male, 15-29	45%	44%	52%
Male, 30-54	33%	35%	37%
Female, 15-29	15%	14%	8 %
Female, 30-54	8%	8%	3%
N	267	361	118

The treatment data were organised by geographic area: Ballymena area, Belfast area, and other area within Northern Ireland.²⁰ Gender, age and route of administration were examined across these three areas. These results are presented in Table 2.

These results suggest that Ballymena treatment sites had clients who were more likely to be male, younger, and with a history of drug injection, compared to other sites. Other areas, and in particular Belfast, have higher numbers of clients who have never injected. These findings suggest the possibility of two diverse heroin populations in Northern Ireland. One group consists of injectors, many of whom are young. The second group consists of heroin users who consume the drug by means other than injection – probably through chasing. These results suggest that location is an important factor in examining problem heroin use in Northern Ireland.

²⁰ More specific geographic locations could not be examined because of the small number of problem heroin users within these areas.

Table 2. *Gender, Age and History of Injection by Geographic Location*

	Geographic Area		
	<u>Ballymena</u>	<u>Belfast</u>	<u>Other Location</u>
% Male	83%	70%	76%*
Age:			
15-29 years	64%	48%	54%*
30-54 years	36%	52%	46%
Ever injected	95%	62%	68%**
N	197	94	70

* Statistically significant at $p \leq .05$

** Statistically significant at $p \leq .01$

These results were examined through logistic regression. That procedure allowed for the examination of gender, age, and location on injection status (ever injected yes/no). Gender/age categories were not statistically significant, which suggests that injection history was similar for males and females within age groups. The only variable that achieved statistical significance was geographic area. Controlling for gender and age, persons treated in Ballymena were approximately 12 times more likely to have injected heroin compared with heroin users from Belfast.²¹

Preliminary inspection of the full capture-recapture model suggested a poor fit thus an estimate could not be generated for the number of hidden problem heroin users. The data were stratified by various age categories and by gender but neither of these approaches produced a good fit. Finally, the arrest sample was divided into two sub-samples: 1) persons who had been arrested for possession only, and 2) persons who had been arrested for acquisitive offences (some of these persons were also arrested for possession). To reduce heterogeneity, models were produced for two age categories, i.e., 15-29 years and 30-54 years. This approach suggested that the “possession only” arrest sub-sample, again demonstrated a poor fit with the data. Better fitting models were estimated by using the sub-sample of persons arrested for acquisitive crimes, perhaps because these types of offences are often more indicative of problem heroin use than “possession only” offences.

Table 3 provides information on the overlaps across the three samples for each age category. To illustrate, 8 of 288 visible users aged 15-29 appeared

²¹ The logistic regression results are presented in more detail in Appendix A.

in the Treatment sample and in the Arrest sample, but not in the Addicts Index/Hospital Inpatient sample. A total of 14 persons aged 15-29 appeared in all three samples. Ten persons appeared in the Arrest sample only, 76 were present in the Addicts Index/Hospital Inpatient sample only, and 122 were identified in the Treatment sample only.

A total of 198 visible users were observed in the 30-54 age group. Thirty-two persons appeared in both the Addicts Index/Hospital Inpatient and Treatment samples, and 7 individuals were present in all three samples. In both contingency tables, the capture-recapture provides the estimate for “X,” i.e., the hidden population of problem heroin users.

Capture-recapture estimates are presented in Table 4. These results are discussed below. Greater detail about model selection is provided in Appendix B.

Age group: 15-29 years. Within this age group, the visible number of problem heroin users was 288 and the model that best fit the data produced an estimate of 178 hidden users (confidence interval 113-266). The number of visible users (from the three samples) was then added to the number of hidden users for a total of 466 problem heroin users, aged 15-29.

Age group: 30-54 years. The visible number of problem heroin users in this age group was 198. The best model produced an estimate of 164 hidden users (confidence interval 96-266), for a total of 362 problem heroin users aged 30-54 years.

Table 3. *Contingency Tables Showing Overlaps Across Three Samples, by Age Category*

Age 15-29				
<i>Addicts Index/Hospital In-Patient</i>				
<i>Treatment</i>				
	<u>Present</u>	<u>Absent</u>	<u>Present</u>	<u>Absent</u>
<i>Arrests</i>				
Present	14	6	8	10
Absent	52	76	122	X

Age 30-54

Addicts Index/Hospital In-Patient

Arrests	<u>Present</u>		<u>Absent</u>	
	<i>Treatment</i>			
	<u>Present</u>	<u>Absent</u>	<u>Present</u>	<u>Absent</u>
Present	7	2	4	4
Absent	32	57	92	X

Table 4. *Capture-Recapture Estimates of the Number of Problem Heroin Users, 1 November 2000 to 31 October 2001*

Age 15-29

<u>Deviance</u>	<u>DF</u>	<u>P-value</u>	<u>AIC</u>	<u>Visible</u>	<u>Hidden</u>	<u>95% CI</u>	<u>Estimate</u>	<u>95% CI</u>
2.56	1	.12	.56	288	178	113-266	----	----

Age 30-54

1.45	1	.23	-.55	198	164	96-266	----	----
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Total Number **828** **695-1018**

Combining the estimates from the two age groups suggests that there were approximately 828 problem heroin users in Northern Ireland between 1 November 2000 and 31 October 2001. The confidence interval suggests that the range of problem heroin users during this time was between 695 and 1018. Using 1999 mid-year population estimates (Northern Ireland Statistics and Research Agency, 2000), the estimated prevalence of problem heroin users was 13 per 10,000 among persons aged 15-29 years, and 6 per 10,000 among persons aged 30-54 years.²² Thus, the prevalence rate of problem heroin use among persons aged 15-29 years, was approximately twice as high as the rate among persons aged 30-54 years.

²² The prevalence rate for the younger age group should be slightly higher as there were no persons aged 15 years old in any of the samples.

Estimates from the Mortality and Addicts Index Multiplier Methods

In this section, the mortality multiplier (discussed previously) is applied to data from Northern Ireland. A total of 21 deaths in Northern Ireland were recorded in the year 2000²³, for which heroin was listed as the main (N=14) or the underlying cause (N=7) of death (Annual Report of the Registrar General, 2001). Other research has documented that both gender and age are associated with fatal heroin overdose. That is, older users (Darke and Ross, 1999) as well as males (Gerostamoulos, Staikos, and Drummer, 2001) have been found to be at higher risk for overdose than are younger users and females. Defining “heroin-related” deaths as well as overdoses is important. Risser et al. (2000: 381) found that “pure heroin-related deaths” occurred more often among younger persons whereas “polydrug heroin-related deaths” occurred more often among older users.

The Northern Ireland data indicate that the ages of the individuals ranged from 19 to 68 years at the time of death, and the average age was 36.8 years. A total of 38% of deaths (N=8) occurred in persons aged 30 or younger at the time of death. Males accounted for 76% (N=16) of these deaths (females accounted for 24%).²⁴ The gender and age distribution differed slightly from data reported elsewhere, a finding that might easily be due to the smaller number of deaths recorded in Northern Ireland. In other countries, researchers have generally recorded higher percentages of males compared to the figure observed for the Northern Ireland data. For example, a study conducted in Victoria (Australia) examined 434 heroin-related deaths that occurred in 1997 and 1998. The vast majority of deaths occurred among males (83%) and 89% of deaths occurred among persons aged 21 and older (Gerostamoulos, Staikos, and Drummer, 2001). Analysis of mortality data from Rome showed that males represented 82% of heroin-related deaths in that city (Bargagli, et al., 2001). Comparisons across countries are difficult to draw because of different methods for recording deaths and the use of different definitions for the term, “heroin-related” deaths.

In several regions, fatal overdoses in which heroin is implicated have increased during the 1990s (Darke and Ross, 1999; Gerostamoulos, Staikos, and Drummer, 2001) and the same pattern might be occurring in Northern Ireland. However, it is difficult to determine whether apparent increases in heroin-related deaths reflect real increases or are due to changes in the reporting or recording of deaths.

In Dublin, Comiskey (2001: 140-141) found that 23 deaths in 1995 had been classified with the code (ICD-9) 304.0, that is, “opioid type dependence.” That author acknowledged that the figure was likely to be underestimated due to reporting delays. Although recognising the problems with comparing mortality data across jurisdictions, the Dublin and Northern Ireland figures are

²³ A total of 22 deaths for which heroin was reported as the main or underlying cause were reported for 1999 (Annual Report of the Registrar General, 2000).

²⁴ The gender proportion in the mortality data is similar to the gender proportion (i.e., 76% male) in both the Treatment and the Addicts Index/Hospital samples.

approximately equal, even though the Dublin figure is based on a different definition, i.e., opioid type dependence (within which heroin dependence would be included). The large numbers of problem heroin users in Dublin in the 1990s cast doubt on this official figure. However, treatment and service provision in Dublin for opiate users, and in particular heroin users, have differed greatly from provision in Northern Ireland, and the more diverse provision in Dublin may have been one factor that contributed to lower heroin-related deaths in that city.

Using the 1-2% mortality rate described earlier, the number of problem heroin users is calculated by $T = A/B$.

Where:

T = Total Number of Problem Heroin Users
A = Number of Heroin Deaths
B = Multiplier

Using Northern Ireland data from 2000, the figures are estimated to be:

21/.02 (low estimate)	=	1050
21/.015 (central estimate)	=	1400
21/.01 (high estimate)	=	2100

The estimates generated through mortality data make three assumptions. First, these results assume that deaths due to heroin have been recorded accurately. Second, the number of deaths that occurred during the 12-month period of the study (i.e., 1 November 2000 to 31 October 2001) was not available. Therefore it is assumed that the number of deaths during calendar year 2000 approximated the number of deaths during the 12-month study period. Finally, the estimates assume that a 1-2% mortality multiplier, as observed by studies conducted elsewhere in the mid-1980s, would apply to Northern Ireland in 2000-2001. In fact, the Northern Ireland true multiplier figure may be higher or lower than 1-2%, which would have implications for the final estimates. In the 1980s, Hartnoll et al. (1985b) suggested that notifications to the Addicts Index should be multiplied by a factor of five, to obtain an estimate of the total number of problem drug users. In Northern Ireland, there were 253 notifications for heroin use to Addicts Index during the study period. Multiplied by a factor of five, the estimate of the total number of problem heroin users would be 1265. Estimates derived from the various methods are shown in Table 5.

Table 5. *Number of Problem Heroin Users by Method of Estimation*

<u>Method</u>	<u>Estimate</u>	<u>Range</u>
Capture-Recapture	828	695-1018
Mortality Multiplier		1050-2100
Addicts Index Multiplier ^a	1265	

^a Omits hospital admissions

Discussion

The confidence interval derived from the capture-recapture approach suggested that there were between 695 and 1018 *problem heroin users* in Northern Ireland between 1 November 2000 and 31 October 2001. The low estimate produced from the mortality data (i.e., 1050) as well as the Addicts Index multiplier (i.e., 1250) tended to approximate the estimates produced by capture-recapture, although the multipliers yielded slightly higher figures. Using all three methods, the total number of *problem heroin users* in Northern Ireland was estimated to range from 695 to 1250. A range of estimates can be important. For example, Hartnoll (1999: 7) suggested that the higher point of the range might reflect a “broader population,” e.g., a group of people who are not necessarily dependent on heroin, but who are “using opiates in a sufficiently intense or risky fashion to be at significant risk of serious health or social consequences...”

Results from the present study suggested that several young adults were identified as problem heroin users. In total, 139 *visible* users aged 15-24 were identified in this study (data not shown). The emergence of or increases in heroin use among youth in recent years have been reported in several countries, e.g., the United States (Schwartz, 1998), England and Wales (Parker, Bury, and Egginton, 1998). In a recent Dublin study, Smyth, O'Brien and Barry (2000) observed that significant numbers of heroin injectors were in the younger age categories.

In the present study, the treatment data suggested that the Ballymena area had a higher proportion of both young adults and injectors. In contrast, a non-injecting population was evident in Belfast, and to a lesser extent, elsewhere in Northern Ireland. It is likely that the non-injectors are chasers, a group that can represent recent initiates of heroin. For instance, 17.2% of smokers in a Spanish study had been using heroin for less than five years, compared to 9.5% of heroin injectors (Barrio et al., 2001). These findings should be considered when planning for future services. Intervention strategies must find ways to deal successfully with various types of problem heroin users identified in this study: 1) older, experienced users, 2) young injectors, and 3) young non-injecting users. However, route of administration can change quickly and it is likely that some chasers observed in these data from 2000-2001, have already progressed to injection. A comparative (and qualitative) study of heroin users in areas of New York City and Sydney found that injection tended to occur within one month and a few years of initiation into heroin use (Johnson, Maher and Friedman, 2001). A qualitative study in Northern Ireland found that 39 of the 43 respondents had progressed to injection and most had done so between one and two years of initiating heroin use. It might be assumed that heroin users who consume the drug without injecting are less in need of treatment. However, research conducted in three cities in Spain found that severity of dependence among heroin injectors was *not* significantly higher than the severity of dependence among heroin

smokers, even among new users²⁵ (Barrio et al., 2001). Those authors also found that the severity of dependence increased with each year of heroin use, levelling off at approximately five years of use.

In the present study, estimates were not derived for *local* areas as only the Treatment sample allowed for comparisons across geographic regions within Northern Ireland. From those data, locale appears to be an important factor in examining problem heroin use in Northern Ireland. Further, locale appears to be related to both the route of administration as well as the age and gender of persons presenting for treatment in Northern Ireland.

Hay, McKeganey and Hutchinson (2001) examined the prevalence of problem opiate and benzodiazepine use in Scotland. When analysing prevalence by age category, those authors observed that a higher prevalence of younger users (i.e., range 15 to 24 years) were found in areas where opiate and benzodiazepine use had surfaced more recently. In contrast, Dundee, Edinburgh and Glasgow, cities where problem drug use emerged several years ago, had higher rates of older drug users compared to other regions in Scotland. Treatment data from Northern Ireland showed that clients presenting to agencies in Ballymena were younger than clients presenting elsewhere. Some research has found that “latency time to go into treatment seems to be shorter in less urbanised areas” (European Monitoring Centre for Drugs and Drug Addiction, 1999a: 15). Such might be the case in the Ballymena area. Alternatively, there might be a very large group of heroin users in that community who have not yet “progressed” to problematic use that would be identified in the data examined here.

Capture-recapture methodology assumes that the population is closed. In general, this assumption does not hold for drug users who can leave from or arrive to the geographic area within the time frame under study. Further, some people might have become “problem heroin users” or abstained from heroin altogether during the time period of interest. Although recognising the weaknesses of the Addicts Index data, figures from 2000 showed that the number of removals from the Index (e.g., through death, abstinence, emigration) was approximately equal to the number of new notifications (79, 77, respectively) which provides some indication that in- and out-movement among problem heroin users was approximately equal in Northern Ireland during that year. This information suggests that the effects of violating the assumption of a closed population might have been minimal. Of less certainty, however, is whether the traits and behaviours were similar of heroin users who emerged and left during the study period. Similar to other research that has utilised this methodology, the capture-recapture estimates relate to the number of persons who were problem heroin users in Northern Ireland “for at least part of the 12-month period” under study (Fisher, et al., 1994).

These estimates are grounded in the data from which they derive. Each of the capture–recapture samples has inherent biases, and given the limited

²⁵ Among newer users, heroin sniffers had significantly lower scores on severity of dependence than smokers and injectors.

research into heroin use in Northern Ireland, the direction of the biases is unclear. The capture-recapture estimate of the number of problem heroin users was 828 (range: 695-1018). The degree to which this figure might be underestimated is unknown. Heterogeneity can manifest itself in several ways, and serve to underestimate the true value of the hidden number of users.

In its “most extreme form” (Brecht and Wickens, 1993: 240), heterogeneity reflects a group or groups of problem heroin users who have certain traits (e.g., belonging to particular ethnic group) or engage in certain behaviours (e.g., injecting) that either increase or decrease the probability of coming into contact with one of the three sources. Stated differently, the probability of appearing on a list *because* of these traits or behaviours is higher (or lower) than the probability of other problem heroin users appearing on a list. This pattern would inflate the number of overlaps across lists, and serve to underestimate the hidden population. Traits might include factors such as household income, place of residence. For instance, results from a qualitative study of heroin users in Northern Ireland suggested that individuals from middle-income households were more likely than other users to conceal “drug user identities” from general practitioners and drug treatment agencies. Similarly, heroin users who reside in small towns might be less willing to confide in local physicians for fear that confidentiality will be compromised. An alternative argument is that people who reside in non-urban settings may have established better relations with general practitioners, and as a result, may be more willing to seek help from these providers. Similarly, policing drug misuse in non-urban areas may differ substantially from policing in urban areas. If these circumstances form part of a pattern among heroin users who share these traits, then the samples might reflect heterogeneity, and produce an underestimate of the hidden population.

Cormack (1999: 929) emphasised his concerns raised in an earlier paper in which he argued that the “unequal vulnerability of different individuals” can present problems in capture-recapture studies of humans. Northern Ireland has been characterised by extreme political conflict for many years. Several communities remain polarised and divided. Within this context, are individuals from one community more “vulnerable” to being “captured” by any one of the samples than individuals in another community? This question could not be addressed by the data collected for this research, but it bears careful thinking. The notion of “disproportionate capture” based on one’s religious background was a possibility first raised to this researcher by an epidemiologist, who wondered whether Catholic medical practitioners might be less willing than Protestant practitioners to notify patients to the Addicts Index. A similar concern can be raised with the Treatment sample. To what extent do persons avoid presenting for treatment at agencies that are located in communities unlike their own? Similarly, Cohen (1997: 31) cautioned readers about generating inaccurate prevalence estimates from arrest data when those data reflect biases towards or against particular ethnic groups. Assuming similar offences and controlling for numbers in the population, are arrest probabilities the same for Protestants and Catholics? These issues are difficult for policy makers to consider, and perhaps acknowledge. However, to omit from this

report the possibility of certain users being more “vulnerable” than others – based on their religious backgrounds – would be an error. Such an omission would in fact ignore the social and political context of the wider environment in which heroin use occurs in Northern Ireland.

The present study used multipliers that had been developed several years ago, and in other countries. The often-cited mortality rate of 1-2% was based on treatment and hospital samples, primarily from the 1980s in England. Detailed research into mortality among heroin users (or injectors, generally) has not been conducted in Northern Ireland, thus it is not known whether the mortality rate used in the present study is accurate. The profile of treatment services in Northern Ireland differs from that of England, particularly with regards to substitute prescribing, a factor that might influence mortality. Additionally, little is known about new heroin users and the proportion of injectors overall, two factors that could affect deaths due to heroin. Finally, the method by which heroin-related deaths are recorded in Northern Ireland also can affect the overall figures.

A factor of five was applied to data generated from the Addicts Index in order to estimate the number of problem heroin users in Northern Ireland. That factor was identified by Hartnoll and his colleagues (1985b) approximately 15 years ago. The degree to which that factor is appropriate for use with Northern Ireland data in 2000-2001 is unknown. The estimates derived from both the Addicts Index and mortality data were similar, and this comparison might suggest that the multipliers were valid. However, it also is possible that both multipliers were biased and that the bias was in the same direction (e.g., both multipliers produced an overestimate of the total population of problem heroin users). This issue cannot be rectified without additional research conducted with problem heroin users. Studies that examine the proportion of heroin users in treatment in Northern Ireland, the treatment history as well as the mortality rates in this population would benefit future studies that seek to estimate prevalence of problem heroin use in Northern Ireland.

Recommendations

1. Drug policy decisions that have occurred elsewhere (e.g., Edinburgh, Wirral) should be carefully reviewed. For instance, it is now believed that only a few heroin users resided in Wirral in the early 1980s. Within six years, the number rose to approximately 4,000 (Parker, Bury, and Egginton, 1998). In the cities of Glasgow and Edinburgh, different policy approaches were taken initially with respect to heroin use and injection. The implications of those decisions also differed. A careful review of those decisions might provide knowledge on how to avoid the mistakes that other policy makers have made with respect to problem heroin use.
2. This report produced baseline estimates of problem heroin use in Northern Ireland and these estimates might be useful for comparing with estimates derived in the future. However, unless additional research is conducted with heroin users in Northern Ireland (e.g., studies of users who are not in contact with services), researchers involved in estimation work in the future will face the same difficulties in terms of data availability and limitations.
3. Information provided to the Northern Ireland Drug Misuse Database has great potential. In particular, data on first treatment exposure have epidemiological importance and would be quite useful for monitoring trends. Agencies should be strongly encouraged to provide accurate data to the Northern Ireland Drug Misuse Database on a regular basis. Fuller participation would allow for drug misuse data to be evaluated with ease. In sum, a treatment monitoring system is extremely important. Service delivery is equally important, however, completing forms can interfere with service delivery. The conflict between monitoring goals and service delivery objectives must be resolved. To the outsider, one cannot survive without the other.
4. The Addicts Index should remain as a register in Northern Ireland, at least until other monitoring systems are validated. Despite criticism of the notification data, if the appropriate multiplier could be determined in Northern Ireland *and* validated periodically, this method might represent an inexpensive way to monitor the population of problem heroin users. Research might investigate how physicians, in particular, make judgements about “suspected” and “known” addiction.
5. Howard Parker argued that many professional staff who work with heroin users in addiction services in Britain, lack the appropriate training for dealing with this population (Dean, 1999: 1947). He cautioned that there could be a “crisis” in the delivery of treatment services as a result of insufficient training and inadequate auditing systems. The present study identified 361 problem heroin users, aged 15-54 who had contact with treatment services during the 12-month study period. The present research did not specifically examine knowledge of heroin addiction and training needs of treatment staff in Northern Ireland. Findings from such research, however, would be beneficial for treatment staff, policymakers, as well as heroin users in need of treatment. It is recommended that research be conducted that

examines staff training needs with respect to heroin addiction among clients.

6. Although the purpose of this study addressed problem heroin use in Northern Ireland, policy makers should consider the importance of research into the use of benzodiazepines. In reviewing hospital in-patient data for this study, the researcher observed dozens of hospital admissions for benzodiazepine use during the 12-month study period. Some of these cases involved opioid dependence as well. Future research should focus on the use of benzodiazepines in Northern Ireland. It is possible that two broad categories of “problem” benzodiazepine users reside in Northern Ireland. In the first group, we would expect to find individuals whose licit or illicit use of the drug at some stage progressed to dependence. Benzodiazepines might represent the drug of choice for this group. A second group might be comprised of persons who are either regular users of or dependent on both benzodiazepines and opiates. Other evidence has found comparatively high rates of benzodiazepine use in Northern Ireland (Heather, McCarthy, and Luce, 2001; Stika et al., 1974). Research should address the linkages between benzodiazepine use and the wider political conflict.

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Appendices

Appendix A

Results from Logistic Regression

Sample: Persons in treatment, 1 November 2000-31 October 2001

Dependent variable: Ever injected

Results:

<u>Variable</u>	<u>B</u>	<u>S.E.</u>	<u>Significance</u>	<u>Odds Ratio</u>
Gender/Age: ^a				
Male, age 15-29	-.053	.351	.880	---
Female, age 15-29	.001	.440	.998	---
Female, age 30-54	-.018	.557	.974	---
Area: ^b				
Ballymena	2.463	.411	.000	11.74
Other Area	.260	.342	.447	---

^a Reference category is "Male, age 30-54"

^b Reference category is "Belfast"

Appendix B

Capture-recapture Models

Models were selected based on the following criteria: 1) non-significance of the model (i.e., low deviance, high p-value), and 2) low AIC value.

Both models contained two interaction terms, i.e., the interaction between the Addicts Index/Hospital Inpatient and the Arrest sample, and the interaction between the Treatment and the Arrest sample. Both interaction terms in both models were positive, suggesting that 1) persons appearing on the Addicts Index/Hospital Inpatient list were more likely to appear in the Arrest sample, and 2) persons appearing on the Treatment list also were more likely to appear in the Arrest sample.

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