

**ORIGINAL ARTICLE**

## **Heroin seizures and heroin use in Scotland**

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### **Abstract**

The seizure of illicit drugs is a key component of the U.K. drug strategy. Whilst information on the quantity of drugs seized and their weight is routinely collected by enforcement agencies, and released to the media, interpreting the meaning of changes in the amounts recorded is fraught with difficulty as a result of not having access to accurate information on the total amount of illegal drugs available within the UK. This article seeks to compare the quantities of heroin seized by police in Scotland with estimates of the amount of heroin consumed over a 12-month period. The research shows that over the period 2000–2006 heroin seizures within Scotland typically amounted to around 1% of the total amount of heroin consumed. The paper discusses the possible reasons why heroin seizures may represent such a low percentage of heroin consumed and considers the implications of this work with regard to drug enforcement activities.

**Keywords:** *Heroin, Seizures, Enforcement, Effectiveness.*

### **Introduction**

The seizure of illegal drugs is a key component of the UK drug strategy. Information on the number of drug seizures and the quantity of drugs seized is collated by government departments, and forms part of the statistical information used to assess the impact of the UK drug strategy. It is evident from the data on drug seizures, however, that there are marked fluctuations in the quantity of illegal drugs seized within the UK over successive years. For example, in 2004–2005 179.3 kg of heroin was seized by Scottish police forces. In the following year the amount of heroin seized was reduced by nearly 50% to 97.5 kg (Scottish Executive, 2007). From an analytic perspective it is very difficult to interpret the meaning of such dramatic changes in the quantity of drugs seized. An increase in either the quantity of drugs seized or the number of drug seizures may be the result of a particularly successful enforcement operation that is unlikely to be repeated in the following year. Equally, an increase in seizures could be the result of an overall increase in the quantity of drugs being targeted at the UK, such that even a marked increase in the quantity of drugs

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seized may represent a reduction in the proportion of 'seized' to 'successfully imported' drugs.

The difficulty in interpreting fluctuations in the quantity of drugs seized arises in part as a result of there being no information available on the total amounts of illegal drugs entering the UK against which to assess such drug seizure data. In order to remedy this analytic problem efforts have been undertaken in some countries to estimate the amount of illegal drugs being imported into particular countries and to use that information to assess the effectiveness of interdiction efforts. Within the United States, for example, analysts have used satellite surveillance of poppy production areas to calculate overall heroin production, and to combine that information with information on heroin consumption, to produce an overall measure of the proportion of heroin successfully stopped from entering the United States. Bruen et al. (2002), for example, have used this approach to estimate that around 6% of heroin targeted at the United States is successfully seized. Such an analysis has not generally been undertaken within the UK as a result of the lack of good information on the number of heroin users or the amounts of heroin being consumed. More recently, research has been undertaken within at least some parts of the UK that can enable a similar calculation to be undertaken. In this article we draw upon information from three sources: on the prevalence of problem drug use; on the estimated number of heroin users; and on the quantity of heroin consumed in Scotland; to estimate the proportion of 'seized' to 'consumed' heroin. Before looking in detail at the estimates we have produced it is important to outline the research studies that our analysis is based upon.

### **The research base**

The first research we have drawn upon here has provided estimates of the prevalence of problematic drug misuse in Scotland. Undertaken by Hay and colleagues the research has provided problem drug misuse prevalence estimates for Scotland for the years 2000 and 2003 (Hay et al 2001; Hay, Gannon, McKeganey, Hutchison, & Goldberg, 2005). The research has applied the capture/recapture statistical technique of modelling the overall problematic drug using population in Scotland on the basis of an analysis of the overlap between diverse and partial samples of problematic drug users. This method is widely regarded as the most appropriate means for providing national and local problem drug misuse prevalence estimates and has been used in a range of countries including: England (Hay, Gannon, MacDougall, Millar, Williams, Eastwood, & McKeganey, 2008), France (Vaissade & Legleye, 2009), Dublin (Comiskey & Barry, 2001), and Norway (Kraus, Augustin, Frischer, Kümmler, Uhl, & Wiessing, 2003).

The second research we have drawn upon in this article is the Drug Outcome Research in Scotland study (DORIS). The DORIS research is the largest survey of problem drug users ever undertaken within Scotland and involved recruiting 1033 drug users starting a new episode of drug treatment from 33 drug treatment agencies in urban and rural locations across Scotland in 2001. The drug treatment agencies participating in this research covered the range of drug abuse treatment available in Scotland at that time. For example, 27% of respondents were receiving methadone treatment; 29% were receiving other prescribed drugs; 12% were receiving residential detoxification; 12% were receiving residential rehabilitation; 14% were receiving counselling; and 6% were receiving group work. Sixty-nine per cent of respondents were male, 31% female. The mean age of respondents was 28 years (range 16–53 years; median 27 years). Previous publications from the DORIS study

have focused on such topics as drug-related deaths in Scotland (Bloor et al, 2008a), the aspirations of drug users seeking drug treatment within Scotland (McKeganey, Morris, Neale, & Robertson, 2004), the effectiveness of drug treatment services within Scotland (McKeganey, Bloor, Robertson, Neale, & MacDougall, 2006), sexual and physical abuse amongst drug users seeking drug treatment within Scotland (McKeganey et al, 2005), the effectiveness of prison based drug treatment services in Scotland (McIntosh & Saville, 2006), the impact of methadone prescribing on addict behaviour (Bloor et al, 2008), the health and treatment needs of Scottish drug users (Neale, 2004a,b; Neale, Robertson, & Saville, 2005), drug users risks of non-fatal overdose (Neale & Robertson, 2005), and drug use and violence (Neale, Bloor, & Weir, 2005).

### **Estimating the number of heroin users in Scotland**

Hay and colleagues estimated the prevalence of problematic drug misuse in Scotland in 2001 to be 55,800 (Hay et al, 2001). When this research was repeated for the calendar year 2003 the prevalence of problematic drug misuse in Scotland was estimated to have reduced to 51,582. The 95% confidence interval attached to this estimate is 51,456–56,379 (Hay et al, 2005). This corresponds to a prevalence rate of 1.84% of the Scottish population aged between 15 and 54 (95% CI 1.84–2.01%). The definition of problematic drug use applied in this study relates to the use of opiates and benzodiazepines, rather than referring specifically to heroin. To estimate the proportion of the overall 51,582 problematic drug users using heroin it is necessary to combine information from the Hay et al. (2005) study of problem drug use prevalence in Scotland with information on drug consumption obtained in the course of the Drug Outcome Research in Scotland study.

On recruitment into the DORIS study individuals took part in a lengthy interview in which they were questioned about their legal and illegal drug use in the 90-day period before having contacted the drug treatment agency. Overall, 90.5% of those interviewed reported having used heroin within the preceding 90 days. Extrapolating that percentage to the wider problematic drug using population (e.g. taking 90.5% of the estimated total 51,582 problematic drug users within Scotland) would produce an estimate of there being 46,687 heroin users within Scotland in the year 2003.

### **Estimating the consumption of heroin in Scotland**

According to the Independent Drug Monitoring Unit (2003) there are a variety of estimates of the amount of heroin consumed by drug users with much of the data on quantity consumed being derived from studies in the late eighties. Gossop, Griffiths, and Strang (1988), for example, estimated that 70% of opiate injectors used less than 0.5 g per day, 19% used 0.5–0.75 g, and 11% used over 0.75 g per day. To establish an estimate of the amount of heroin consumed by problematic drug users in Scotland it is necessary to draw again upon the Drug Outcome Research in Scotland study.

On average DORIS respondents reported having used heroin on 64 of the preceding 90 days. Extrapolating that figure over a 12-month period would indicate that problem drug users in Scotland were consuming heroin on 261 days per year. With regard to the amounts of heroin used, DORIS respondents further reported consuming on average 0.88 g per day. Combining the information from DORIS on the number of days heroin was consumed over a 12-month period with an estimate of their being 46,687 heroin users within Scotland

would produce a total heroin consumption figure over a twelve month period of 10,705 kg or 10.7 tonnes.

### Heroin seizures as a proportion of consumption in Scotland

In Table I below we summarize data on heroin seizures in Scotland supplied by the Scottish Executive for the period 2000–2006 (Scottish Executive, 2007) with our estimates of total heroin consumption within Scotland.

Table I has been constructed on the assumption that the number of heroin users in Scotland remained constant for the period 2000–2006. The figure we have chosen for this purpose is based on the lower of the two problem drug misuse estimates provided by Hay and colleagues. The first thing that is evident from Table I is the marked variation in quantities of heroin seized in Scotland over the time period 2000–2006, ranging from a high of 179.3 kg in 2004–2005 to a low of 49.0 kg in 2000. However, irrespective of the year-on-year variation in the quantity of heroin seized, the consistent picture remains that seizures represent only a tiny fraction of estimated total amount of heroin consumed in Scotland. Even the high heroin seizure year of 2004–2005 represents only 1.67% of the total amount of heroin estimated to have been consumed in Scotland over a 12-month period. In the next section of this paper we present the results of having undertaken a sensitivity analysis with regard to the possibility that the low proportion of seized to consumed heroin may be explicable in terms of the differential purity of seized to consumed heroin.

### Sensitivity Analysis

On the basis of our analysis we have estimated that heroin users in Scotland consume a total of 10,705kg of heroin annually. Police Forces in Scotland, by contrast, reported seizing a total of 101.6kg of heroin in 2005–06. A simple calculation shows that this means Police Forces in Scotland seized  $\frac{101.6}{10705.0} = 0.009 = 1.0\%$  of the total amount of estimated heroin in Scotland in that time period. However this does not take into account the possible impact of differences in the purity of heroin seized by police when compared with the purity of heroin that is consumed by users. Further, the seizure figures reported by police reflect a variety of seizure points ranging from seizures of small personal amounts to large scale operations resulting in seizures of larger supply scale amounts. Therefore there may be some variation in the purity of the heroin seized that is dependent upon the point in the supply chain at which the heroin was seized.

It is not possible to determine from the published drug seizure statistics for Scotland the point in the supply chain that the seizure took place and, as a consequence of this, to

Table I. Heroin seizures by Scottish police forces

Time period	Quantity of heroin seized in Scotland (kg)	Percentage of seized to estimated consumed heroin in Scotland
2000–2001	49.0	0.45%
2001–2002	133.9	1.25%
2002–2003	60.9	0.56%
2003–2004	71.0	0.66%
2004–2005	179.3	1.67%
2005–2006	97.5	0.91%

determine what proportion of seizures could be at a higher or lower purity level. A sensitivity analysis that simulates varying proportions and varying purity levels can measure what effect these two inputs have on the resulting estimated percentage of seized to consumed heroin in Scotland.

For example, we can look first at one extreme scenario in which all of the police seizures are assumed to take place at some point high up in the supply chain (which, for the purposes of this paper is termed as 'dealer level'), with no seizures occurring at the final stages of the supply chain (termed as 'street level'). If in addition we assume that the purity of heroin at the dealer level is five times that at street level it is clear that the 10,705kg of street level heroin consumed is a different substance to the 101.6 kg of dealer level heroin that has been seized by the police. It is necessary, then to convert one of these so that both measure either street level heroin weights or dealer level heroin weights. In the equation below we have converted the heroin seized by police at the dealer level to heroin at street level. Since the dealer level heroin is five times purer than the heroin at street level then the 101.6kg would equate to 508kg of street level heroin. This means that police would have seized  $\frac{508}{10705} = 0.047 = 4.7\%$ .

Conversely we can look at the other extreme and assume that all of the police seizures were at the street level and that there is no difference between the purity at street level and at dealer level. Since the police seizures are all street level heroin then there is no need to convert. Therefore the police would have seized  $\frac{101.6}{10705.0} = 0.009 = 1.0\%$ .

A further point to note with this example is that since the purity is the same at dealer level as it is at the street level, the proportion of police seizures at the dealer level and street level is incidental and will have no bearing on the estimated percentage. This can be seen from the three dimensional surface chart below. At the point where the purity differential is one (meaning that the purity is the same for street and dealer level) there is no change in the percentage seized even though the percentage seized at street level (or dealer level) is changing.

What this figure does show is that even the most extreme and perhaps unlikely scenario whereby the police are always seizing the heroin before it reaches the drug users and the heroin they seize is five times purer than it is at the 'street level' then they will still only be seizing 4.7% of all heroin being consumed in Scotland annually. It has been shown therefore that due to the sheer scale of the estimated amount of heroin consumed annually (10,705kg), the impact that varying purity and varying points of seizure has on the estimated percentage seized is very small.

## Discussion

Our analysis here of the number of heroin users within Scotland and the quantity of heroin consumed is based upon a combination of the national problem drug misuse prevalence research undertaken by Hay and colleagues for the year 2003, and data from the Drug Outcome Research in Scotland study for the year 2001. It is important to recognize that the two time periods covered by these studies is not coterminous. Similarly, our estimates of the proportion of heroin seized to heroin consumed relates to the period 2000–2006, whereas our prevalence calculations and amount of heroin consumed calculations relate to 2003 and 2001, respectively. With regard to the research estimating the prevalence of problem drug misuse within Scotland we have assumed that the estimated figure of 51,582 obtained for 2003 can be broadly applied to the period 2000–2006 and used as the basis to calculate the number of heroin users in Scotland. It is possible that the prevalence of

problematic drug misuse in Scotland (and by implication the number of heroin users) may have reduced from the period 2003–2006, although there is, at present, no more recent estimate of problem drug misuse prevalence with which to calculate an up to date figure for heroin consumption.

With regard to the data on heroin consumption obtained from the DORIS study for 2001 it is important to recognize that the DORIS research relates to drug users contacting drug treatment services. On that basis, the DORIS sample should be seen as a treatment sample of problem drug users rather than a representative sample of drug users overall (i.e. those who are in contact with drug treatment services and those who are not in contact with such services). Nevertheless, the baseline interview undertaken with DORIS respondents on recruitment into the study relates to the preceding 90-day period, i.e. a period when the DORIS respondents were not in contact with drug treatment services. It has to be recognized, however, that the DORIS data relates to a sample of drug users who were on their way to contacting drug treatment services, i.e. they were closer to a treatment population than a group of drug users who had only recently begun to use heroin. It is possible that we may have over-estimated heroin consumption levels as a result of basing our estimate on the level of heroin consumption reported by DORIS respondents. At the same time it is important to recognize that our estimate of heroin consumption does not include individuals who are using heroin within Scotland on only an occasional and possibly controlled, i.e. non-problematic way. Whilst the notion of controlled or non-problematic heroin use is controversial within the addictions field, recent research in both Scotland and England has reported on the characteristics of individuals who appear able to consume heroin without experiencing many of the problems that would otherwise bring them to the attention of drug treatment or drug enforcement services (Shewan & Dalgarno, 2005; Warburton, Turnbull, & Hough, 2007). It is not possible on the basis of the limited amount of research undertaken on this topic to provide any kind of estimate of the number of controlled heroin users in Scotland. For that reason, our estimate of the quantity of heroin being consumed in Scotland relates only to those who are using the drug in a problematic way and has not been revised up to include an element of such controlled or non-problematic use.

It is important to recognize that our information on the amounts of heroin consumed, and the average number of days on which heroin is consumed, is based solely on self-report data. We do not have any means of checking the veracity of drug user's accounts of the frequency with which they were using particular drugs or the quantities that they report using. Research was undertaken within the DORIS study comparing drug users self reported drug use data with oral fluid testing (Neale & Robertson, 2004). This research identified a very high concordance between such testing and drug users self-report of what drugs they said they had used, although it is not possible on the basis of such an analysis to confirm the quantity of any particular drug consumed. Nevertheless, it was explained to drug users on recruitment into the DORIS study that their answers would in no way impact on their access to treatment. There was then no gain to the drug users themselves in inflating their reported level of drug consumption.

With regard to the implications of this study it is important to stress that the calculation of 'seized' to estimated 'consumed' heroin in Scotland does not stand as a measure of the quantity of heroin imported within Scotland. In other words, our analysis should not be seen as tantamount to the claim that enforcement agencies within Scotland are seizing only around 1% of the heroin entering Scotland. We do not have any data on the amount of heroin being targeted at Scotland or the amount of heroin successfully imported into

Scotland, although on the basis of the analysis we have undertaken here the level of heroin importation would at minimum appear to be sufficient to meet the estimated 10 tonne consumption needs of heroin users in Scotland.

However, why might the proportion of seized to estimated consumed heroin be so low at around 1%? In seeking to answer that question it is important to acknowledge the fact that our analysis is not based upon information as to the purity of the heroin being consumed in Scotland. It is known that the journey from heroin production to heroin consumption is a process during which heroin may be 'cut' with the addition of certain bulking agents by drug dealers' intent on maximizing the quantity of the heroin they are selling. Where research has been carried out on the cutting process there has been some suggestion that the process itself has been subjected to some considerable myth making, for example, in the suggestion that drugs may be cut with the addition of toxic substances (Coomber, 1997a–d). It is possible that the extent of such heroin dilution may be influenced by fluctuations in heroin production and possibly also by the effectiveness of heroin seizures. However, we do not have any information on the way in which heroin seizures may impact upon heroin purity levels at either a national or a local level. With regard to heroin purity at the national level within the UK the European Monitoring Centre for Drugs and Drug Addiction has estimated this to be around 40% (EMCDDA, 2008). If the figure of 40% purity is broadly accurate for heroin in Scotland then the low proportion of seized to consumed heroin is unlikely to be fully explained as a consequence of the cutting process. Further, the sensitivity analysis we have undertaken looking at the possible impact of significant variations in drug purity and drug seizures indicates that the issue of purity does not greatly influence the overall proportion of seized to consumed heroin.

A recent review of the role of drug enforcement within the UK stressed the capacity of drug markets to adapt to enforcement tactics (McSweeney, Turnbull, & Hough, 2008). It has similarly been observed that despite high profile successes in the area of enforcement; nevertheless, the price of illegal drugs has continued to decline (MaCoun & Reuter, 2001). If we are correct that heroin seizures tend to amount to around 1% of heroin consumption it is easy to see why such seizures may not be having a dramatic impact on pushing up the price of heroin within Scotland. It has been estimated by the United Nations Office of Drugs and Crime that to successfully influence heroin consumption it would be necessary for enforcement agencies to seize around 75% of the illegal drugs entering a county. On the basis of our analysis here it is unlikely that the present level of drug seizure is anywhere near that figure. But does this mean that existing enforcement efforts aimed at seizing heroin are having only a very limited impact on consumption? To answer that question it would be necessary to have access to information on what the level of heroin consumption and importation might be if our existing barriers to importation were to be reduced or removed.

Where our analysis is useful is in enabling a comparison to be made between heroin seizures and heroin consumptions. Ideally, that analysis should be complemented with analysis of heroin purity at both national and local levels. Through this means it should be possible over time to begin to build up a picture of the relative success of drug seizure and drug enforcement activity in much the same way as has been undertaken within the United States (e.g. Bruen et al., 2002). In terms of future research it would be useful if the analysis of heroin seizures and heroin consumption could be undertaken at a local level. In this way it might be possible to assess the overall impact of enforcement activities and drug seizures on a local drug markets and to identify how long it takes for local drug markets to effectively replace the shortfall in heroin availability arising from major heroin seizures.

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## Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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