

Estimating the prevalence of problem opioid use in Copenhagen 1997-1998

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ABSTRACT

Introduction: Estimates of the prevalence of drug use in Denmark were, until 1999, based on the mortality multiplier method. This paper presents a study estimating the prevalence of problem opioid use in the Greater Copenhagen region using the capture-recapture method.

Methods and material: Records from the prehospital mobile emergency care unit, *The Copenhagen Prehospital Research Database*, were searched with a particular focus on treatment of opioid overdose. In addition, data from *The National Register of Drug Users in Treatment* in Greater Copenhagen were analysed for the years 1997 and 1998. Four samples were used within the capture-recapture analysis, ie the *Prehospital Research Database* for 1997/1998 and the Register of Drug Users in Treatment for the same period.

Results: The estimates from the stratified capture-recapture analyses, when summed up, suggest that there is a hidden population of 4116 and thus a total population of 6992 opioid users in Greater Copenhagen (population approx 700,000). This corresponds to a rate of 10 per 1000 inhabitants aged 15-54 years. The 95% confidence attached to this estimate is 5787 to 10,885.

Discussion: The prevalence rate of 10 per 1000 inhabitants aged 15-54 years is comparable to figures found in similar cities in Europe. A previous study of Central Copenhagen calculated the rate to be 12.4 per 1000 inhabitants between 15 and 59 years. It seems reasonable that the estimate of prevalence of problem drug use in Greater Copenhagen is lower than the prevalence in Central Copenhagen, as the city area is more urbanised and has a slightly different demographic and socio-economic profile. About 75% of all opioid overdose incidents are assumed to occur in the central district of the city during the observed period.

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INTRODUCTION

There have been moves across Europe to improve the methods for estimating the prevalence of problem drug use and therefore to provide more accurate estimates of prevalence at both the local and the national level. These estimates are employed in different ways. At the European level national prevalence estimates are useful when making cross-national comparisons and placing national drugs policies in perspective; at local level prevalence estimates are used to inform the provision of drug treatment and related services.

In accordance with local estimation prevalence projects, problem drug use is defined by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) as intravenous drug use or long/regular use of opioids, cocaine and/or amphetamines. Ecstasy and cannabis are not included. Moreover EMCDDA recommends the use of an identical age group (15-54 years) when prevalence rates, ie prevalence per 1000 inhabitants are compared.

Estimates of the prevalence of drug use in Denmark have, until 1999, been based on the mortality multiplier method in which estimates are derived from assuming that there is a fixed mortality rate of 2% per year among drug users (1). By dividing the number of drug related deaths registered by the National Commission of Police by the mortality rate, the estimate of the total number of drug users can be calculated.

Table 1. Drug related deaths in Denmark 1991-2000 according to the National Commission of Police.

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Men	153	162	166	227	226	222	227	211	201	197
Female	35	46	44	44	48	46	51	40	38	50
Total	188	208	210	271	274	268	278	251	239	247

According to figures from The National Commission of Police, approximately 270 drug-related deaths per year have been registered since 1994 with a moderate decrease during the last few years as shown in Table 1. For several years this calculation has translated into estimates of approximately 12,500 problem drug users in Denmark.

However, it cannot be assumed that any change in the number of drug-related deaths reflects changes in the prevalence of drug use as the mortality of drug users is a complex phenomenon that may be related to several issues. Drug-related deaths may fluctuate substantially and could be less prevalent within a growing population of drug users or, alternatively, the number of drug-related deaths could rise in spite of reductions in the levels of prevalence. All of the previous drug-related mortality studies carried out in Denmark used information from specific groups of drug users, such as those in contact with treatment services or those in prison.

In 1999, a study that employed the capture-recapture methodology, estimated the prevalence of problem drug use in Denmark to be approx 14,000 (2). The latest study at a smaller regional level (Copenhagen City area) found that there were approx 4000 problem drugs users in 1996 with an additional 2000 drug users exhibiting potentially addictive risk behaviours (3).

This paper presents the results of a study that estimated the prevalence of problem drug use in the Greater Copenhagen region using the capture-recapture method. In contrast to most recent capture-recapture studies in Europe (4-6), only two readily available sources of data were employed – a register of opiate overdoses recorded in the Greater Copenhagen area and also the number of opiate users in contact with treatment services. Both data sources contained data for the calendar years of 1997 and 1998 and the data from each year within each source were treated as a separate sample within the capture-recapture analyses. The main benefit of treating the two sources in this manner is to enable a four-sample capture-recapture analysis to be undertaken on two series of data that were collated for other reasons, and therefore there was no associated cost of collecting the data. The Greater Copenhagen area includes the City of Copenhagen and the suburban area of the County of Copenhagen.

MATERIAL AND METHODS

For the first time records from the prehospital mobile emergency care unit, *The Copenhagen Prehospital Research Database*, are used as one of the sources for local capture-recapture estimation of problem opioid use in Greater Copenhagen.

The Mobile Intensive Care Unit (MICU) in Copenhagen is a second tier physician-manned prehospital unit that has provided advanced life support (ALS) and prehospital care since 1987. Records from the *Copenhagen Prehospital Research Database* were searched with a particular focus on opioid overdose (OD) incidents (7). In addition, data from *The National Register of Drug Users in Treatment* (NDR) about opioid-using clients of drug treatment agencies in Greater Copenhagen were used for the years 1997 and 1998. This register has since 1996 monitored all patients in treatment for drug addiction in Denmark. Only persons below the age of 55 years were included in the analysis as there were too few patients in both sources to make a reliable estimate for the group older than 54 years.

Patients found by the MICU with fatal cardiac arrest or with advanced signs of death for reasons not obvious in the prehospital setting were also included within the analysis if the death was later verified as drug-related in the *Register of Causes of Death*. Drug-related

deaths were counted if coded with ICD-10 codes Y12.0, X42.0 or X62.0 and the contributing cause of death was T40-T40.0.

THE CAPTURE-RECAPTURE METHOD

The capture-recapture method is one of the main methods used to estimate the prevalence of problem drug use at the local level. The method was initially developed more than 100 years ago and was first used by biologists to estimate the number of wild animals in a given area. To estimate the number of animals in a habitat, a sample of animals is caught, tagged, and released (n_1). A second sample (n_2) will include some of the tagged animals (T) from the first sample. If the two samples are independent random selections from the total population (N), the proportion of tagged animals in the second sample (T/n_2) is equal to the first sample as a proportion of the total number of animals in the habitat (n_1) as $N = (n_1 \times n_2) / T$ (8).

The conditions for the model to be valid are:

- Those selected must be representative of the group under observation, and this group must be constant, ie there may be no newcomers and members may not leave the group during the period of study.
- Those selected should be homogenous, ie the probability of being selected should be constant for all individuals.
- Selection must be independent, ie the probability of selection of a given individual on one occasion must not influence the probability of selection of this individual on another occasion.

Examining the two data sources involved in this study, the MICU and NDR, we see that the conditions mentioned above are not satisfied; for example, if those attending the MICU are more likely to be on the NDR then the resultant figure would be an underestimate. Thus, if there is some kind of relationship between data sources the estimate will be biased. The capture-recapture methodology can compensate for this problem by employing three or more sources. In this case both the MICU and the NDR data sources were split by calendar year to give four data sources, two for 1997 and two for 1998. It was then possible to use statistical models to account for any relationships between these four sources and obtain estimates of the total number of problem opioid users (9).

RESULTS

Table 2 presents the four samples being used within the capture-recapture analysis, ie the *Prehospital Research Database* for 1997 (S1) and 1998 (S2) and in the *Register of Drug Users in Treatment* for the same period 1997 (T1) and 1998 (T2). A total number of 2876 problem drug users were identified from all four samples. The analysis was stratified into gender and age (subgroups 15-24, 25-34 and 35-54). The estimates from the stratified capture-recapture analyses, when summed up, suggest that there is a hidden population of 4116 and thus a total population of 6992 opiate users in Copenhagen. This corresponds to a prevalence rate of 10 per 1000 inhabitants aged 15-54 years. The 95% confidence attached to this estimate is 5787 to 10,885 (10).

In the model, the "Category" signifies the type of stratification used in order to obtain the model with the best fit. The (S1) (T2) signifies that the best model fitting the overlap between the four sources had an interaction between source 1 and source 4. That means that those in treatment in 1998 in this age/gender group were either more or less likely to have an emergency episode in 1997.

DISCUSSION

It may have been assumed that there would be a relationship between the two treatment samples, those in treatment in 1997 and those in treatment in 1998. Indeed, it is only within the younger age group that the two treatment sources were found to be independent of each other. The model that includes the independence of these two sources was identified as being the best fit. In all the older cat-

Table 2. Summary of four-sample analyses in Copenhagen.

Category	Model	Known	χ^2	df	Hidden	Estimate	95% CI
<i>Males</i>							
15-24	(S1) (S2)	136	4.51	9	193	329	182-845
25-34	(S1) (S2) + (T1) (T2)	728	6.75	8	789	1517	1231-1937
35-54	(S1) (S2) + (T1) (T2)	1182	7.24	8	1829	3011	2363-3995
Total males		2046			2811	4857	3776-6777
<i>Females</i>							
15-24	(S1) (T1) + (S1) (T2)	97	2.10	8	18	115	103-132
25-34	(S1) (S2) + (T1) (T2)	307	5.97	8	302	609	437-944
35-54	(S1) (S2) + (T1) (T2)	426	14.53	8	985	1411	1471-3032
Total females		830			1305	2135	2011-4108
<i>Total</i>							
15-24		233			211	444	285-977
25-34		1035			1091	2126	1668-2881
35-54		1608			2814	4422	3834-7027
Total (15-54)		2876			4116	6992	5787-10,885

S1 Overdose incidents treated by MICU in 1997.

S2 Overdose incidents treated by MICU in 1998.

T1 Drug addicts in maintenance treatment in 1997.

T2 Drug addicts in maintenance treatment in 1998.

egories, interactions were found between the two emergency samples and also between the two treatment samples.

When using the capture-recapture model and including the patients in treatment in the Greater Copenhagen area it is assumed that most overdose incidents among citizens from Greater Copenhagen are taking place in Central Copenhagen. This assumption is supported by the proportion of patients among the emergency cases coming from other parts of the country including this part of Copenhagen. Among the 769 emergency cases, 474 had an address in Copenhagen and 123 were from the suburbs of the Greater Copenhagen area. The rest (22.4%) came from other parts of the country.

Another possible bias in the results is the fact that the poisoning cases in the emergency database cover only opioid poisoning while the treatment database also covers treatment for other kinds of drugs (hash, cocaine, ecstasy, amphetamine, benzodiazepines). This bias is negligible as only seven percent of the drug users in treatment in Greater Copenhagen have non-opiates as their main drug.

In this study an estimate of the prevalence of problem opioid drug use of 6992 in Greater Copenhagen was found. The prevalence rate was 10 per 1000 inhabitants aged 15-54 years. This rate is comparable to the prevalence rates found in similar cities in Europe. A study of Greater Glasgow found a prevalence rate of 9.2 opioid drug injectors per 1000 inhabitants aged 15-54 (4). In Barcelona a capture-recapture estimate calculated the prevalence to be 12.9 opioid addicts per 1000 inhabitants aged 15-44 years (11).

The previous study of Central Copenhagen from 1996 mentioned above analysed the prevalence by using data from the addiction treatment services, number of individuals registered by the police as violating drug laws and drug related somatic and psychiatric admissions to local hospitals during that year. The estimated prevalence found was 4000 problem drug users resulting in a rate of 12.4 per 1000 inhabitants between 15 and 59 years. But including the additional 2000 drug users that were assumed to exhibit potentially addictive risk behaviours the prevalence for the selected age group can be calculated to be approximately 20 per 1000 inhabitants (3). In the present paper covering Greater Copenhagen the sources were based on detailed data from overdose incidents registered by the prehospital emergency service and from the public drug addiction treatment

clinics. Most drug users experiencing overdose in Central Copenhagen are not brought to the hospital, and therefore they have not been registered as cases in earlier capture-recapture studies. Only 13.5 % of overdose incidents are referred to hospitals after prehospital resuscitation, therefore the definition of drug use within this research may be wider than the definition used in previous studies (7). It seems reasonable that the estimate of prevalence of problem drug users in Greater Copenhagen is lower than the prevalence in Central Copenhagen, as the city area is more urbanised and has a slightly different demographic and socio-economic profile. Moreover about 75% of all opioid overdose incidents treated by the prehospital emergency service occurred in the central district of the city during the observed period (7).

REFERENCES

1. Sørensen HJ, Haastrup S, Jepsen PW. Mortality in a population of 300 intravenous users in Copenhagen. Deaths among drug users, growth, stagnation, change. Danish National Board of Health, 1996.
2. The National Board of Health in Denmark: Nye tal fra Sundhedsstyrelsen, no 3, 1999.
3. Sælan H. Medical Office of Health Report (1999), City of Copenhagen. Prevalence of problem drug users in Copenhagen 1996.
4. Hay G. Capture-recapture estimates of drug misuse in urban and non-urban settings in the north east of Scotland. *Addiction* 2000;95:1795-1803.
5. Hickman M, Cox S, Harvey J, Howes S, Farrell M, Frischer M et al. Estimating the prevalence of problem drug use in inner London: a discussion of three capture-recapture studies. *Addiction* 1999;94:1653-62.
6. Comiskey CM, Barry JM. A capture-recapture study of the prevalence and the implications of opiate use in Dublin. *European Journal of Public Health* 2001; 11 (2): 198-200.
7. Ishøy T, Høgskilde S, Haastrup L. Prehospital treatment of opioid overdose in Copenhagen 1995-1998. *Ugeskr Læger* 2003;165:3624-7.
8. Domingo-Salvany A. (1996) Estimating the Prevalence of Drug Abuse Using the Capture-Recapture Method: An Overview in: "Estimating the Prevalence of Problem Drug Abuse in Europe" (EMCDDA).
9. Hook EB, Regal R. Capture-recapture methods in epidemiology – methods and limitations. *Epidemiological Reviews* 1995;17:243-64.
10. Cormack RM. Interval estimation for mark-recapture studies of closed populations. *Biometrics* 1992;48:567-76.
11. Brugal MT, Domingo-Salvany A, Maguire A, Cayla JA, Villalbi JR, Hartnoll R. A small area analysis estimating the prevalence of addiction to opioids in Barcelona, 1993. *J Epidemiol Community Health* 1999;53: 488-93.