

Drug-related deaths during the 1980s

A comparative study of drug addict deaths examined at the institutes of forensic medicine in Aarhus, Denmark and Oslo, Norway

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Summary. Cases of fatal poisoning among drug addicts examined at the institutes of forensic medicine in Aarhus, Denmark ($n = 238$) and Oslo, Norway ($n = 263$) are compared and discussed on the basis of the availability of illicit and medical drugs during the 1980s. The annual number of deaths among drug addicts in age groups over 30 years increased, but there was no increase in the number of deaths among younger drug addicts in either country. More than 80% of the drug addicts in both samples were men. Heroin-/morphine-related deaths comprised three-quarters of the Norwegian material compared with one-third of the Danish material. The registered medical drugs propoxyphene, methadone and ketobemidone accounted for half of the Danish cases but only a small number of the Norwegian cases. Amphetamine caused few deaths in either country. Alcohol and benzodiazepines were present in more than one-third of the cases in both countries, indicating frequent use of these substances.

Key words: Drug-related deaths – Drug addicts – Heroin – Methadone – Propoxyphene

Zusammenfassung. Tödliche Vergiftungen Drogenabhängiger, untersucht in den Instituten für Forensische Medizin in Aarhus, Dänemark ($n = 238$) und Oslo, Norwegen ($n = 263$) werden verglichen und vor dem Hintergrund der Verfügbarkeit illegaler Drogen und mißbräuchlich verwendeter Arzneistoffe während der 80er Jahre diskutiert. Die jährliche Zahl von Todesfällen unter jungen Drogenabhängigen in den Altersklassen über 30 Jahren nahm zu, aber es gab in keinem der beiden Länder eine Zunahme der Zahl der Todesfälle unter jungen Drogenabhängigen. Mehr als 80% der Drogenabhängigen in beiden Kollektiven waren Männer. Heroin- und morphinbezogene Todesfälle machen Dreiviertel des norwegischen Materials aus,

verglichen mit einem Drittel des dänischen Materials. Die dort rezeptpflichtigen Medikamente Dextropropoxyphen, Methadon und Ketobemidon standen für die Hälfte der dänischen Fälle, aber nur für eine kleine Zahl der norwegischen Fälle. Amphetamin verursachte wenige Todesfälle in jedem der beiden Länder. Alkohol und Benzodiazepine waren in mehr als einem Drittel der Fälle in beiden Ländern vorhanden. Dies weist auf einen häufigen Gebrauch dieser Substanzen hin.

Schlüsselwörter: Drogentodesfälle – Drogenabhängige – Heroin – Methadon – Dextropropoxyphen

Introduction

Drug-related death is one of 8 indicators proposed by the Pompidou group for measuring drug abuse [1]. In general, a comparison of studies on drug-related deaths in different countries is difficult due to the use of different definition terms and selection criteria [2–5]. Some studies only include deaths caused by overdose (poisoning cases), while others also include natural deaths or deaths resulting from external violence. Moreover, the term “overdose” is not clearly defined. Low concentrations are frequently found, particularly in cases involving the injection of heroin [5–9]. In this study only poisoning cases are included.

Medico-legal regulations are very similar in Denmark and Norway. In Denmark a medico-legal autopsy as well as forensic toxicological investigations are compulsory in all cases in which death is assumed to be related to the abuse of euphoriant drugs. In Norway the police must be notified in all cases of death related to drug abuse and in the area covered by this survey the autopsy frequency is high [10].

The purpose of this study was to compare trends in drug abuse in the western part of Denmark and in the south-eastern part of Norway indicated by drug-related deaths in

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the areas covered by the institutes of forensic medicine in Aarhus and Oslo. The populations of the 2 selected areas in Denmark and Norway are approximately the same, and both areas include one major city. The substances found to have caused deaths are discussed on the basis of the availability of licit and illicit drugs in the 2 countries during the 1980s. Although this study does not include all drug-related deaths among drug addicts in the 2 countries, the material can provide some information on trends. The use of identical definition terms and selection criteria enabled a comparison of the results from the 2 countries.

Material and methods

The material consisted of fatal poisonings among drug addicts examined at the institutes of forensic medicine in Aarhus, Denmark (238 cases) and Oslo, Norway (263 cases) during the period 1980 through 1989. The Institute of Forensic Medicine, Aarhus University covers the peninsula of Jutland, except the southern part. The area has a population of approximately 2 million including 0.6 million living in the county of Aarhus, the second largest city in Denmark. In Norway, the Institute of Forensic Medicine in Oslo covers the south-eastern part of Norway including the capital Oslo. This area has a population of approximately 2.2 million including 0.8 million living in the Oslo region.

In both countries a complete medico-legal autopsy was carried out in all cases, whereas the extent of the toxicological examinations was decided according to the circumstances of each individual case. Analyses for alcohol and opiates were performed in nearly all cases included in this study. In the Norwegian material all toxicological examinations were performed at the National Institute of Forensic Toxicology.

In all cases the conclusions were based on information and results from police reports, autopsy reports and toxicological reports. Cases in which the immediate cause of death was aspiration, hypothermia or bronchopneumonia apparently caused by drugs were included. Cases of carbon monoxide poisoning caused by fire were not included. The Oslo data concerning the manner of death only includes information from the last 2 years of the period. In both forensic institutes deaths were categorized as suicides only in cases involving a suicide note, suicidal behaviour prior to death, or other information indicating suicide.

The fatal poisonings were categorized according to the substance which had caused death. Cases in which more than one drug was found in concentrations considered fatal, or in concentrations so low that none of the drugs present were likely to have caused death alone, were categorized according to the drug which was estimated to have been of main significance. These multiple drug deaths accounted for 15% of the Danish material and 7% of the Norwegian material. Most of the poisonings in which both drugs and alcohol (ethanol) were detected were categorized as deaths related to the drug in question. Only when the drug concentration was estimated to have been insignificant were these cases categorized as deaths caused by alcohol.

The definition of drug addicts applied in this survey was originally used in a joint Nordic study on drug addicts: "Persons who according to information from police reports and/or autopsy reports were known to have abused drugs intravenously, and/or were abusers of drugs listed in the Single Convention on Narcotic Drugs 1961, schedule 1 and/or the Convention on Psychotropic Substances 1971, schedule 1 or 2" [11].

Results

During the decade 1980 through 1989 approximately the same number of fatal poisonings among drug addicts were

Table 1. Cases of fatal poisoning among drug addicts examined at the institutes of forensic medicine in Aarhus, Denmark and Oslo, Norway during the decade 1980–1989

	Aarhus	Oslo
Women	32	51
Men	206	212
Total	238	263

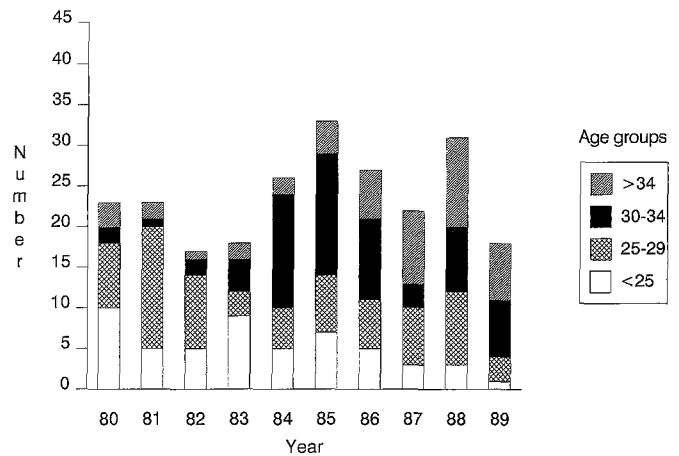


Fig. 1. Number and age distribution in cases of fatal poisoning among drug addicts examined at the Institute of Forensic Medicine, Aarhus University, Denmark, during the period 1980 through 1989 ($n = 238$)

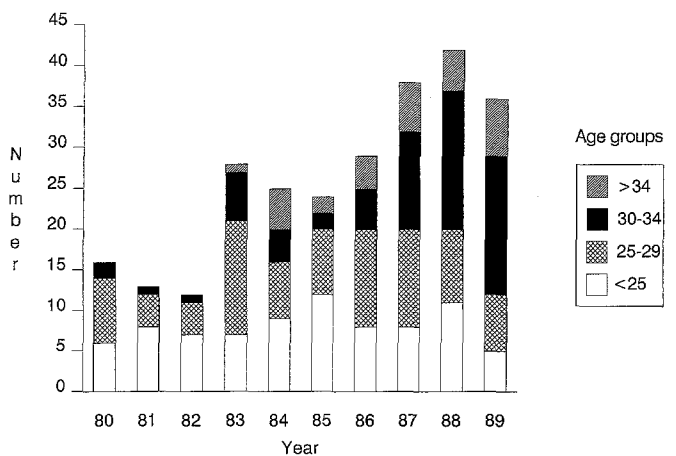


Fig. 2. Number and age distribution in cases of fatal poisoning among drug addicts examined at the Institute of Forensic Medicine, Oslo University, Norway, during the period 1980 through 1989 ($n = 263$)

examined at the forensic institutes in Aarhus and in Oslo (Table 1). In the Danish material a minor increase in the number of deaths was noted in the latter half of the survey period (Fig. 1). In the Norwegian material a significant increase was observed (Fig. 2). In both countries the rise was caused by an increasing number of deaths of drug addicts over 30 years old. The number of deaths of younger drug addicts did not increase in either country. The aver-

Table 2. The cause of death in cases of fatal poisoning among drug addicts examined at the institutes of forensic medicine in Aarhus, Denmark and in Oslo, Norway 1980–1989

	Aarhus		Oslo	
	%	(n)	%	(n)
Heroin/morphine	32	(75)	73	(192)
Propoxyphene	26	(61)	6	(15)
Methadone	14	(33)	2	(6)
Ketobemidone	8	(19)	1	(3)
Ethylmorphine/codeine/pholcodin ^a	–	(0)	7	(19)
Dextromoramide ^b	2	(5)	–	(0)
Barbiturates	5	(12)	1	(3)
Hypnotics ^c	3	(8)	2	(5)
Benzodiazepines	1	(2)	2	(4)
Other medical drugs ^d	4	(10)	3	(9)
Amphetamine	1	(3)	1	(2)
Alcohol	4	(10)	2	(5)
	100 (238)		100 (263)	

^a Not registered in Denmark

^b Not registered in Norway

^c Chloral hydrate, methaqualone, methyprylone

^d Pethidine, chlorpromazine, orphenadrine, promethazine, diphenhydramine, carbamazepine, tubocurarine, chloroquine

age age in the Danish material increased from 27 years to 33 years during the decade and in the Norwegian material from 26 years to 31 years. In both materials the average age of the male addicts was 2 years higher than that of the female addicts. In both countries only 8% of the deaths were categorized as suicides.

The increase in the annual number of deaths in the Norwegian material was mainly due to an increase in the number of heroin-/morphine-related deaths (Table 2). No increase was observed in the annual number of heroin-/morphine-related deaths in the Danish material. Heroin-related deaths predominated among drug addicts who had lived in the larger cities, with 53% of the addicts in Aarhus and 84% of the addicts in Oslo dying from heroin/morphine poisoning.

Death caused by the registered medical drugs *propoxyphene*, *methadone* or *ketobemidone* accounted for 48% of the deaths in the Danish material compared with only 8% of the Norwegian material. In Denmark deaths caused by propoxyphene predominated in the early 1980s but declined towards the end of the survey period. The number of deaths caused by methadone, however, increased significantly (from 4 cases in the first half of the 1980s to 29 cases in the latter half).

Benzodiazepines – mainly diazepam and flunitrazepam – were detected in 35% of the Danish poisoning cases and in 41% of the Norwegian cases. The frequency may be even higher than indicated by these figures, as the toxicological analyses did not always include benzodiazepines. *Alcohol* was detected in almost half the Danish cases and in one-third of the Norwegian cases (Table 3). In both countries alcohol was detected more frequently among male than among female addicts.

Table 3. The frequency with which alcohol was detected in cases of fatal poisoning among drug addicts 1980–1989

	Aarhus		Oslo	
	♀ (n = 32) %	♂ (n = 206) %	♀ (n = 51) %	♂ (n = 212) %
BAC > 0.2 g/kg	41	47	20	36
BAC > 1.0 g/kg	28	28	14	19

BAC = Blood Alcohol Concentration

Fresh needle marks and/or a syringe containing the narcotic drug found near the deceased indicated that the drug had been injected in 51% ($n = 121$) of the Danish cases and in 69% ($n = 181$) of the Norwegian cases. The frequency of injection did not seem to vary between the sexes or between different age groups in either country.

Discussion

Drug-related deaths are registered by official authorities in both Denmark and Norway. In Denmark the annual number of drug-related deaths varied between 109 and 165 during the 1980s according to the nationwide police statistics [12]. Previous forensic studies on drug-related deaths have described some of these cases in detail [6, 13]. In Norway the police and the health authorities have estimated the annual number of drug-related deaths to be approximately 50–65 by the end of the survey period [14, 15]. The results of a comparative study on drug-related deaths in the Nordic countries support the estimate that there were about three times as many drug-related deaths in Denmark as in Norway [11]. However, it should be noted that in both countries the registered number of drug-related deaths is assumed to be a minimum figure, because some deaths – especially non-poisoning cases – are not reported.

In comparative studies the use of identical definition terms is essential [2–5]. Different definition terms and selection criteria used in official statistics make the comparison between officially registered data in Denmark and Norway uncertain. As previously mentioned, the definition of “drug addicts” used in this study is in accordance with the definition used in a Nordic study on drug-related deaths [11]. A similar definition has later been proposed in a Nordic report on mortality rates among drug addicts with the purpose of improving the comparability of official statistics [16]. The definition applied in this survey excludes deaths among abusers of alcohol alone, abusers of some “narcotic” drugs taken orally (e.g. propoxyphene) and abusers of organic solvents (sniffers). On the other hand smokers of cannabis are included even when no other illegal substances were involved. Abuse of cannabis alone was however seldom seen in the materials in this study.

In the majority of the cases the manner of death was assumed to be accidental. The suicide frequencies found in both materials are somewhat lower than in other Nordic

studies [8, 17]. In this study, however, we have used a rather restricted definition of suicide. Particularly in cases of drug abuse, establishing the manner of death can be difficult. High postmortem drug concentrations which could indicate suicide were rare, especially in cases involving injection of drugs. The concentration of morphine in blood after the injection of heroin was in most cases low, sometimes even lower than the concentrations described in the literature concerning the medical use of morphine [6–9]. Many of the heroin-related deaths were presumably accidents due to the large variation in the purity of street heroin [15, 18]. Moreover, some of the heroin-related deaths were cases in which the deceased had not been taking drugs for a period of time. Such deaths were presumably accidents caused by a change in tolerance.

The route of administration is not always easy to establish and the frequency of injection may be higher than the results of this study indicate. Needle marks made by very thin hypodermic needles can be overlooked at an autopsy. Likewise, the route of administration is difficult to establish in putrefied bodies.

The increase in the average age seen in both materials was caused by an increase in the number of deaths among drug addicts older than 30 years. The number of deaths among younger drug addicts did not increase. These results indicate a cohort effect.

In drug addict treatment programmes women account for approximately one-third of the clients [19, 20], yet female addicts accounted for only 13% of the Danish material in this study and 19% of the Norwegian material. The relatively low proportion of female addicts found in this study agrees with the results of other studies [2, 5, 8, 13, 21]. This could indicate a lower mortality rate for female addicts. Still, one has to take into consideration the fact that, according to official health statistics, the mortality rate for young women in general is lower than for young men.

The illicit drug markets in Denmark and Norway showed many similar trends during the 1980s. In both countries cannabis was the most frequently abused illegal drug, while heroin predominated among the so-called hard illegal drugs [12, 15, 19, 22, 23]. Both countries experienced growing abuse of amphetamine during the decade. Moreover, the purity of street samples of illicit drugs was similar in the 2 countries throughout the 1980s [15, 18]. In neither Denmark nor Norway was cocaine abuse a major problem during the period. The non-medical use of legal drugs was, however, an increasing problem [23]. In both countries benzodiazepines (diazepam, flunitrazepam) dominated among the medical drugs in the illicit market [12, 15]. The widespread misuse of these drugs is reflected in this study by the high proportion of cases in which these drugs were detected. Registered medical narcotics were also frequently seen among police seizures in both countries. One-third of the seizures of medical drugs in Denmark in 1989 consisted of methadone and Ketogan (ketobemidone). In Norway, Paralgin Forte (codeine and paracetamol) was the most frequently seen analgesic drug in the illicit market [15]. Previous British studies have shown a similar widespread misuse of medical drugs among drug addicts [2, 21, 24].

The abuse of amphetamine increased during the 1980s in both Denmark and Norway. However, very few deaths caused by amphetamine were seen. The low mortality rate of amphetamine poisonings found in this study corresponds with the results of other studies [8, 11].

Most barbiturates were withdrawn from the market in Norway in 1980 and in Denmark in 1986. The withdrawal, together with a tightening of distribution regulations for the remaining barbiturates, brought about the relatively low frequency of deaths caused by these drugs in this study compared with the results of forensic studies on drug addict deaths covering previous periods [13, 21].

In Denmark deaths caused by dextropropoxyphene dominated in the early and mid-eighties [25, 26]. However, the number of deaths among drug addicts caused by this drug has declined significantly in recent years, probably due to a tightening of the dispensing regulations in 1988 [23]. In Norway stricter distribution regulations for propoxyphene were passed as far back as 1982 and a decrease in propoxyphene-related deaths was seen earlier than in Denmark [26].

Ketobemidone produced in Denmark and distributed under the trade name Ketogan is used as an alternative to other opioid drugs. The drug is very popular among Danish drug addicts. In Norway ketobemidone was seldom used. Likewise, differences in availability and abuse of cough-relieving syrups containing ethylmorphine, codeine or pholcodin could be the explanation why deaths caused by these drugs were quite frequent in Norway but were not seen in the Danish material. Deaths caused by dextromoramide were only seen in Denmark; this drug is not registered in Norway.

The number of methadone-related deaths in the Danish material increased during the survey period. In Norway methadone was not used in drug addict treatment programmes during the 1980s, whereas in Denmark the use of methadone in long term treatment programmes was extended significantly during the second half of the period [19].

All Danish physicians are authorized to prescribe methadone. Special regulations have been issued with the intention that treatment programmes involving methadone should be reported to the health authorities in order to ensure that no one could receive methadone from more than one source at a time. Unfortunately, the reporting system does not seem to work well. Moreover, the rule that methadone should be ingested under supervision is not always applied. The failure to control the prescription of methadone and to maintain the principle of supervised intake is reflected by the widespread availability of methadone in the illicit Danish drug market and an increasing number of methadone-related deaths [12, 23].

One could ask whether methadone is a substitute drug or just an additional drug on the drug scene. Would more drug addicts have died in Norway if methadone had been available in the Norwegian illicit drug market during the 1980s, and would fewer drug addicts have died in Denmark if methadone had not been available? In our opinion the fact that we see a number of methadone-related deaths in the Danish material and hardly any in the Norwegian reflects the supply in the illicit drug markets and cannot

be used as an argument against methadone treatment carried out under adequate control.

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