

Unnatural deaths among drug abusers

BACKGROUND Deaths caused by drug abuse, in which the cause of death is intoxication, so-called overdose deaths, are regularly reported and studied. Other deaths related to drug abuse have been less frequently studied. We wished to investigate the prevalence and characteristics of unnatural deaths in persons in whom drugs were detected in blood samples taken at autopsy.

MATERIAL AND METHOD A total of 1 338 forensic autopsy reports from Southern Norway for the years 2000–2005, in which there were positive drug findings in post mortem blood, were aged 20–59 years and had an unnatural manner of death (accident, suicide, homicide) were investigated. Gender, age, cause of death, manner of death, circumstances and police district were recorded.

RESULTS The mean age of those included in the study was 34 years, and 81 % of them were men. Of all the deaths investigated, 998 of the deceased were in the age group 20–39 years, and 322 deaths were due to accidents other than intoxication (most frequently traffic-related), suicide or homicide. The remaining deaths were accidental intoxications (i.e. intoxications not suspected to be suicides, and which primarily account for the official «overdose statistics»). The proportion of women and the circumstances varied according to the manner of death.

INTERPRETATION Unnatural deaths that occur during drug use but are not accidental poisonings are not included in the regular «overdose statistics». These deaths account for a significant proportion, and are in all likelihood being underreported. They are somewhat different from the accidental poisonings in terms of their gender distribution and circumstances.

Illicit drug use is a risk factor for disease, accidents and reduced life expectancy (1–10). Narcotic substances are available all over the country and have been seized in all of the country's police districts since 2000 (11). Deaths related to drug use, primarily intoxications («overdoses»), are frequently reported by the police (12), in public reports (11, 13) and in scientific journals (14, 15). In some scientific papers, deaths from causes other than intoxication among drug users have been included (2, 9), but no systematic public registration of other types of unnatural deaths among users of narcotic substances is available.

Konstantinova-Larsen and collaborators have published a study on the prevalence of drugs in blood and urine samples from deaths that occurred in the period 2000–09 (16). However, the authors did not distinguish between different causes and manners of death. To obtain the best possible knowledge on how narcotics may be a contributing factor to mortality, causes and manners of death other than intoxication must be investigated.

«Manner of death» in the medicolegal sense refers to the manner in which death occurred: natural, accident, suicide or homicide. Hence, this is not the same as «cause of death». For example, the manner of death can be a traffic accident, while the cause of death is chest injuries. As far as we are

aware, no major systematic investigation has previously been undertaken based on all types of unnatural deaths where narcotics were detected in post mortem blood. Only scarce documentation is available regarding how circumstances and different manners of death are distributed among the genders and age groups of the adult drug using population, and whether there are any regional differences.

The objective of our study was to obtain more knowledge regarding the prevalence of and circumstances around unnatural deaths in the age group 20–59 years, where the person died while using narcotics.

Material and method

Information was collected from medicolegal autopsy reports that met the inclusion criteria (see below), with a date of death between 1 January 2000 and 31 December 2005. The autopsies had been performed at the Institute of Forensic Medicine at the University of Oslo, the Gade Institute at the University of Bergen and the Department of Pathology at Stavanger University Hospital. The Institute of Forensic Medicine investigated deaths from the police districts in Southern and Eastern Norway, from Agder to Oppland police districts. The Gade Institute at the University of Bergen served areas in Western Norway from Haugaland and Sunnhordland to Sunnmøre police districts. Stav-

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MAIN MESSAGE

In nearly every fourth unnatural death in which the deceased underwent a medicolegal autopsy in which narcotic substances were detected in the blood, another cause of death than accidental poisoning was established.

Differences in the circumstances around the various manners of death may have implications for the prevention of deaths among users of narcotic substances.

To improve diagnosis and registration of unnatural deaths while using drugs, the medicolegal autopsy rate ought to be increased for all cases of unnatural death.

Table 1 Gender distribution of the various unnatural deaths

	Total number of unnatural deaths	Accidental intoxication	Other accident	Suicide	Homicide
Number of men	1 089	838	104	122	25
Number of women	249	178	19	46	6
Total	1 338	1 016	123	168	31

Table 2 Scene of death and circumstances in the various types of unnatural deaths

Scene of death ¹	All unnatural manners of death N = 1 338	Accidental intoxication n = 1 016	Other accident n = 123	Suicide n = 168	Homicide n = 31
Indoors, private	887	762	12	96	17
Indoors, public	109	100	Few ²	7	Few ²
Residential/treatment facility	40	36	Few ²	Few ²	Few ²
Custody/prison	14	12	Few ²	Few ²	Few ²
Outdoors	194	92	42	52	8
In or near motor vehicle	84	5	66	9	4
Circumstances					
Died in home municipality	1 017	792	60	143	24
Died alone ³	650	482	40	127	Few ²
Emergency treatment ³	227	170	30	17	10
Finding of drug user's equipment ³	668	620	12	35	Few ²

¹ For accidental poisonings, nine cases had no information on death scene, for homicides one case.

² This group consisted of ≤ 3 persons, the exact number is therefore not stated.

³ Only cases with explicit information on positive findings have been included in the table. In some cases there was no information: In 124 cases, there was no information on whether the person had died alone. In 128 cases there was no information on whether any advanced medical treatment or first aid had been administered. In total 433 reports had no information on drug user's equipment.

Table 3 Number of cases by manner of death and the autopsy locations Institute of Forensic Medicine¹ and the Gade Institute/Stavanger University Hospital²

	All unnatural manners of death	Accidental intoxications	Other accident	Suicide	Homicide
Autopsies at the Institute of Forensic Medicine	1 005	768	79	130	79
Autopsies at the Gade Institute/Stavanger University Hospital	333	248	44	38	3

¹ The Institute of Forensic Medicine served the police districts Agder, Telemark, Vestfold, Asker og Bærum, Follo, Romerike, Hedmark, Gudbrandsdal, Vestoppland, Nordre Buskerud, Søndre Buskerud og Oslo

² The Gade Institute and Stavanger University Hospital served the police districts Rogaland, Haugaland og Sunnhordland, Hordaland, Sogn og Fjordane and Sunnmøre

anger University Hospital served Rogaland police district.

Reports stating that narcotics had been detected in the blood were included. All forensic toxicology analyses had been undertaken at the National Institute of Forensic Toxicology (in the period 2000–02) or the Norwegian Institute of Public Health (in the period 2003–05) in accordance with prevailing routines. Since the National Institute of Forensic Toxicology in 2003 was transferred to the Norwegian Institute of Public Health, all analyses were in practice undertaken at the same laboratory.

The following narcotic substances were registered: amphetamine, methamphetamine, cannabis (THC), cocaine and/or the cocaine metabolite benzoylecgonin, morphine, the heroin metabolite 6-monoacetylmorphine, ecstasy (MDMA, MDA), phencyclidine (PCP), LSD, elevated levels of GHB (more than 1 mmol/l), methadone and buprenorphine.

For those deaths that were investigated at the Institute of Forensic Medicine and the Gade Institute, the Department of Pharmacological and Toxicological Interpretation at the Division of Forensic Medicine and Drug Abuse Research, the Norwegian Institute of Public Health, supplied lists of medicolegally autopsied deaths in which any of the abovementioned substances had been detected. At Stavanger University Hospital, cases were identified by manually reviewing medicolegal reports with a date of death within the same period.

Persons aged 20–59 years whose manner of death was deemed to be unnatural (accident, homicide or suicide) were included. Individuals younger than 20 or older than 59 years were excluded, since there were very few unnatural deaths that had occurred under the influence of drugs in these groups. Cases in which only morphine was found and there was information that medical treatment had been provided immediately before death were excluded, since the morphine could have been administered during treatment. Moreover, cases involving codeine and morphine, in which the concentration of morphine was lower than that of codeine, were also excluded, since the morphine could generally be interpreted as a metabolite of codeine. Gender, age, manner of death, cause of death, police district, municipality of residence and scene of death were registered.

The unnatural manners of death were divided into accidents, suicides and homicides (assumed accidents/assumed suicides were registered as accidents and suicides respectively). Accidents were further subdivided into accidental intoxications and accidents other than intoxication, hereafter referred to as «other accidents». The regis-

tration was undertaken on the basis of the cause and manner of death indicated by the forensic pathologist in each individual autopsy report. The causes and manners of death were not cross-checked with the Cause of Death Registry. We used the following groupings for age at time of death: 20–29 years, 30–39 years, 40–49 years and 50–59 years. Scene of death was defined as the location where the deceased was found dead or lifeless. Furthermore, it was noted whether the person had died in his/her home municipality.

Other variables pertaining to the circumstances included whether any other adults were present at the time of death/the incident that caused the death, whether the person had received professional emergency treatment, and whether there was any information on «drug user's equipment» on or close to the deceased. Drug user's equipment included narcotic substances and/or equipment for use/intake of such substances.

The chi-square test was used for estimating the p-value. A p-value of < 0.05 was considered statistically significant. Comparisons were made at the group level, in which differences between the four unnatural manners of death and the other variables were tested simultaneously. The testing was done exploratorily, and no corrections were made for multiple testing.

The study was approved by the Regional Committee of Health Research Ethics (REK). Approval of data collection was granted by The Director of Public Prosecutions, The National Police Directorate and Norwegian Board of Forensic Medicine at the Norwegian Civil Affairs Authority. The study is not subject to duty of notification or licence pursuant to the Personal Data Act.

Results

During the period 2000–05, a total of 8 576 medicolegal autopsies were undertaken at the Institute of Forensic Medicine, the Gade Institute and Stavanger University Hospital. Of these, a total of 1 338 cases (1 089 men and 249 women) were included in the study, 1 005 of which had been examined at the Institute of Forensic Medicine, 213 at the Gade Institute and 120 at Stavanger University Hospital.

The annual number of included deaths varied from 141 to 207 at the Institute of Forensic Medicine (Southern and Eastern Norway) and from 50 to 63 in Western Norway (at the Gade Institute and Stavanger University Hospital). The highest total number of cases was found in 2001 and the lowest in 2005, but there were no significant differences between the various years.

The median age was 33 years, and 998 (75%) of those included were between 20

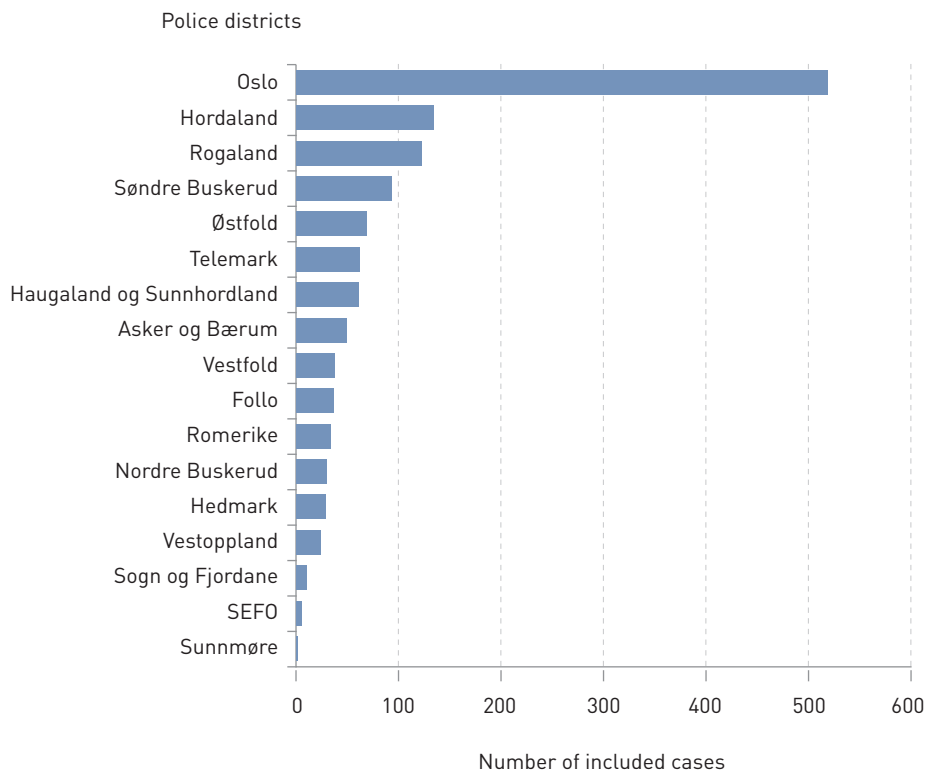


Figure 1 Absolute number of cases from each police district. The results have not been corrected for population size in each police district. No cases from Gudbrandsdal police district were included. SEFO (the Special Investigations Office) was replaced by the Norwegian Bureau for the Investigation of Police Affairs on 1 January 2005.

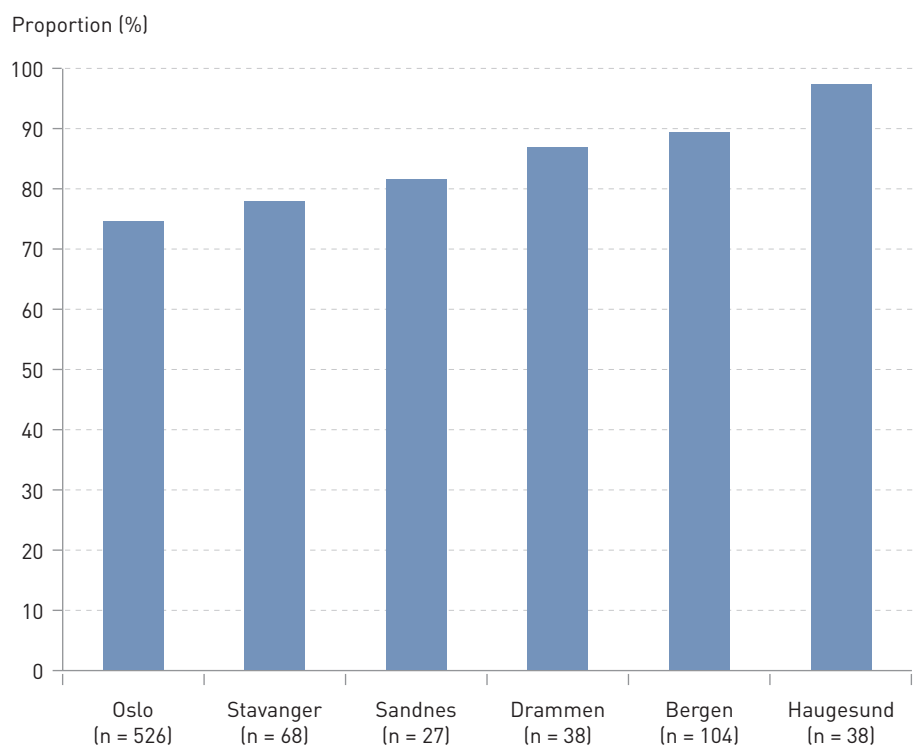


Figure 2 Proportion of deaths in which the deceased was a registered resident of the municipality of death. Figures from some of the largest cities.

and 39 years at the time of death. In 322 (24%) of the 1 338 cases, the manner of death was another than accidental poisoning. Of these, 168 were suicides, 123 other accidents and 31 homicides (Table 1). Of those who died from other accidents, 66 were found in or near a motor vehicle (Table 2). We found no significant differences in age distribution between the various manners of death.

In total, the material encompassed 249 women. The proportion of women varied for the different manners of death (Table 1), and there were significant differences in the gender distribution of the manners of death ($p = 0.002$). The proportion of women varied from 27% for suicide to 16% in the category «other accident». Of the 46 women who committed suicide, 23 died of intoxication, whereas the equivalent figure for men was 47 out of 122. Six of a total of 31 homicide victims were women.

The scene of death and the circumstances of the various manners of death are shown in Table 2. There were significant differences between the manners of death with regard to the proportion who died alone ($p < 0.001$). The highest proportion was found for suicides (76%), whereas «other accidents» had the lowest proportion (33%). Regarding deaths that occurred outdoors, a total of 109 of 194 died alone (not shown).

The investigated deaths were unevenly distributed among the police districts, although differences in population size have not been controlled for (Figure 1). Gudbrandsdal was the only police district in which no deaths met the criteria for inclusion. Table 3 shows the distribution of cases from Western Norway (Gade Institute and Stavanger University Hospital) and Southern and Eastern Norway (Institute of Forensic Medicine) with regard to manners of death.

As regards the *cause of death* for suicides, there were significant differences between the regions. In Southern and Eastern Norway, intoxication was the cause of death in 48% ($n = 62$) of the suicides, whereas intoxication was the cause of death for 18% ($n = 7$) of the suicides in Western Norway (p -value for the discrepancy = 0.001). There were differences between Southern and Eastern Norway on the one hand and Western Norway on the other with regard to the proportion of women whose manner of death was accidental poisoning. From the Institute of Forensic Medicine, a total of 144 included women (23%) had this manner of death, while at the Gade Institute and Stavanger University Hospital the combined number amounted to 34 (16%).

Figure 2 shows the proportion of the deaths that occurred in the home municipality of the deceased (according to the population register) in some of the largest cities.

Discussion

Of the 1 338 investigated deaths that occurred during the use of narcotics, 322 were not encompassed by the general concept of overdose (other accidents, suicides and homicides).

Approximately 6% of the medicolegal autopsies performed in the area and the time period for the study were performed in departments of clinical pathology in hospitals not included in the study (17). As an example, a total of 90 medicolegal autopsies were performed at Innlandet Hospital in Lillehammer during the studied period (17), a fact that may explain why we did not register any unnatural deaths positive for narcotic drugs from Gudbrandsdal police district.

The varying practices in different police districts with regard to requesting a medicolegal autopsy (18, 19) is a weakness of the study. Section 36 of the Health Personnel Act with appurtenant regulations defines the types of deaths that the doctor is obliged to report to the police (20), and Section 228 of the Criminal Procedure Act (21) and Chapter 13 of the Prosecution Instructions (22) state the cases in which the police *shall* and *ought to* request a medicolegal autopsy. A medicolegal examination is mandatory only in cases where death is suspected to have been caused by a punishable act or in cases where the deceased is unidentified.

This means that in the remaining cases (accidents, suicides, sudden unexpected deaths etc.) the head of the police district in question is free to decide whether or not to have such an examination performed. This may result in random (in)equalities in numbers and proportions that are not representative of the real prevalence. Moreover, the medicolegally autopsied deaths represented only 4% of all deaths during this period (17, 23). Because of the varying practices for requesting a medicolegal autopsy, we assume that suicides, fatal accidents and accidental intoxications during drug use are under-registered.

As regards accidental intoxications, our results in terms of age and gender distribution are in accordance with other studies from the same period (15, 16). The question of why the proportion of women suffering accidental intoxications is lower in Western Norway than in the southern and eastern regions merits investigation in more detail. With regard to accidental intoxications, the autopsy rate was most likely quite high (18), and these regional differences in the proportion of women may thus be real. With regard to the other manners of death, such regional differences cannot be assessed with certainty on the basis of our study, due to the variation in practices for requesting autopsies as well as the relatively small number

of cases for some of the manners of death in the material from Western Norway.

More than half (66 of 123) of the deaths in the category «other accident» were traffic-related. It has previously been shown that the use of drugs is associated with an elevated risk of accidents, especially traffic accidents (5–8). An increased prevalence of other unnatural deaths has also been demonstrated among substance abusers (2, 9, 24). We have not distinguished between «heavy users» and more occasional and recreational drug users, nor between the types and numbers of the drugs that were detected in each individual. It will be important to undertake further studies to obtain more knowledge about the extent to which drug-use careers and types of substances are related to specific risks of accident, suicide or homicide.

We found an increased frequency of intoxication as a suicide method in both genders (more than half of the suicides had been committed by intoxication) when compared to the general suicide population (25). This may indicate that substance abusers are more prone to committing suicide by this method, possibly because they have better access to and a lower threshold for using narcotic substances as well as medicinal products than the population as a whole.

In our study, the proportion of women with homicide as the manner of death was significantly lower than in the police statistics of homicides in general (26). The numbers are too small to draw any conclusions in this respect. The homicide figures registered by the police are not directly comparable to those from the autopsy material, because the definition of homicide is different. Forensic pathologists, as opposed to the police, also regard serious bodily harm resulting in death as a homicide.

The substantial variations among the large urban municipalities regarding the proportion of individuals who die in their home municipality may have an impact on how one should design preventive strategies. The large variations may be related to the access to drugs, as well as the characteristics of the user populations and the user cultures in the various cities. The reasons for these large variations merit further investigation. In the Oslo study of overdose deaths in 2006–08 (27), one-third of the deceased were not registered residents of the city. Our study, however, also includes deaths other than those due to overdose. In the case of Oslo, it seems to be a persistent trend that many of those who die from unnatural causes while using drugs are not registered residents of this municipality.

Studies from the same period as in our study, as well as subsequent periods, have shown that most drug-related deaths occur

in private homes (13). Our study supports this finding, but also shows that the scene of death strongly co-varies with the manner of death. A large proportion of the deaths occurred with other adults in the vicinity.

Knowledge about where the deaths occur and the fact that very often other adults are present provide important information for the assessment of preventive and life-saving measures.

We wish to thank Associate Professor Emerita Brita Teige for her initiative, inspiration and important academic input to the design and implementation of the study. We also wish to thank Christian Lycke-Ellingsen, pathologist at Stavanger University Hospital, and Paul Koksæter at the Norwegian Institute of Public Health for their invaluable help with the data collection. Furthermore, we wish to express our gratitude to the archivists at the Ministry of Justice and the Board of Forensic Medicine for their facilitation of the practical implementation of the data collection process. Finally, we wish to thank Professor Thore Egeland for his input to the statistical analysis.

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References

1. Arendt M, Munk-Jørgensen P, Sher L et al. Mortality among individuals with cannabis, cocaine, amphetamine, MDMA, and opioid use disorders: a nationwide follow-up study of Danish substance users in treatment. *Drug Alcohol Depend* 2011; 114: 134–9.
2. Bjørnaas MA, Bekken AS, Øjlert A et al. A 20-year prospective study of mortality and causes of death among hospitalized opioid addicts in Oslo. *BMC Psychiatry* 2008; 8: 8.
3. Degenhardt L, Bucello C, Mathers B et al. Mortality among regular or dependent users of heroin and other opioids: a systematic review and meta-analysis of cohort studies. *Addiction* 2011; 106: 32–51.
4. Degenhardt L, Singleton J, Calabria B et al. Mortality among cocaine users: a systematic review of cohort studies. *Drug Alcohol Depend* 2011; 113: 88–95.
5. Gjerde H, Christophersen A. Ruspåvirkning blant bilførere som omkom i trafikkuulykker i 2001–2010. Oslo: Nasjonalt folkehelseinstitutt, 2011. www.fhi.no/dokumenter/c34df9501d.pdf [28.5.2013].
6. Brevig T, Arnestad M, Mørland J et al. Hvilken betydning har sykdom, ruspåvirkning og selvmord ved dødsfall blant bilførere? *Tidsskr Nor Lægeforen* 2004; 124: 916–9.
7. Bogstrand ST, Normann PT, Rossow I et al. Prevalence of alcohol and other substances of abuse among injured patients in a Norwegian emergency department. *Drug Alcohol Depend* 2011; 117: 132–8.
8. Bogstrand ST, Gjerde H, Normann PT et al. Alcohol, psychoactive substances and non-fatal road traffic accidents – a case-control study. *BMC Public Health* 2012; 12: 734.
9. Ødegård E, Amundsen EJ, Kielland KB. Fatal overdoses and deaths by other causes in a cohort of Norwegian drug abusers – a competing risk approach. *Drug Alcohol Depend* 2007; 89: 176–82.
10. Legrand SA, Gjerde H, Isalberti C et al. Prevalence of alcohol, illicit drugs and psychoactive medicines in killed drivers in four European countries. *Int J Inj Contr Saf Promot* 2013. E-publisert 9.1.
11. Bryhni A, Bretteville-Jensen AL, Bye EK et al. Rusmidler i Norge 2005. Oslo: Statens institutt for rusmiddelforskning (SIRUS), 2005. www.sirus.no/Rusmidler-i-Norge+2005.d25-SMdnU1g.ips [15.1.2014].
12. Politiets narkotikastatistikk 2005. www.politi.no/vedlegg/statistikk/Vedlegg_14.pdf [28.5.2013].
13. SIRUS. Narkotikasituasjonen i Norge/The Drug situation in Norway 2005. National report to the EMCDDA 2005. http://sirus.no/filestore/Import_vedlegg/nasjonal_arsrapport_eng_2005.pdf [28.05.13].
14. Steentoft A, Teige B, Ceder G et al. Fatal poisoning in drug addicts in the Nordic countries. *Forensic Sci Int* 2001; 123: 63–9.
15. Steentoft A, Teige B, Holmgren P et al. Fatal poisoning in Nordic drug addicts in 2002. *Forensic Sci Int* 2006; 160: 148–56.
16. Konstantinova-Larsen SV, Normann PT, Arnestad M et al. Surveillance of abused drugs in forensic autopsy cases in Norway. *Norsk Epidemiologi* 2011; 21: 43–8.
17. Årsmeldinger. Den norske patologforening. <http://legeforeningen.no/Fagmed/Den-norske-patologforening/DNP-stoff/arsmeldinger/28.5.2013>.
18. Frost J, Slørdal L, Vege A et al. Forensic autopsies in a naturalistic setting in Norway: autopsy rates and toxicological findings. *Forensic Sci Int* 2012; 223: 353–8.
19. Årsmeldinger for Den rettsmedisinske kommisjon 2002–2006. Oslo: Den rettsmedisinske kommisjon/Justissekretariatene, 2006. www.justissekretariatene.no/nb/Innhold/DRK/Arsmeldinger-og-veiledere/28.5.2013.
20. Helsepersonelloven § 36. LOV-1999-07-02-64. www.lovdato.no/all/nl-19990702-064.html#36 [28.5.2013].
21. Straffeprosessloven § 228. LOV-981-05-22-25. www.lovdato.no/all/tl-19810522-025-033.html#228 [28.5.2013].
22. Forskrift om ordningen av påtalemyndigheten (Påtaleinstruksen) kapittel 13. FOR-1985-06-28-1679. www.lovdato.no/for/sf/jd/xd-19850628-1679.html#map023 [28. 5.2013].
23. Dødsfall, hele landet 2000–2005. Oslo: Statistisk sentralbyrå, 2006. www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&ProductId=&MainTable=Dode2&nvl=&PLanguage=0&nyTmpVar=true&CMSSubjectArea=befolkning&KortNavnWeb=dode&StatVariant=&checked=true [1.9.2013].
24. Gjeruldsen S, Abdelnoor M, Opjordsmoen S et al. Death rates and causes of death in cohorts of serum hepatitis patients followed up for more than 20 years. *Epidemiol Infect* 2001; 126: 89–96.
25. Titelman D, Oskarsson H, Wahlbeck K et al. Suicide mortality trends in the Nordic countries 1980–2009. *Nord J Psychiatry* 2013; 67: 414–23.
26. Politiets drapsstatistikk. Drapstall 2006. www.politi.no/vedlegg/statistikk/Vedlegg_3.pdf [28.5.2013].
27. Gjersing L, Jonassen KV, Biong S et al. Diversity in causes and characteristics of drug-induced deaths in an urban setting. *Scand J Public Health* 2013; 41: 119–25.

Received 2 July 2013, first revision submitted 12 September 2013, accepted 19 December 2013.
 Editor: Kristin Viste.