



Demographics and post-mortem toxicology findings in deaths among people arrested multiple times for use of illicit drugs and/or impaired driving



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ABSTRACT

Background: Multiple arrests for use of illicit drugs and/or impaired driving strongly suggests the existence of a personality disorder and/or a substance abuse problem.

Methods: This retrospective study (1993–2010) used a national forensic toxicology database (TOXBASE), and we identified 3943 individuals with two or more arrests for use of illicit drugs and/or impaired driving. These individuals had subsequently died from a fatal drug poisoning or some other cause of death, such as trauma.

Results: Of the 3943 repeat offenders 1807 (46%) died from a fatal drug overdose and 2136 (54%) died from other causes ($p < 0.001$). The repeat offenders were predominantly male (90% vs 10%) and mean age of drug poisoning deaths was 5 y younger (mean 35 y) than other causes of death (mean 40 y). Significantly more repeat offenders (46%) died from drug overdose compared with all other forensic autopsies (14%) ($p < 0.001$). Four or more drugs were identified in femoral blood in 44% of deaths from poisoning (drug overdose) compared with 18% of deaths by other causes ($p < 0.001$). The manner of death was considered accidental in 54% of deaths among repeat offenders compared with 28% for other suspicious deaths ($p < 0.001$). The psychoactive substances most commonly identified in autopsy blood from repeat offenders were ethanol, morphine (from heroin), diazepam, amphetamines, cannabis, and various opioids.

Conclusions: This study shows that people arrested multiple times for use of illicit drugs and/or impaired driving are more likely to die by accidentally overdosing with drugs. Lives might be saved if repeat offenders were sentenced to treatment and rehabilitation for their drug abuse problem instead of conventional penalties for drug-related crimes.

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1. Introduction

People arrested multiple times for use of illicit drugs and/or impaired driving are at greater risk of dying prematurely compared with the general population [1,2]. The cause of death in users of illicit drugs is often attributed to acute intoxication, accidental overdose, self-inflicted injuries (suicide), various types of trauma, irreversible damage to body organs and tissues and viral infections, such as hepatitis and HIV [3].

The use and abuse of drugs in society, both licit and illicit, represents a major public health problem, owing to drug overdose

becoming the leading cause of death among people in some age groups [2]. Besides illicit recreational drugs many psychoactive prescription drugs are subject to abuse, especially pain medication, such as various opiates or opioids, which are highly prevalent in drug overdose deaths [4]. One way to monitor patterns and trends in drug abuse in society is from arrests for use of illicit drugs or driving under the influence of drugs (DUID) [5–7]. The conventional penalties for petty drug offences and DUID, such as monetary fines and/or short terms of imprisonment, do not appear to be effective, judging by high rates of recidivism [8,9]. Much could be gained by sentencing repeat offenders to treatment and rehabilitation for substance abuse, and this approach might lower the incidence of drug-related deaths [2,8,10].

Results from analysis of blood samples from people arrested for DUID and in victims of a fatal drug overdose show a high prevalence of multiple drug use, which often includes various

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combinations of licit and illicit substances [11,12]. This development follows the upsurge of poly-pharmacy in today's society, and many psychoactive prescription drugs are subject to abuse and dependence [13,14]. Studies from USA and several European nations verify the high prevalence of opiates or opioids in drug-related deaths, such as heroin/morphine, methadone, fentanyl, buprenorphine and/or tramadol [15,16].

This article represents an 18-year retrospective study reporting the demographics and post-mortem toxicology findings in people with multiple previous arrest for use of illicit drugs and/or impaired driving. Our hypothesis was that these individuals suffer from a substance abuse problem and/or personality disorder and run an increased risk of a premature death from drug poisoning (overdose).

2. Material and methods

2.1. Post-mortem toxicology

The official Swedish statistics show that approximately 100,000 deaths occur annually and of these roughly 5000 are considered suspicious or unnatural and police authorities therefore request that a forensic autopsy is performed. Age and gender of the deceased along with the results of toxicological analysis are contained in a national forensic toxicology database (TOXBASE). The cause and manner of death is assigned by the responsible forensic pathologist after all information is considered including autopsy findings, toxicology results and the police reports.

Forensic toxicology in Sweden is centralized to one accredited laboratory and the methods of analysis are well standardized. Autopsies are performed at the six teaching hospitals in Sweden and whenever possible the pathologists are instructed to submit specimens of femoral blood, bladder urine and vitreous humour for toxicology. Potassium fluoride (2%, w/v) is added as preservative and enzyme inhibitor and the biological specimens are put into refrigerated containers and sent to a central forensic toxicology laboratory by express mail for analysis.

2.2. Selection of cases

We searched TOXBASE between the years 1993 and 2010 to find individuals with two or more previous drug-related offences, who had subsequently died and a forensic autopsy was completed. Demographics of the victims, the concentrations of drugs identified in femoral blood and the cause and manner of death according to the forensic pathologist's report were noted.

Drug-related death refers to deaths that occur shortly after consumption of one or more psychoactive substances and where the underlying cause was fatal poisoning by one or more of these substances. Such deaths are often referred to as overdose (poisoning) deaths, which is the term used in this manuscript. However, equivalent concepts are found in the literature, such as deaths directly related to drug use and dependence, drug intoxication deaths or drug-induced deaths.

Information about the age and gender of people with multiple previous drug-related arrests, the cause and manner of death and the concentrations of alcohol and/or drugs in femoral blood were retrieved from TOXBASE. The control material was deaths occurring in people with no previous arrests or only a single arrest for use of illicit drugs and/or DUID during the same time period. The manner of death was assigned by the pathologist as being accidental, suicide or undetermined intent. Non-drug related deaths were the result of trauma, road traffic crash, work-related accident or a natural cause of death.

2.3. Toxicological analysis

A wide range of analytical methods was utilized to determine the concentrations of ethanol and other drugs, both illicit and prescription medication, in femoral blood samples. Blood-ethanol concentration was determined in duplicate by headspace gas chromatography (HS-GC) by a well-established method [17]. Immunoassay screening methods (EMIT and/or CEDIA) were used to detect presumptive positive case for later verification. The screening analysis was directed towards various classes of illicit drugs (amphetamines, opiates, cannabis, cocaine metabolite, benzodiazepines). If urine was available at post-mortem, as was mostly the case, this biological specimen was used to screen for presence of drugs. Otherwise blood samples were analyzed after precipitation of proteins with acetone. Because sensitivity of the method is lower for blood than urine, the detection limits for presumptive positives was six times lower for blood samples compared with urine. All positive results from the screening analysis were verified by re-analysis of femoral blood samples by more sensitive and specific chromatographic methods, including gas chromatography–mass spectrometry (GC–MS) and deuterium labelled internal standards.

Prescription drugs, including methadone and other opioid analgesics, were determined in femoral blood after solvent extraction with n-butyl acetate and use of capillary column gas chromatography with nitrogen-phosphorous detector [18]. This analytical method allowed the simultaneous screening and quantitative analysis of about 200 different weakly acid and basic drugs as well as many metabolites. The analytical limits of quantitation for reporting positive results were different for different substances as published elsewhere [19].

The analytical cut-off concentration for reporting blood ethanol was 0.20 g/L (200 mg/L), which is motivated because small amounts of ethanol might be produced in the body after death, especially in traumatic deaths [20].

2.4. Statistical analysis

Because the concentration distributions of drugs in post-mortem blood were not normally distributed, the descriptive statistics used were mean, median and upper percentiles (90th, 95th and 97.5th). Two percentages were compared by a chi-squared test and $p < 0.05$ was used to indicate a statistically significant difference. The age of people at time of death was reported as mean \pm SD and differences between two means were compared by Student's *t*-test.

3. Results

3.1. Forensic autopsies in Sweden

The annual number of forensic autopsies performed in Sweden 1993–2010 has remained remarkable constant at about 5000 per year (range 4581–5244). Toxicological analysis of alcohol and other drugs was done in 98–99.5% of all forensic autopsies and in 67% of cases (range 65–70%) one or more drugs were identified and quantitated in femoral blood.

The information in TOXBASE used in this study was from 1993 to 2010 (18 years) and results from ~90,000 forensic autopsies were available for scrutiny. We identified 3943 individuals (4.4%) with multiple arrests (two or more) for use of illicit drugs and/or DUID.

3.2. Demographics of people with multiple arrests

Table 1 shows a clear predominance of male gender (~90%) in deceased with multiple previous drug-related offences. The

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