

Deaths from acute drug reactions in Galician (Spain) Prisons (2001-2010)

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ABSTRACT

Introduction and objectives: drug use is associated with multiple complications with an increase in morbidity, with death by acute drugs reactions (ADR) being the most serious. A large percentage of the prison population has problems associated with drug additions, and substance abuse is also a common internal problem of penal institutions, despite their control measures. The goal of this study is to analyse the prevalence of ADR in penitentiaries, deceased sociodemographic characteristics as well as the circumstances in which they are produced.

Material and methods: All deaths by ADR between 2001-2010 in Galicia are studied, in particular, those deaths that took place inside prisons.

Results: In the whole sample (n=510) male (90.6%), single (46.1%) with an average age of 35.8 and with a prevalent factor of long experience in drug abuse. Thirty seven of them died in Penal/Correctional Institutions, representing 7.3% of the total sample. The characteristics of this population subtype were similar to the total sample (average age: 34.7 years; 89.2% were males) but we found significant differences regarding the substances detected.

Discussion: ADR is the most frequent cause of death among drug addict convicts in prisons. The pattern of the detected substances in the toxicological analysis as well as the socio-demographic characteristics can help to establish a higher risk profile and preventive measures.

Keywords: prisons; mortality; drug overdose; epidemiology; methadone; morbidity; death; Spain.

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INTRODUCTION

Drug addiction is defined as compulsive drug seeking and use which progressively entails a modification of behavior. The illegal nature of most drugs determines that their production and distribution be carried out beyond sanitary and legal controls, which implies high prices and a lack of health security. All of this determines that drug users frequently resort to offending behaviors (theft, robbery, smuggling, etc.) to support their addiction, as well as offences against individuals in the environment of criminality and marginality that surrounds clandestine trade. Moreover, psychoactive effects of substances entail disinhibition, which can lead to serious conflict with the en-

vironment (reckless driving, assaults, abuse, etc.). This is why a significant percentage of drug users end up with a generous criminal record with multiple arrests and stays in prison.

Our country has one of the highest imprisonment rates in Europe with an imprisoned population of 63403 individuals as of December 31 2010, 5041 of whom (8%) were women. The main reason for being imprisoned are crimes against property (38.8%), followed by crimes against public health (27.6%), both of which are closely related to the use of illegal drugs. This determines that a significant proportion of the imprisoned population are users of different substances¹. The prevalence of mental disease is around 25-40% and between 30-50% of inmates have a substance

use disorder². On the other hand, several publications highlight that perpetrators of crimes against road safety, violent crimes, sexual assaults and domestic violence have a high incidence of alcohol abuse^{3, 4}. The high prevalence of drug users among inmates determines that despite control measures already implemented in these facilities, drug dealing and use are common practice in prison.

Drug use has been associated to constant health hazards, with a significant increase of morbidity among drug users, sometimes even causing their death. Acute drug reactions (ADR) are the main cause of death in this group although there are other circumstances leading to this fatal outcome: suicide, associated diseases (secondary to the effects of the substance or to the route of administration), accidents, trauma, aggressions, etc.^{5, 6, 7, 8}.

The increase of mortality among drug users can range between 10 and 20 times higher in comparison with non-users⁹. Cohort studies carried out in several European countries determine a mortality of drug users ranging between 1-2% per year, which has remained somewhat stable for the last decade⁸. It is estimated that in 2010 there were between 99000 and 252000 casualties in connection with the use of illegal substances, representing between 0.5 and 1.3% of all deaths from people between 15 and 64 years old. The main cause was opioid overdose, which was considered responsible for between 70000 and 100000 of deaths^{10, 11}. In Europe, according to the EMCDDA, every year between 10000 and 20000 opioid users pass away, overdose being responsible of most of them (between one third and half of the cases: around 7000-8000 deaths/year)^{7, 12}.

Within ADR we find different etiopathogenic mechanisms: anaphylactic reactions, presence of toxic adulterants, overdose itself, and the use of several substances in combination (polydrug use)¹³. The latter is quite common in our environment and according to 2011 EMCDDA data⁴, almost 50% of European addicts use two or more drugs. Our study and other national publications report similar figures¹⁵. Polydrug use entails a significant increase of risks¹⁶, mostly unknown by the user. Drugs most frequently identified, and which represent a higher risk, are central nervous system (CNS) depressants, and more specifically opioids in combination with alcohol and hypnotics-sedatives¹³.

Tolerance determines an increased susceptibility to overdose in sporadic drug users. However, in most of the studies on ADR-related mortality, higher overdose rates are found among regular and experienced users («veterans») than among newcomers. No-

netheless, this mechanism can be of great importance in overdose among addicts who have reduced or lost their tolerance after periods without using drugs. This fact is especially relevant upon their release from prison^{17, 18}, treatment centers^{19, 20, 21} or after any situation where the access to substances was impaired (admission to hospital). Therefore, there are many factors that can reduce or aggravate the consequences and complications derived from the use of a specific substance in a certain quantity and thus, condition the survival of the individual^{22, 23}.

The objective of this study is to assess sociodemographic features of those passed away and the circumstances associated to ADR-related deaths, since they are of great value as indirect indicators of drug use in a particular community at one point and for the development of preventive strategies aimed at reducing their prevalence.

MATERIAL AND METHOD

All deaths occurred in Galicia (Spain) between 2001 and 2010 (both inclusive) with judicial intervention where the cause of death was determined to be an acute drug reaction (ADR) were recorded. This was determined according to the inclusion and exclusion criteria established by the *Sistema Estatal de Información en Toxicomanías (SEIT)* (National Institute on Drug Abuse) and specified by the individual record sheet developed by the *Plan Nacional sobre Drogas (PND)* National Drug Plan.

Statistical processing was carried out by means of SPSS 17.0 software. The basic analysis of results used the Descriptive procedure (sample size, average, minimum, maximum, standard deviation, variance, addition, etc.). To develop contingency tables, the Tables procedure was used with Pearson's chi-square test with the standard corrections. To calculate summary statistics when the cases are split up in groups according to their values for other variables the Anova procedure was used. In all cases, statistical significance was established for $p < 0.05$.

RESULTS

General sample

Throughout the study period (2001-2010) 510 ADR-related deaths were reported. Among those deceased, men (90.6%) who were single (46.1%) and with an average age of 35.8 years prevailed although there was an increasing trend of age per annual perio-

ds (33.5 years old in 2001 and 37.9 in 2010). The main descriptive features are depicted on Table 1.

33.3% were positive for HIV. Moreover, in 36.4% there were clear signs of recent injection. In 13.4% of cases it was determined that the main cause of death was a previous underlying pathology aggravated by drug use.

With regard to the distribution of casualties throughout the week, the greatest percentage took place on Sunday (32.7% followed by Saturday (15.9%), Tuesday (14.5%), Friday (14.1%), Thursday (11.8%), Wednesday (9.6%) and Monday (1.4%), thus almost 50% took place during the weekend.

The province where more deaths were reported was A Coruña (n=231, 45.3%) followed by Pontevedra (n=187, 36.7%), Lugo (n=49, 9.6%) and last Ourense (n=43, 8.4%).

Drugs most frequently identified were opioids (heroin in 55.5% of cases and methadone in 42.5%), followed by cocaine (56.7%), benzodiazepines (44.1%), alcohol (27.1%) and cannabis (17.2%). Most commonly, several substances were identified (poly-drug). Only 11.8% corresponded to single-drug users. Table 2 depicts the substances and annual trends.

With regard to the place where ADRs took place first were homes (58.2%) followed by the street (21.2%) and prisons (7.3%). There was minor representation of other locations (hotels, motels, other public establishments, etc.).

ADR-related deaths occurred in prisons

There were 37 (7.3%) deaths associated to ADR in penitentiary institutions in our community, which corresponds, as aforementioned, to 7.3% of all cases. The percentage of casualties increased throughout the study period as it is depicted on Figure 1, from 2.9% in 2001 to 11.8% in 2010.

In this group, men (89.2%) who were married (47.6%) prevailed (Table 1).

Recent injection signs (less than a week old) were observed in 47.6% of cases, the intravenous route being the more common in 42.3% of cases. 56.8% were positive for HIV.

In relation to the distribution in provinces, the highest percentage corresponded to Pontevedra (35.1%) followed by A Coruña (29.7%), Lugo (18.9%) and Ourense (16.2%).

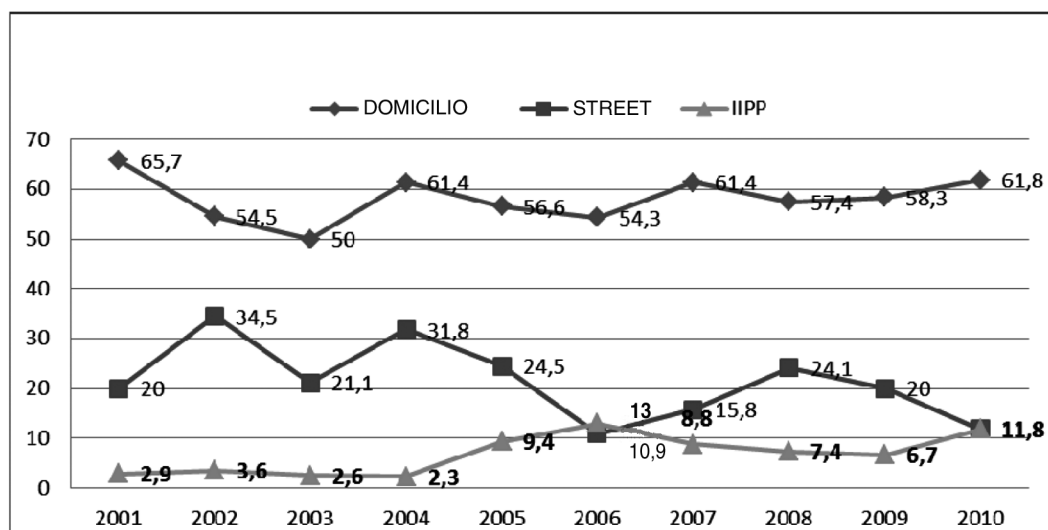
The day of the week when more ADR-related deaths took place in prisons was Sunday (29.7%) followed by Tuesday (27%).

The substance most commonly identified among those deceased in prisons was methadone (70.3%), followed by benzodiazepines (64.9%) although, as previously stated, generally in combination with other substances.

Comparison of ADR-related deaths between inmates and general population

When comparing this group with the rest of the sample, differences were identified although they we-

Figure 1: Distribution of the localization of the corpse per yearly period.



IIPP: Penitentiary institution

re not statistically significant the variables studied, mainly due to the small size of the sample. In relation to gender, although in both groups men prevailed, the percentage of women was slightly higher (10.8% vs 9.3%). The mean age was somewhat younger in the inmate group (34.7 vs 35.9). With regard to the marital status, among those deceased in prison, unlike the rest of the sample, those married prevailed (47.6% vs 24.6%), whereas the percentage of single individuals was 33.3% in comparison with 47.9% of the external population.

Individuals passed away from ADR in prisons presented higher percentages of positive serology for HIV (56.8% vs 31.5%) and a higher rate of recent in-

jection signs (Table 1), in both cases without statistical significance.

Statistically significant differences were found with regard to some of the substances identified among those deceased in prisons. This is how the substance most commonly identified was methadone (70.3% vs 40.4%, $p: 0.000$), followed by benzodiazepines (64.9% vs 40.4%, $p: 0.008$). However, other substances were found in an inferior proportion than in the general population, such as heroin ($p > 0.05$), cocaine ($p: 0.002$) and alcohol ($p: 0.001$) (Table 3).

As from 2007, we tried to identify the specific type of benzodiazepine. In the overall population, the most common was alprazolam ($n=32$, 13.4%), nor-

Table 1: Casualties in prison vs rest of the sample.

	Total sample	ADR in prison	ADR elsewhere
Age (years)	35.8	34.7	35.9
Gender: male	90.6%	89.2%	90.7%
M.status: married	26.3%	47.6%	24.6%
Previous pathology	13.4%	9.5%	13.8%
HIV-positive	33.3%	56.8%	31.5%
Signs of injection	36.4%	47.6%	35.3%

Table 2: Detection of substances per yearly period.

	Morphine*	Cocaine	Methadone	Benzod	Alcohol	Cannabis**
2001	62.9%	48.6%	28.6%	51.4%	20%	
2002	60%	52.7%	43.6%	54.5%	47.3%	
2003	42.1%	63.2%	47.4%	44.7%	21.1%	
2004	45.5%	70.5%	38.6%	40.9%	18.2%	
2005	56.6%	67.9%	45.3%	52.8%	26.4%	
2006	54.3%	56.5%	43.5%	54.3%	32.6%	
2007	50.9%	61.4%	59.6%	28.1%	15.8%	15.8%
2008	64.8%	50%	33.3%	37%	38.9%	33.3%
2009	61.7%	50%	31.7%	40%	28.3%	33.3%
2010	52.9%	50%	48.5%	41.2%	19.1%	30.9%

*Morphine recorded as heroin metabolite.

**It began to be determined in 2007.

Tabla 3: Detection of substances in those deceased in prison vs elsewhere.

	Prison	Elsewhere	P value
Methadone	70.3%	40.4%	<0.05
Morphine (heroin)	48.6%	56.0%	No sign.
Codeine	14.3%	29.8%	No sign.
Benzodiazepines	64.9%	42.5%	<0.05
Cocaine	32.4%	58.6%	<0.05
Cannabis	19.0%	17.0%	No sign.
Alcohol	2.7%	29.0%	<0.05

dazepam (n=24, 10%), diazepam (n= 15, 6.3%) and lormetazepam (n=11, 4.6%).

We must consider that nordazepam is a metabolite from several benzodiazepines (chlordiazepoxide, diazepam, ketazolam, halazepam and clorazepate).

In the group of those deceased in prisons, the benzodiazepine which was most commonly identified was nordazepam (28.6% vs 8.3%), followed by alprazolam (19% vs 12.8%). Lormetazepam was identified in 9.5% of cases in prisons and in no case was diazepam identified. These differences were only statistically significant in the case of nordazepam (p: 0.003). Table 3 shows the substances identified in both groups.

DISCUSSION

First, we must underline the trend observed throughout recent years towards a clear increase of deaths associated to ADR within penitentiary facilities. Thus as from 2005 they represent almost 10% of all deaths due to overdose in Galicia. In the rest of the country, these percentages are usually significantly lower, and in no way do they exceed 5% of all deaths secondary to ADR¹⁵.

The sociodemographic profile of those deceased in prison is similar to that of the rest of the sample in terms of age and gender although it presents significant differences with regard to marital status, with a higher percentage of married casualties. In spite of what we could initially believe, these are no inexperienced newcomers but drug users with a record of years of addiction. On the other hand, they present significantly higher rates of infection by HIV, a fact that could imply a more severe organic decay among those deceased in prisons.

Drugs most commonly identified among inmates were opioids, followed by benzodiazepines whose combination increases the risk of mortality as it has been previously stated¹³. Nevertheless, among inmates, the opioid most frequently identified was methadone, unlike the rest of the sample, where heroin prevailed. We must also take into account that during 2010, 16804 inmates underwent methadone-based therapies in the penitentiary institutions of our country 1. Unfortunately, we do not have data on how many of those deceased secondary to ADR in whom methadone was identified were included in methadone-maintenance programs. It is therefore very difficult to establish its role as a direct cause of these deaths (due to the presence of multiple drugs too).

Although these are facilities with high degrees of control that count upon permanent healthcare, the accumulation of many users determines that drug dealing and drug use are widespread and therefore that serious complications such as ADRs can take place. However, the increasing percentage of casualties within prisons could actually be due to an improved detection and report of cases. Studies in other countries have also reported high rates of overdose-related deaths in prisons.

The identification of these individuals' profile and those who have witnessed an overdose could allow the detection of the target population as well as the development of preventive measures within these facilities²⁴⁻²⁶.

Several studies conclude that one of the most effective measures in reducing drug use, risk behaviors, communication of infections and prevention of deaths (those secondary to overdose too) is the implementation and enhancement of opioid agonist maintenance therapies²⁷. Although the substance most

commonly used in these programs is methadone, throughout recent years, buprenorphine has gained ground since it is associated with a lower risk of overdose²⁸. This reduction is associated to buprenorphine being a partial agonist (agonist-antagonist) which determines that it presents a plateau in its toxic effects when increasing its concentration.

On the other hand, preventive campaigns need to be implemented aimed at the general training of drug users on risk behaviors implying potential ADR^{29, 30} and developing realistic strategies aimed at the population at risk and their environment to reduce their appearance and in case of taking place, so that the appropriate measures be taken to avoid fatal outcomes³¹.

Despite therapeutic measures and programs implemented by different administrations, the rate of ADR-related deaths have remained relatively stable throughout recent years. Therefore, it is essential to identify the groups at risk and focus preventive measures on them and their environment.

Overall, ADR are the main cause of death among drug users and a significant percentage take place in prisons, with an increasing trend throughout recent years. It is therefore imperative to implement preventive measures to reduce these casualties. We suggest that knowing what substances are identified in toxicological analysis and other sociodemographic circumstances can help determine the profile at risk and enhance these preventive measures.

CONCLUSIONS

— ADR are the main cause of death among drug users.

— A significant percentage of ADR-related deaths took place in prisons, with a clear increase of reports throughout recent years.

— No statistically significant differences were observed with regard to sociodemographic variables between inmates and the general population (males, around 35 years old, very experienced in drug abuse).

— Among inmates, methadone and benzodiazepines were more frequently found, and cocaine and alcohol less.

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CONFLICT OF INTEREST

Authors declare that there are no conflicts of interest.

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