



# Underreporting of fatal poisonings in Brazil – A descriptive study using data from four information systems

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## ABSTRACT

Poisoning is a worldwide problem that involves individuals of all ages and a range of chemicals. In this study, fatal poisoning cases that occurred in the Federal District of Brazil (DF) from 2009 to 2013 were described using information from four systems, and the reasons for underreporting of each system were discussed. Data were obtained from the mortality information system (SIM), the notifiable disease information system (SINAN), the poison information center (CIT), and the forensic medicine institute (IML) of the DF. In total, 288 cases were reported to SIM, 18 to SINAN, 29 to CIT and 101 cases identified in the IML. SIM data indicated a prevalence of 2.24 cases/year/100,000 individuals in the DF, higher than the national estimation (1.36). After eliminating the 98 duplicate cases among the systems, 338 fatal unique cases were identified, from which 74.0% were reported in only one system (mainly the SIM), 23.4% in two systems, 8 cases in three systems and only 1 case was reported in the four systems. Over two thirds of the 338 fatalities involved men (67.4%), and 46.9% involved individuals aged 20–39 years. Medications were the main agent involved (49.4%), followed by pesticides (29.9%). The fatalities occurred mainly after unintentional exposure (50.8%) and suicide (47.7%, of which 53.5% involved pesticides). These results confirmed the previous hypothesis that none of the information systems could capture the whole picture of fatal poisonings in the DF. Underreporting was found in all systems, indicating the need to improve the information quality and the coordination of data reporting, so that health authorities can better understand and reduce these fatalities.

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## 1. Introduction

Human exposure to toxic substances is a worldwide problem and estimates from the World Health Organization indicated that unintentional exposure was associated with 300,000 deaths in 2000, with 20% involving children up to 14 years old [1]. Poisoning is implicated in about 4% of all infant deaths worldwide and is ranked in 13th place among adolescents from 15 to 19 years old [2]. Handley and Flanagan [3] reported that 0.5% of all deaths that occurred in England and Wales from 2000 to 2011 were due to poisoning, with about 3000 per year.

In Brazil, the main source of mortality data is the mortality information system (*Sistema de Informação de Mortalidade*, SIM), in operation since 1975. The information included in the SIM (online system) is provided by public and private hospitals and clinics;

reporting is compulsory in all Brazilian territory. The classification of the primary cause of death in the SIM is done according to the Statistical Classification of Diseases and Related Health Problems (ICD-10) [4].

In addition to the SIM, other information sources of poison data in the country are the notifiable disease information system (*Sistema de Informação de Agravos de Notificação*, SINAN), the poison information centers (*Centro de Informação Toxicológica*, CIT), and the forensic medicine institutes (*Instituto Médico Legal*, IML). The SINAN was developed at the beginning of the 1990s. The data are provided by all hospitals/clinics, who are required to report the diseases or adverse health events listed in the legislation as compulsory reporting. Poisoning due to occupational exposure to pesticides was included on the compulsory list in 1997, all chemicals involved in occupational exposure in 2004 and all poison events in 2011 [5]. Both the SIM and the SINAN are coordinated nationally by the Brazilian Ministry of Health, and locally by the state and Federal District health secretariats.

The main objectives of poison centers are to provide information and advice concerning the diagnosis, prognosis, treatment,

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and prevention of intoxication, on the toxicity of chemicals and other agents and the risks they pose to humans and animals [6]. The information is provided primarily through telephone calls, mainly made by health professionals but also by the general population. The poison information center of the Federal District (CIT-DF), which is part of the Health Secretariat of the Federal District, started its activities in February 2004, responding to calls 24 h/7 days through a toll-free number. The forensic medicine institute of the Federal District (IML-DF) is part of the Civilian Police of the Federal District and is responsible for all autopsies related to violent death (including homicide, suicide, poisoning and accidents) and death under suspicious circumstances that occur in the Federal District.

Each information system mentioned above has different objectives, sources of information to be completed, operation modes, and is managed by different government bodies. Therefore, it is expected that none can capture the whole picture of fatal poisonings. To test this hypothesis, and to describe quantitatively the fatal poisonings that occurred in the Federal District from 2009 to 2013, data from the four available information sources were used. Furthermore, national SIM data were also included in the study to compare the profile and the prevalence of these events in Brazil and in the Federal District. The Federal District is located in the Midwest region of Brazil, with a total area of 5,779,999 km<sup>2</sup>, including the Brazilian capital Brasília, and a population of 2,570,163 in 2010 [7].

## 2. Methods

The data collected for this study are related to the fatal poisonings that occurred in the Federal District from January 1, 2009 to December 31, 2013. Table 1 summarizes the characteristics of the four data sources used in this study, and the information obtained in each case.

The information included in the mortality information system of the Federal District (SIM-DF) were provided by the Health Secretariat of the Federal District. All cases which the primary cause of death were classified in Chapter XX of the ICD-10 (External causes of morbidity and mortality) were provided, and the cases with the relevant codes for poisoning were retrieved for this study (X40–X49, X60–X69, X85–X90 and Y10–Y19) [8]. National SIM data (SIM-Brazil), which concerns data for the whole country, were provided by the General Coordination for Epidemiological Information and Analysis of the Ministry of Health (*Coordenação Geral de Informações e Análises Epidemiológicas*).

Poisoning data from the notifiable disease information system of the Federal District (SINAN-DF) were also provided by the Health Secretariat, and data from the CIT-DF were obtained directly from the CIT electronic system.

Data from the forensic reports of the IML-DF were obtained directly from its electronic system. Results of toxicological testing and other information in the forensic report (including pathological observation during autopsy and chemical name), and of the police report, were considered to identify additional cases among the cases with unknown cause of death. Toxicological testing was requested by the forensic pathologist when there was a suspicion of chemical poisoning, and includes immunoassay screening for amphetamines, benzodiazepines, barbiturates, tricyclic antidepressant, tetra-hydro-cannabinol, cocaine and opiates in urine, and some organophosphorus and carbamate (mainly aldicarb) compounds in stomach contents (by thin-layer or gas chromatography). Blood alcohol concentration (BAC) were determined in most cases of violent deaths. Laboratory information may be included in the forensic report after the death certificate has been issued.

The fatal cases were consolidated using information from the four sources. When there was inconsistency among the systems regarding a specific case (agent involved or circumstance), the information included in the SIM was considered the most reliable, unless information from one of the other systems clearly indicated otherwise. This study was approved by the Ethical Committee of the Foundation for Research and Education of the Federal District (CAEE 36189714.2.0000.5553).

## 3. Results

### 3.1. Data from each information system

A total of 288 fatal poisoning cases included in the SIM-DF between 2009 and 2013 were classified according to the relevant ICD-10 and retrieved for investigation in this study. They represented 4.8% of all reported deaths from external causes (Chapter XX of ICD-10) during the period. In average, the individuals were 44 years old, and 65.2% were men. On average, 57.6 cases/year  $\pm$  12.0 were reported during the period, with a declining trend from 2010 to 2013 (74–47 cases).

Table 2 shows the distribution of the fatal poisoning cases reported in the SIM that occurred in the Federal District (SIM-DF; N=288 cases) and in Brazil (SIM-Brazil; N=12,936 cases), according to the ICD-10. In the Federal District, the highest number of poisoning cases were classified as unintentional with

**Table 1**

Characteristics of the four information sources concerning fatal poisoning in the Federal District (DF) and Brazil (SIM only).

	Mortality information system (SIM)	Notifiable disease information system (SINAN-DF)	Poison information center (CIT-DF)	Forensic medicine institute (IML-DF)
Data source for the database	Information is included in the online-SIM system by the epidemiology department of public and private hospitals and clinics, based on the death certificate. The primary cause of death is classified according to the ICD-10	Information is included in the online-SINAN system by the epidemiology department of public and private hospitals and clinics, based on the poisoning investigation form	Voluntary calls, primarily from health professionals in hospitals and clinics. The information is included in the CIT-DF computer software	Forensic report of the autopsy conducted by a medical pathologist. Forensic reports are included in a on-line system
Data provider for the study	DF: Health Secretariat Brazil: Ministry of Health	Health Secretariat of the Federal District	Direct search in the CIT-DF database	Direct search in the forensic reports on-line system
Relevant information provided	DF: Date of the death, name, birth date, age, sex, mother and father's name and ICD-10 code Brazil: number of cases for each ICD-10 code	Date of the poisoning/death, name, birth date, age, sex, mother's name, agent (s), circumstance, outcome of the poisoning	Date of the poisoning/death, name, birth date, age, sex, mother's name, agent, circumstance, outcome of the poisoning	Autopsy date, name, birth date, age, sex, medical cause of the death, circumstance, agent, and toxicological testing results

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