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Epidemiology and risk factors of Poisoning in the north central region of Morocco (2013-2014)

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ABSTRACT: The present study was aimed at determining the epidemiological profile and risk factors of poisonings in the north central region of Morocco (Meknes-Tafilalet) in 2013-2014. The data collected from a survey that was carried out on the poisonings registered by health delegations and hospitals in the region in 2013 and 2014, in addition to poisonings reported to the poison control and pharmacovigilance center of Morocco (PPCM) during the same period were subjected to a descriptive epidemiological analysis. The survey detected 2530 intoxications of different types outside of the scorpion stings. Following transmission to the PPCM and elimination of 1185 duplicates, our survey was able to list 1345 new cases, to have 4142 cases in 2013 -2014. According to the data analyzed: 58.6% of the intoxicated was adults, the Sex ratio (male / female) = 0.68, 83.37% of cases were recorded in urban areas. 54.49% progressed favorably, while 23 patients died. Poisoning was symptomatic in 40.24% of cases. The highest incidence was recorded in Ifrane city (2.15 ‰), but Meknes city registered the highest fatality rate (1.2%). these poisonings were caused by gaseous products in 41.6% of cases. The number of new poisonings collected during our survey was important: 1345 cases not reported to the PPCM, which means that Health officials should intervene in time to the statements of poisoning, in order to participate in the fight against their harmful effect on the health.

KEYWORDS: Poisoning, health surveys, Epidemiology, Risk assessment, Incidence.

1 INTRODUCTION

Poisoning is a serious public health problem in the world. In 2012, the world health organization announced that an estimated of 193,460 people died worldwide from unintentional poisoning [1]. In Morocco, according to the official report of the Ministry of Health "Health in figures 2009", the mortality rate by traumatic lesions, poisonings and other consequences of external causes is 8.8%, and it comes in third place after that of diseases of the circulatory system and tumors [2]. By age group, this rate holds the leading position among the other causes of death for the 1-4 year (22.4%) and 5-19 (48.4%) age groups [3]. Poisoning occurs when people drink, eat, breathe, inject, or touch enough of a hazardous substance (poison) to cause illness or death. Some poisons can cause illness or injury in very small amounts. Illness may occur very quickly after exposure to a poison, or it may develop over several years with long-term exposure [4]. The World Health Organization (WHO) reported in 2004 that 345,814 people of all ages died worldwide, due to accidental poisoning, or 5.4 deaths per 100,000 inhabitants [5]. Since 1980, and according to Ministerial Circular No. 19 829DR / BF / MM, the poison control and pharmacovigilance center of Morocco (PPCM) receives reports of poisoning cases and he is responsible for ensuring the functions of vigilance and health alert. He collected 78,374 cases of poisoning between 1980 and 2007 (except Scorpion stings) in the 16 regions of Morocco

(case-fatality rate = 15.34 ‰) and 9,525 cases in 2012 [7]. In 2013-2014, the PPCM was able to determine 11881 cases of poisoning in 2013 and 13057 in 2014, or 24938 cases in all country in this period [8], of which the region of north central (Meknes-Tafilalet) represents a percentage of 16.60%. According to this center, this region occupied the first position regarding reporting poisoning cases in 2013 (64.47 statements per 100 000 inhabitants) [7], and the third position in 2014 (66.93 per 100,000 inhabitants) [8], which indicate that poisonings in this region are worrying. However, surveys aimed at collecting poisoning cases that are not reported to the center from hospitals and health delegations are still essential for determining and assessing the severity of poisoning.

2 MATERIALS AND METHODS

This work consists of a descriptive epidemiological statistical study of poisoning cases in 2013-2014 collected during a survey carried out in the north central region of Morocco. We also took into account the other cases of poisonings that were reported to the PPCM during two years through two information systems: Toxicovigilance and Toxicological Information, and risk factors that may threaten the health of patients.

The data used in this study is medical files in delegations and hospitals of the region (survey), in addition to files set up in the service of toxicological information in the PPCM:

- Declaration card on which are recorded the poisoning cases declared by health professionals.
- Telephone answer sheet.
- Monthly statements sent by provinces [7].

This study takes into consideration all cases of poisonings recorded by health facilities in the north central region of Morocco during 2013 and 2014.

Whit regard to studied parameters, they are characteristics related to the intoxicated patient (sex, age, origin), characteristics of the toxic agent (product family), characteristics of the intoxication (type, circumstance, gradation, evolution, Lethality, Incidence and risk factors), as well as the time and place of intoxication.

The INTOX classification method [9] was used to determine age ranges, while the Poisoning Severity Score (PSS) [10] was used to determine grades of health status change of the patient, we distinguish:

- Grade 0: Absence of functional or physical sign.
- Grade 1: Minor, transient and spontaneously regressing symptoms.
- Grade2: Marked or persistent symptoms.
- Grade 3: Severe or life-threatening symptoms.
- Grade 4: Fatal poisoning.

IBM SPSS Statistics 22 software was used for data mining.

2.1 REGION AND POPULATION OF STUDY

The ancient region of Meknes-Tafilalet was located in the north central of Morocco, is one of sixteen regions in the country since the regional division of 1996 (before the territorial redrawing of 2015), which has dedicated the region as a local community. The region currently counts after the new administrative division of 2009, the prefecture (Meknes) as chief town and five provinces (El Hajeb, Ifrane, Khenifra, Errachidia and Midelt). Its surface area is 73,253 Km², which is 10.3% of the Moroccan territory and it is characterized by a diversity of physical environments and natural conditions.

Demographically, the region population would reach 2267,000 inhabitants in 2012, representing 6.9% of total population of Morocco, and 2,280,000 inhabitants in 2013. In 2014, the region registered a population of 2,292,000 in the provinces of Meknes (795,000 inhabitants), Errachidia (449,000 inhabitants), Khenifra (388,000 inhabitants), Midelt (263,000 inhabitants), El Hajeb (244,000 inhabitants), and Ifrane (153,000 inhabitants). [11]

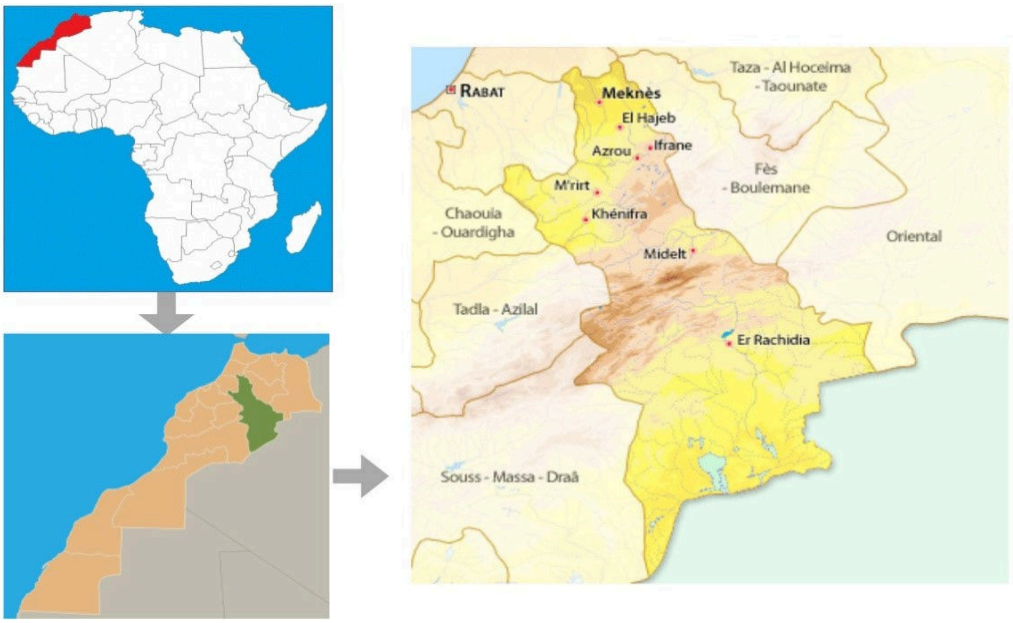

Fig. 1. Geographic location and data on the population of Meknes-Tafilalet region in Morocco

- Population: 2,280,000 inhabitants in 2013, and 2,292,000 inhabitants in 2014.
- Area: 73 253 Km²
- Source: Office of the High Commission for Planning, Regional Directorate of Meknes. Monograph of Meknes-Tafilalet region.

3 RESULTS

The survey detected 2530 poisoning cases from different origins, while 2797 cases were already reported to the PPCM in both years. After elimination of 1185 duplicates, our survey was able to index 1345 new cases to have a final number of 4142 poisoning cases in the study area during 2013-2014.

The average age of the patients was 25.18 ± 16.23 years. The age group most affected by this problem was adults (19-75 years of age with 58.6%), followed by adolescents (15-19 years with 16.6%). According to obtained results, Females were most often affected. The sex ratio (male / female) was 0.68 ($p < 0.001$).Urban population was the most affected with 83.37% of cases against 16.63% in rural areas. Poisonings occurred mainly in spring (27.77%) and in winter (27.35%). Pareto diagram below (Figure 2) represents the most incriminated toxicants according to the cumulative percentage. This diagram presents the most important toxic substances involved in the total number of intoxications. From the results of the diagram, we found that 35.44% of the poisonings were caused by gaseous products, 14.3% caused by pharmaceuticals, and then the foodstuffs that are responsible for 13.4% of poisonings.

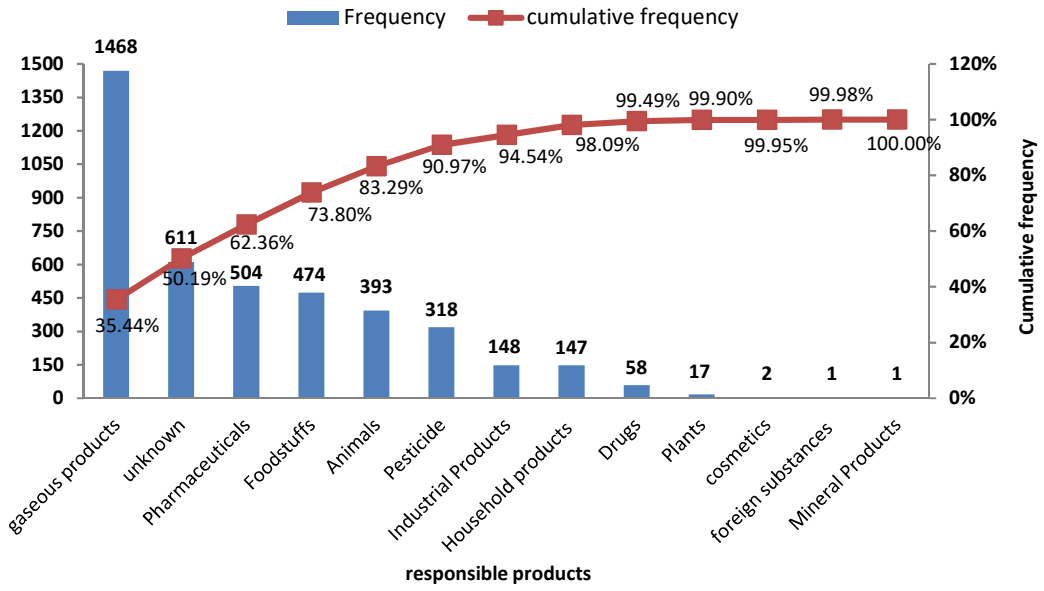

Fig. 2. Pareto diagram of toxic products in function of cumulative frequency

Clinical manifestations were present in 64% of cases (presence of at least one clinical sign), while 36% were asymptomatic. Regarding the severity of poisonings, it was predominantly moderate (grade 2) (73%). Fatal condition (grade 4) was not insignificant (5%) with 23 cases of death corresponding to a fatality rate of 100% (Table 1).

Table 1. Characteristics of the subjects who experienced poisoning

Variables	Cases	Clinical status			Fatality rate (%)	p-value
		Recovery	Death	Unknown		
Age group						<0.001
Newborns	1	0	0	1	0	
Nursling	20	0	15	5	0	
Toddlers	382	2	257	123	0.52	
Children	572	0	294	278	0	
Teenagers	676	4	355	317	0,59	
Adults	2385	17	1264	1104	0,71	
Elderly	33	0	21	12	0	
Unknown	73	0	51	22	0	
Sex						<0.001
Female	2354	12	1259	1083	0,51	
Male	1621	11	908	702	0,68	
Unknown	167	0	90	77	0	
Place of residence						<0.001
Urban	2946	13	1658	1275	0,44	
Rural	588	7	399	182	1,19	
Unknown	608	3	200	405	0,49	
Pathway						<0.001
cutaneous	204	2	187	15	0,98	
Inhalation	1520	10	817	693	0,66	
Ocular	3	0	2	1	0	
Oral	1562	11	1170	381	0,7	
percutaneous	62	0	59	3	0	
rectal	4	0	4	0	0	

Unknown	94	0	16	78	0	
Type of intoxication						<0.001
Collective	635	0	496	139	0	
isolated	3507	23	1761	1723	0,66	
Grade						<0.001
Grade 0 (none)	241	0	234	7	0	
Grade 1 (minor)	196	0	193	3	0	
Grade 2 (moderate)	1492	0	1329	163	0	
Grade 3 (severe)	78	0	71	7	0	
Grade 4 (fatal)	23	23	0	0	100	
Unknown	1862	0	429	1682	0	
Provinces						<0.001
Errachidia	1662	3	280	201	0,61	
Ifrane	1319	1	752	566	0,07	
Khenifra	535	2	384	149	0,37	
Meknes	484	17	783	862	1,02	
Midelt	138	0	55	83	0	
EL Hajeb	4	0	3	1	0	

With regard to the distribution of poisoning cases according to circumstances, accidental circumstances accounted for 87.54% of cases against 12.45% occurred in voluntary circumstances including 471 cases (91.27%) of suicide attempts, 33 (6.39%) addiction, 9 (1.74%) abortion and 3 (0.58%) in criminal conditions.

Table 2. Distribution of poisonings circumstances according to responsible products.

Toxic Product	Accidental	Voluntary	Total
Foodstuffs	469	5	474
Animals	391	2	393
Foreign substances	1	0	1
cosmetics	1	1	2
Drug	27	31	58
pharmaceuticals	290	214	504
pesticides	167	151	318
plants	12	5	17
Gas Products	1468	0	1468
Industrials	124	23	147
Household products	124	24	148
Mineral Products	1	0	1
Unknown	551	60	611

The geographical distribution of intoxications and deaths in Meknes-Tafilalet region showed that all cities in this region were affected by this problem. However, the province of Meknes recorded the maximum rate of cases (40.12%), while the province of Ifrane registered the highest incidence rate (2.15 ‰). Meknes city had a significant lethality of 1.06 ‰ (Figure 3).

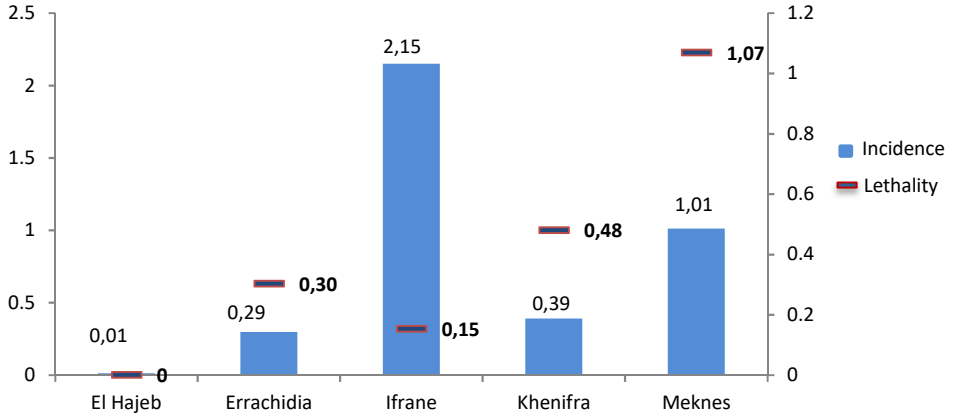

Fig. 3. Distribution of incidence and lethality per thousand inhabitants in the region of Meknes-Tafilalet

To determine the factors influencing the prognosis of patients, we examined the effect of gender, age, environment, clinical status, and circumstances of intoxication. Sex, origin and clinical status were risk factors with a significant influence on the health status of patients. Rural addicts have a twice fold risk of death from those in urban areas (RR = 2.24, 95% CI: 0.89-5.64), as well as intoxications that occurred under voluntary circumstances in relation to involuntary circumstances (RR = 1.48, 95% CI: 0.5-4.37) (Table 3).

Table 3. Effects of the studied characteristics on the outcomes of the patients

Variables		Healings	Death	RR (95% CI)	p-value
Sex	Male	908	11	1.27(0.56, 2.89)	0,33
	Female	1259	12	1.00 (reference)	
Origin	Rural	399	7	2.24 (0.89, 5.65)	3.07
	Urban	1658	13	1.00 (reference)	
Clinical status	Symptomatic	1667	14	0.53 (0.23, 1.23)	2.23
	Asymptomatic	563	9	1.00 (reference)	
Circumstances	Voluntary	516	4	1.48 (0.5, 4.37)	0.51
	Accidental	3626	19	1.00 (reference)	

4 DISCUSSIONS

In 2013-2014, the region of Meknes-Tafilalet registered 4142 poisoning cases of which 23 people died. The most incriminated toxins were gaseous products (41.6%), drugs (14.3%) and food products (13.4%).

According to the analyzed data: The average age of patients was 25.18 ± 16.23 years, of which adults were the most affected (58.6%), followed by adolescents (16.6%), 1011 at least been hospitalized. Women were the most affected with a percentage of 59.2%. In 64% of cases, patients had clinical symptoms of which 73% were Grade 2 (Moderate). 87.50% of poisonings were accidental, while 12.50% were in voluntary circumstances, with 473 suicidal attempts of which 92.81% were adolescents and adults. Meknes city had the highest fatality rate (1.02%), while the highest incidence was recorded in the city of Ifrane (2.15 ‰).

During the two years, 1468 poisonings caused by gaseous products were detected, with a remarkable evolution of the number of cases: 415 cases in 2013 against 536 in 2014. According to the PPCM, 5235 intoxication by the same toxic was recorded in Morocco in 2013-2014 with 2682 cases in 2014 (20.1% of all intoxications), of which carbon monoxide (CO) represent a percentage of 97.65% [8]. The center stated that the notification rate of poisonings caused by gaseous products has changed in 2014; this rate has evolved by 5% compared to 2013, and the region of Meknes-Tafilalet was the most represented in 2014 (19.6%) [8]. During the years 1991-2007, this region was the first in the declaration of poisonings by carbon monoxide (CO) (16.1%), as well as the center registered 79 cases of death due to poisoning by gaseous products in Morocco [12]. During the study period, only Meknes city recorded 542 cases of intoxication, followed by the province of Ifrane with 504 cases, and then the province of Khenifra with 298 cases. Among 722 poisonings registered in the city of Ifrane which is

considered the coldest city in the region [13], 379 intoxications were caused by gaseous products (52.49%). In all region, 74.13% of these poisonings occurred in winter and autumn, compared to 25.86% in spring and summer, showing that most poisonings are related to heating means, especially gas heaters, braziers (kanoun) and gas water heaters, which represents a real risk especially in non-ventilated rooms [14,15].

In France, carbon monoxide is the leading cause of death by intoxication (4000 to 6000 poisoning per year), in 2010 the National Institute for Prevention and Health Education in France (Inpes) reported 1,509 episodes of carbon monoxide poisoning involving 5,195 people [16,17], which means that it is a problem that threatens public health globally.

Whit regard to pharmaceutical poisonings, they represent 14.3% of all cases, or 504 intoxications recorded in the region in 2013-2014. According to the PPCM, pharmaceuticals represent the most incriminated toxin out of scorpion stings during the same period of our study in all Morocco with 6376 cases (25.56%) [8]. Comparing with data of the previous years, the center reported 6605 pharmaceutical intoxications throughout the kingdom during the years 2004 and 2008, including 427 cases in Meknes-Tafilalet (3.9 per 100,000 population), as well as 19204 cases from 1980 to 2008 [18]. Pharmaceuticals remain largely responsible for domestic poisoning and one of the most common causes of emergency hospitalizations in several countries around the world [19] [20]. In France, for example, the annual incidence of this type of intoxications is 151,000 cases per year with 2,000 deaths [20]. In Quebec, 49.6% of calls to the Quebec Poison Center (CAPQ), from 2008 to 2012, involved potential poisoning by pharmaceuticals [21].

As in Mali, a retrospective study of all types of intoxications in the city of Bamako shows that pharmaceuticals were the most incriminated toxin recorded during the years 2000 to 2010 [22].

Despite the low rate of pharmaceuticals consumption by the Moroccan population compared to other countries [18], the reporting of medication poisonings is growing remarkably each year. During the study period, 42.37% cases of pharmaceutical poisonings were in voluntary conditions including 98.13% suicidal case, which means that the use of the pharmaceuticals in suicide is common because they are easy to obtain and to consume [23].

In third place, we distinguish food poisonings by 474 cases (13.4%), with a remarkable decrease in the number of cases between the two years: 265 cases in 2013 against 167 in 2014, that is the same thing concerning all food poisonings throughout Morocco according to the PPCM which received 4842 declaration of poisoning: 2670 cases in 2013 against 2172 in 2014 [8]. The center stated that Foodstuffs are the leading cause of poisoning during the period of 1999 and 2008 (22%) [24], which can be explained by the improvement of food hygienic conditions, and the awareness of population in this context.

Comparing with previous years, gaseous products, pharmaceuticals and foodstuffs, still occupy the first three positions as the most incriminated toxics.

According to the PPCM, Since the announcement of national system of Toxicovigilance (NSTV) in 1980 in Morocco, poisonings declarations have known a growing increase according to the years [7], indeed, since 2009, the CAPM realized several activities that have contributed to increased reporting, from 6,000 cases (annual average) reported before 2009 to more than 15,000 cases in 2015 [25]. Despite this progress, these figures remain below what is really happening in comparison with other countries. In Quebec, for example, the Anti-poison center received 317098 calls for poisoning during the period from 2008 to 2014, or an average of 45,300 calls per year [21]. In France, 197,042 cases of poisoning were recorded by the French poison control center in 2006 [26].

5 CONCLUSION

Despite the efforts and activities of the PPCM that have contributed to increase the report of poisonings in Morocco, the number of new cases collected during the survey is interesting: 1345 cases of poisoning undeclared to the center, what means that health professionals in delegations and hospitals in Morocco must be more responsible for declaring poisonings to the PPCM, as well as the population must be sensitized to report intoxications by phone calls to the center, in order to give real figures and to participate in the fight against their effects on health.

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