

Prevalence and costs of hospitalizations for poisoning and accidental intoxication in Brazilian elderly

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A cross-sectional study of secondary data/information obtained from the Hospital Information System (HIS) spanning the years 2008 – 2009 was performed. The distribution of the main hospital admissions by gender, age, color/race, region and federal unit of residence, average expenditure and average length of hospital stay, year of hospitalization and mortality rates (MR) were studied. The data collected were tabulated by TabNet and keyed into Microsoft Excel 2007. It was verified that elderly males (54.3%), from 60 to 69 years old (50.6%), nonwhites (36.3%) and residents of Southeast and North regions of the country had the highest rates of hospitalization. Seniors were hospitalized for an average of 4.8 days, and the major causes were exposure to alcohol (43.7%) and to drugs (33.9%). Expenses related to hospital admissions were, on average, R\$ 529,817.70. The highest mortality rates were recorded among females (MR = 4.34), in elderly, 80 years or older (MR = 10.16) and Caucasians (MR = 3.95), where pharmacological substances with action on the Autonomic Nervous System were the leading cause of death. There are demographic differences in morbi-mortality of these elderly since, although men and younger elderly were the main victims, women and elderly of advanced age have greater mortality. The leading causes of hospitalization were alcohol and drugs.

Uniterms: Hospital Information System. Elderly patients/hospitalization. Medicines/inappropriated use. Hospitalization/rates. Poisoning. Alcohol/use.

Realizou-se um estudo transversal de dados secundários obtidos no Sistema de Informação Hospitalar (SIH), nos anos 2008/2009. Estudou-se a distribuição das principais internações segundo sexo; faixa etária; cor/raça; região e unidade federativa de residência; valor médio pago e média de permanência das internações hospitalares; ano de internação e as taxas de mortalidade (TM). Os dados coletados foram tabulados por meio do TabNet e transcritos para o Programa Microsoft Excel® 2007. Verificou-se que idosos do sexo masculino (54,3%), com 60 e 69 anos de idade (50,6%), não brancos (36,3%) e residentes nas regiões Sudeste e Norte do País apresentaram os maiores percentuais de internação hospitalar. Idosos ficam em média 4,8 dias internados, sendo as principais causas a exposição ao álcool (43,7%) e a medicamentos (33,9%). Os gastos com as internações equivaleram a R\$ 529.817,70. As maiores taxas de mortalidade foram registradas no sexo feminino (TM=4,34), em idosos entre 80 anos e superior (TM=10,16) e pessoas brancas (TM=3,95), sendo as substâncias farmacológicas de ação sobre o Sistema Nervoso Autônomo maiores causas do óbito. Existem diferenças demográficas na morbimortalidade desses idosos, visto que apesar de homens e idosos mais jovens serem as principais vítimas, mulheres e idosos com idade mais avançada morrem mais. Sendo as principais causas de internação o álcool e os medicamentos.

Unitermos: Sistema de Informação Hospitalar Paciente idosos/hospitalização. Medicamentos/uso inapropriado. Hospitalização/causas. Envenenamento. Álcool/uso.

INTRODUCTION

Alcohol, drugs and pesticide products are intensively used both worldwide and in Brazil, and the productive and marketing contexts in which they are present pose risks to health and the environment related to their use, including poisoning (Marinho, Mendonça, 2005).

Alcohol abuse is seldom recognized as a health problem, hampering the early diagnosis of alcoholism and its treatment. Studies performed in the United Kingdom have demonstrated the need for improved detection of alcohol abuse in patients treated in emergencies due to this morbidity, either directly (physiopathological, e.g.: hypertension, intoxication, cirrhosis, cancer) or indirectly (through social harm, e.g.: road accidents, drowning of children, abuse, murders, robberies, deaths by fire), a situation aggravated by the alcohol culture accepted by the Western world, by apathy or lack of skill on the part of physicians and denial by patients (Huntley, 2001).

Poisoning by biological substances is a pathological process caused by endogenous or exogenous chemical substances, characterized by a physiological imbalance as a result of biochemical changes in the body (Almeida *et al.*, 2005).

In Brazil, akin to other countries, the large arsenal of new drugs and the role of the pharmaceutical industry in running advertisements for its products, has led to key shifts in the usage profile of these products, creating challenges to public health (Margonato *et al.*, 2008). Since, according to the authors, drugs began to rank as the major cause of accidents resulting from exposure to toxic agents where, in 2002, drugs were responsible for 26.9% of the occurrences of poisonings recorded by the Brazilian national network of poison control centers.

According to estimates by the Community Health Service of Porto Alegre, Rio Grande do Sul, in 2001 and 2002, around 23% of the Brazilian population consumed approximately 60% of medicines produced nationally, with the biggest consumers being elderly over 60 years of age (Flores, Mengue, 2005).

It is essential to perform studies on the use of medications in the elderly to prevent overspending and unnecessary hospitalizations, since it is known that the elderly organism presents physiological modifications that lead to changes in pharmacokinetic and pharmacodynamics properties of the drugs. Hepatic metabolism, homeostatic mechanisms, as well as filtration ability and renal excretion can be compromised, hindering the elimination of metabolites, causing the accumulation of toxic substances in the body and ultimately producing adverse

reactions (Hulse, 2002; Nobrega *et al.*, 2005; Rocha *et al.*, 2008; Medeiros *et al.*, 2009).

In view of the above, and the need to ascertain the main causes of hospitalizations for poisoning or accidental intoxications by exposure to noxious substances, such as alcohol, drugs, pesticides and biological substances, the aim of this study was to describe these hospitalizations in elderly Brazilians, as well as to evaluate spending by the Brazilian National Health System (SUS) on these hospitalization for the years 2008 and 2009.

METHODS

A cross-sectional study of secondary data on hospitalization recorded in Brazilian hospitals participating or linked to the Brazilian National Health System (SUS) was performed. Elderly victims of poisoning and accidental intoxication by exposure to harmful substances, whose authorization for Hospital Admittance (AIH) was registered on the Hospital Information System (HIS) during the period spanning from January 1st, 2008 to December 31st, 2009, were the research subjects. It is noteworthy that in 2009, the elderly population estimated by the Brazilian Institute of Geography and Statistics (IBGE) was 19,428.086, representing 10.15% of the Brazilian population.

The poisoning and accidental intoxication records were obtained through a data tabulator prepared by the Ministry of Health - HS (TabNet) to provide data online at Datasus (www.datasus.gov.br). These poisonings are classified under the Chapter XX code (External causes of morbidity and mortality) of the International Classification of Diseases, Tenth Revision (ICD-10), in the Large Groups of Causes of Death (W00 - X59 - Other external causes of accidental injury) according to the coding of Categories of Causes (X40 - X49 - poisoning by accidental intoxication and exposure to noxious substances) (WHO, 2008). It is noteworthy that the cause of hospitalization is reported as the principal diagnosis, defined as the underlying reason for admission.

Thus, these are listed under X40 (Accidental poisoning by and exposure to nonopioid analgesics, antipyretics and antirheumatics), X41 (Accidental poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, not elsewhere classified - NEC), X42 (Accidental poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified - NEC), X43 (Accidental poisoning by and exposure to other drugs acting on the Autonomic Nervous System), X44 (Accidental poisoning by and exposure to other

and unspecified drugs, medicaments and biological substances), X45 (Accidental poisoning by and exposure to alcohol), X46 (Accidental poisoning by and exposure to organic solvents and halogenated hydrocarbons and their vapours), X47 (Accidental poisoning by and exposure to other gases and vapours), X48 (Accidental poisoning by and exposure to pesticides), X49 (Accidental poisoning by and exposure to other and unspecified chemicals and noxious substances).

The evolution of hospitalizations for these causes in the period studied, and their distribution according to the variables, were analyzed: gender (male and female); age group (60 to 69 years, 70 to 79 years and 80 years or older); color/race (white or nonwhite); region and federative unit of residence; the average expenditure per admission (in R\$); average length of hospital stay (in days); year of hospitalization and hospital deaths (number of deaths and mortality rate).

The average length of hospital stay regarding paid AIH, as well as mortality rates for these poisonings and intoxications (ratio between the number of deaths and the number of paid AIH computed as hospital admissions in the period multiplied by 100), were obtained from the database. The data collected were tabulated by Tabnet and keyed into the Microsoft® Excel program, 2007, in which the categorical variables were presented as absolute frequencies and/or percentages in tables.

Therefore, since this was a study involving humans, the study protocol (Cover Page for Research, version October/99 - Resolution 196/96 of the National Health Council), was submitted to and approved by the Ethics and Research Committee of the Caruaruense Association of Higher Education, under CAAE 0023.0.217.000-10.

RESULTS

Analysis of the 1058 hospital admissions recorded in Brazil during the period studied, yielded the following data.

Regarding the demographic profile of patients (Table I), it was observed that majority of older adults were males (54.3%), between 60 and 69 years old (50.6%) and nonwhites (36.3%), whereas the data on color/race was not given in 32.7% of cases. Residents in the Southeast and North of the country had the highest percentage of hospitalizations (35.1% and 30.2%, respectively), however, some Federative Units (UF) in the Northern Region (Amapá, Amazonas and Roraima) recorded no hospitalizations due to this cause, and likewise in the state of Sergipe (Northeast Region).

The distribution of poisoning by harmful substances for the elderly age group is shown in Table II. It is evident

TABLE I - Demographic characteristics of elderly inpatients (n = 1,058). Brazil, 2008-2009

Characteristics	n	%
Sex		
Male	574	54.3
Female	484	45.7
Age Group (in years)		
60-69	536	50.6
70-79	335	31.7
80 or older	187	17.7
Color/race		
White	329	31.0
Nonwhite	384	36.3
Information not given	345	32.7
Region of Residence		
North	319	30.2
Northeast	181	17.1
Southeast	371	35.1
South	106	10.0
Midwest	81	7.7

Source: Raw data from Datasus /HS. SIH-SUS.

that the largest percentage of hospital admissions were due to exposure to alcohol (43.7%) and medicines [categories X40 to X44 (33.9%)]. In this study, the exposure to alcohol was 8.5 times higher among the elderly aged 60 to 69 years compared to analgesics, antipyretics and antirheumatics, reducing to 5.0-fold greater in elderly aged 70 to 79 years, and 1.9 times in those aged 80 years or older.

The average hospital stay in elderly patients was 4.8 days, ranging from 2.5 (category X45) to 5.9 days (category X46), as shown in Table III. It is noteworthy that cases of exposure to alcohol (X45) in the elderly aged 60 to 69 years and 80 or older required a longer hospital stay (average of 5.6 and 5.7 days, respectively), and likewise for accidental exposure to other gases and vapors (X47) and other pharmacological substances that act on the Autonomic Nervous System (X43) in elderly aged 70 to 79 years (9.7 and 6.7 days, respectively).

Table IV shows that, from the years 2008 to 2009, the Single Health System spent R\$ 529,817.70 on hospitalization for accidental poisoning, of which R\$ 256,214.40 was spent due to exposure to alcohol and R\$ 127,713.75 to medicines.

Regarding the demographic profile of hospitalized patients who evolved to death (Table V), it is evident that the highest mortality rates were recorded in women

TABLE II - Elderly patients hospitalized for accidental poisoning by age group. Brazil, 2008-2009

Accidental Poisoning	Age Group			n	%
	60-69	70-79	80 or older		
X40 Analgesic, antipyretic and antirheumatic, nonopioid	31	30	16	77	7.3
X41 Anticonvulsants, sedatives, hypnotics, antiparkinsonian and psychotropic NEC	21	28	6	55	5.2
X42 Narcotics and psychodysleptics NEC	4	3	3	10	0.9
X43 Other pharmacological substances acting on the Autonomic Nervous System	3	6	5	14	1.3
X44 Other and unspecified drugs, medicaments and biological substances	87	60	56	203	19.2
X45 Exposure to alcohol	265	141	56	462	43.7
X46 Organic solvents and halogenated hydrocarbons and their vapors	2	0	0	2	0.2
X47 Other gases and vapors	8	3	4	15	1.4
X48 Exposure to pesticides	55	29	23	107	10.1
X49 Other and unspecified chemicals and noxious substances	60	35	18	113	10.7
Total	536	335	187	1058	100.0

NEC (not elsewhere classified). Source: Raw data from Datasus /HS. SIH -SUS.

TABLE III – Average hospital stay (in days) for accidental poisoning by age group. Brazil, 2008-2009

Accidental Poisoning	Age Group			Mean
	60-69	70-79	80 or older	
X40 Analgesic, antipyretic and antirheumatic, nonopioid	3.0	3.8	4.9	3.7
X41 Anticonvulsants, sedatives, hypnotics, antiparkinsonian and psychotropic NEC	4.3	5.2	3.8	4.7
X42 Narcotics and psychodysleptics NEC	1.8	3.7	3.0	2.7
X43 Other pharmacological substances acting on the Autonomic Nervous System	2.7	6.7	3.4	4.6
X44 Other and unspecified drugs, medicaments and biological substances	4.6	4.4	4.7	4.5
X45 Exposure to alcohol	5.6	4.6	5.7	5.3
X46 Organic solvents and halogenated hydrocarbons and their vapors	2.5	0	0	2.5
X47 Other gases and vapors	4.8	9.7	5.5	5.9
X48 Exposure to pesticides	3.4	4.7	3.1	3.7
X49 Other and unspecified chemicals and noxious substances	5.3	4.5	3.7	4.8
Total	4.9	4.6	4.6	4.8

NEC (not elsewhere classified). Source: Raw data from Datasus /HS. SIH -SUS.

(MR = 4.34), in elderly aged 80 or over (MR = 10.16) and in Caucasians (MR = 3.95). It is noteworthy that the deaths among the elderly aged 80 or over were five times higher than in those aged 60 to 69 years. There was no percentage difference between whites and nonwhites. However, this information was not given in 35.0% of cases.

Among the categories of intoxication, the type that most led to death in the elderly was accidental poisoning

by and exposure to other drugs acting on the Autonomic Nervous System (MR=21.43) which was 7.6 times higher than the rate for exposure to alcohol (MR=2.81).

DISCUSSION

The verification that the occurrence of hospitalizations for poisoning was higher in males, corroborates the results of studies in Brazil (Bortoletto,

TABLE IV – Expenditure on hospitalizations for accidental poisoning in the elderly. Brazil, 2008-2009

Accidental Poisoning	Amount spent (R\$)
X40 Analgesic, antipyretic and antirheumatic, nonopioid	22,485.43
X41 Anticonvulsants, sedatives, hypnotics, antiparkinsonian and psychotropic NEC	13,473.47
X42 Narcotics and psychodysleptics NEC	1,439.15
X43 Other pharmacological substances acting on the Autonomic Nervous System	6,903.58
X44 Other and unspecified drugs, medicaments and biological substances	83,412.12
X45 Exposure to alcohol	256,214.40
X46 Organic solvents and halogenated hydrocarbons and their vapors	919.15
X47 Other gases and vapors	2,752.25
X48 Exposure to pesticides	59,657.34
X49 Other and unspecified chemicals and noxious substances	82,560.74
Total	529,817.70

NEC (not elsewhere classified). Source: Raw data from Datasus /HS. SIH -SUS.

TABLE V – Demographic and epidemiological characteristics of elderly inpatients by number of deaths and mortality rates. Brazil, 2008-2009

Characteristics	n	%	MR
Sex			
Male	19	47.5	3.31
Female	21	52.5	4.34
Total	40	100.0	3.78
Age Group (in years)			
60-69	11	27.5	2.05
70-79	10	25.0	2.99
80 and over	19	47.5	10.16
Color/race			
White	13	32.5	3.95
Nonwhite*	13	32.5	3.69
Information not given	14	35.0	4.06
Total	40	100.0	3.78
Accidental Poisoning			
X40 Analgesic, antipyretic and antirheumatic, nonopioid	3	7.5	3.90
X43 Other pharmacological substances acting on the Autonomic Nervous System	3	7.5	21.43
X44 Other and unspecified drugs, medicaments and biological substances	6	15.0	2.96
X45 Exposure to alcohol	13	32.5	2.81
X48 Exposure to pesticides	5	12.5	4.67
X49 Other and unspecified chemicals and noxious substances	10	25.0	8.85
Total	40	100.0	3.78

NEC (not elsewhere classified). *Deaths recorded only in nonwhite elderly/ Source: Raw data from Datasus /HS. SIH -SUS.

Bochner, 1999; Marinho, Mendonça, 2005; Moreira *et al.*, 2010) and other countries (Pérez-Barquero *et al.*, 2001; Wu-Chien *et al.*, 2011). Arozullah *et al.* (2006), emphasized that males, elderly and those without the social support of medical care are 4-5 times more likely to be rehospitalized.

Elderly nonwhites were the most prevalent victims of hospital admissions studied, in disagreement with a study conducted in southern Brazil (Flores, Mengue, 2005). However, Arozullah *et al.* (2006) reported no statistically significant association between patient race and hospitalizations in their study. Some pertinent issues can be raised, for example, the divergences resulting from regional differences in the country (Mascarenhas *et al.*, 2009) or the predominance of a given race in the population studied (Arozullah *et al.*, 2006).

The leading cause of hospitalization of elderly patients was exposure to alcohol, probably due to excessive alcohol consumption among the elderly, which is a growing public health problem (Miller *et al.*, 1991; Jukka *et al.*, 2010). In Brazil, alcohol is one of the major factors contributing to disease and mortality, and is involved in 8% to 14.9% of all health problems in the country (Meloni, Laranjeira, 2004).

However, it is clear that with advancing age, poisoning by alcohol in these elderly decreases when compared to drugs, from a factor of 8.5 to 1.9 times. The proportion of hospital admissions due to drugs is growing every year (Moraes, 2009). As evidenced by studies conducted in other countries of Latin America (Argentina, 2001; Argentina, 2000), in Brazil as a whole (Marinho, Mendonça, 2005) and in Santa Catarina, drugs figure as a major cause of hospitalization in the elderly (Medeiros Netto *et al.*, 2005). However, the authors did not include alcohol exposure in their studies. According to recent data from the World Health Organization (2011), Brazil is the fourth largest consumer of alcohol in the Americas and this overconsumption has proven prevalent, with men having consumption of 24.4 liters of alcohol per year, while women consume 10.6 liters.

It is noteworthy that the types of drugs used by the elderly, such as antidepressants, enhance the effects of alcohol and probably other sedatives. Drug poisoning in this age group was attributed to several factors, including the occurrence of drug interactions and side effects due to use of many medicines for associated diseases, along with the increased longevity of the elderly population (Flores, Mengue, 2005).

Among the main drug intoxications that resulted in hospitalization, were cases arising from the consumption of analgesics, antipyretics and antirheumatics, non-opioid, corroborating the findings of other studies (Srivastava *et al.*, 2005; Trivalle *et al.*, 2011).

Intentional poisoning by opiates, sedatives, and tranquilizers increased by 130% compared to intentional poisonings by other substances, which increased by 53%, over a period of seven years (Coben *et al.*, 2010),

corroborating the results related to drugs used in the treatment of the central nervous system (CNS).

Anticonvulsants, sedatives, hypnotics, antiparkinsonian and psychotropic NEC were the most recorded in this study, in disagreement with the study of Trivalle *et al.* (2011) which found this class of drugs contributed to 37.3% of hospital admissions in the elderly. However, the combination of antipsychotics and anticoagulants accounted for around 50% of these cases.

In the present study, the exposure to pesticides also emerged as a major cause of hospitalization in the elderly since, according to (Landigran, Garg, 2002), the WHO recognizes pesticide poisoning as a global widespread problem and that most poisonings occur in developing countries.

The results of this study revealed spending of R\$ 529,817.70 (or R\$ 501.00 per patient) on these hospitalizations, figures higher than those reported by the study of (Melione, Mello-Jorge, 2008). In Spain, these costs to the health system accounted for some € 1.533 billion in the 2001-2006 period, increasing from € 226 million in 2001 to € 272 million in 2006, being higher in elderly patients (≥ 56 years) (Carrasco-Garrido *et al.*, 2010).

The average hospital stay recorded here corroborates the findings of (Melione, Mello-Jorge, 2008; Moreira *et al.*, 2010). However, the latter author mentions that elderly intoxicated with psychotropics remain hospitalized for longer, where this result was slightly below our findings (5.7 days). However, the average hospital stay (8 days) found in a study conducted in Spain (Carrasco-Garrido *et al.*, 2010) exceeded that obtained in the present study, except for stays recorded in patients aged 70-79 years, victims of exposure to other gases and vapors (9.7 days).

However, Moreira *et al.* (2010) stated there are no data to compare the average days of hospitalization incurred by specific classes of toxic agents even among the therapeutic classes, and pointed to the need to conduct further studies directed to the field of pharmacoconomics in order to obtain a better picture of the representativeness of the data above, correlating them to the costs involved in the sustainability of the SUS.

It is also important to mention that some studies have shown the magnitude of drug interactions. Secoli (2010) states that these interactions may result in hospitalization, permanent injury of the patient, treatment failure or death. The highest mortality rates were recorded for those aged 80 and over, probably because, physiologically, they are more vulnerable than other seniors. This may also be due to a higher incidence

of chronic disease, and therefore, a great consumption of medication (Karbakhsh, Zandi, 2008). In addition, this study showed that older people die more due to the use of alcohol where, according to data from the World Health Organization (2002), alcohol consumption is responsible for about 3% of all deaths globally, including clinical causes such as poisoning. Moreover, chronic alcoholics have a significantly worse survival with advancing age (Pérez-Barquero *et al.*, 2001).

Possible limitations of this study should be highlighted, for example, the fact that it was conducted using secondary data, which does not allow the researcher to control for possible errors due to typing and recording, in addition to possible sub-registries on hospitalizations for acute poisoning, since (Flanagan, Rooney, 2002; Landigran, Garg, 2002) mention that not all cases of suspected poisoning are referenced and not all intoxicated patients are included in these statistics. Also, it is known that attendances at health centers do not generate Authorizations for Hospital Admittance (AHA) and therefore are not computed by the SIH/SUS, leading to an underestimation of the true magnitude of morbidity arising from these causes.

Finally, it is noteworthy that poisoning from alcohol abuse are not registered in the National Poisoning Information System (SINITOX) and, according to (Bortoletto, Bochner, 1999), its statistics do not include all of the poisoning cases recorded in Brazil, owing to the fact that centers do not cover the whole of the national territory. Despite some limitations of this study, it is believed that since it drew on official national data the results led to the achievement of the study objectives.

CONCLUSION

There were demographic differences in the morbidity of these elderly since, although men and younger elderly were the main victims, women and elderly of more advanced age had a greater mortality in the Brazilian hospitals participating or linked to the national health system (SUS). In elderly nonwhites and due to alcohol there are differences between the distribution of the main causes of hospitalization for poisoning and ages of the elderly. Alcohol and drugs incurred greater spending for the SUS and were associated with a longer average hospital stay.

Based on these results, it is reasonable to conclude that public health policies targeting the elderly should be implemented, with a focus on alcohol consumption and on the use of therapeutic drugs, since these are the leading causes of hospitalization among older adults.

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