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Severity of occupational injuries treated in emergency services

ABSTRACT

OBJECTIVE: To estimate the severity of occupational injuries and associated factors.

METHODS: Longitudinal study performed in the city of Salvador, Northeastern Brazil, with all 406 occupational injury cases treated in two emergency rooms of public hospitals, between June and August 2005. Participants were identified during admission to the emergency room and interviewed monthly in their homes, until returning to work or ending the treatment. Severity was defined by the Abbreviated Injury Scale, used to calculate scores from the Injury Severity Score. Hospital lethality and mortality, and length of inpatient and intensive care unit (ICU) stay were estimated. Descriptive variables were sex, age, economic field of activity and occupation. Proportions, proportion ratios and confidence intervals were used for statistical inference and mean, and the Student t test for normal continuous variables.

RESULTS: The majority of the 406 cases had a mild (39.4%) and moderate severity (38.7%), followed by serious (17.2%), severe (3.2%) and critical severity (1.5%). Overall lethality was 0.7% and 5.0% among those who stayed for inpatient treatment (14.8%), whereas mean length of inpatient stay was 3.2 days (SD=2.8). A total of three cases (0.7%) required ICU (mean=8.4 days, SD=1.2). The majority of serious cases occurred among men and those older than 37 years of age. Injuries among transport (PR=2.20; 90% CI: 1.06;4.58) and retail workers (PR=1.85; 90% CI: 1.14;3.00) were more serious than those in the reference group. Proportion of serious injuries was 54% higher among commuting accidents than among typical ones. In all, there were 325 days of inpatient stay and 34 days of ICU stay.

CONCLUSIONS: Severity of occupational injuries was high, especially those occurring among transport and retail workers, thus affecting emergency services and hospital bed and ICU occupancy.

DESCRIPTORS: Emergency Medical Services. Length of Stay. Statistics on Sequelae and Disability. Occupational Health. Injuries, Occupational, prevention & control. Injury severity. Severity scales.

INTRODUCTION

In addition to deaths, occupational injuries cause permanent and temporary disabilities.[1] In Brazil, from all 376,240 occupational injuries recorded in 2000, 81% resulted in temporary disability, 4% in permanent disability and 1% in deaths.[a] In the state of Bahia, in 2000, health-related compensation benefits provided by the *Previdência Social* (National Institute of Social Security) show that 9.6% of work injuries caused total permanent disability.[12] Even

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though statistics on occupational injuries[11] and their consequences for impairment of insured workers in Brazil are known,[a] information about the severity of injuries could not be found. The severity of injuries, intoxications, poisonings and drowning, when work-related, is similar to those known as external causes in general. In addition, knowledge about the severity of injuries is useful to define priorities for prevention, to estimate medical and social security costs, and to identify the needs for specialized care such as rehabilitation.[9] Injury severity levels are usually recorded as standardized scales based on three constructs: risk of death, functioning and disability.[b]

The advantages and disadvantages of severity scales depend on the context and research questions.[b] Among injury severity scales, the Abbreviated Injury Scale (AIS) has been the most frequently used worldwide since 1971.[6] To cover the common occurrence of multiple injuries, the Injury Severity Score (ISS) was developed from the AIS, based on anatomical regions.[13] These scales have been reviewed,[c] validated and used in several types of research[6,8,9,13] or in clinical practice, especially in emergency services.[5,4,c,d]

The AIS[13] corresponds to an ordinal value: 1 – mild severity, 2 – moderate, 3 – serious, not life-threatening, 4 – serious with risk of death, although with probable survival, 5 – critical, with uncertain survival, and 6 – maximum severity without chance of survival. This scale is used to classify severity based on the extension and depth of injury, involvement of inner organs such as visceral rupture, or amputation, considering six anatomical regions: head, thorax, abdomen, upper and lower limbs, and external surface. Based on AIS data, the ISS is calculated using the sum of squares of the three highest scores, which correspond to the three most severely, injured anatomical regions. ISS scoring varies from 1 to 75, and the index is categorized as mild (1-3), moderate (4-8), serious (9-15), severe (16-24), and critical (25-75).[14]

There are few studies on the severity of occupational injuries using standardized scales, none of which was carried out in Brazil. This makes it difficult to define priorities for planning and criteria for notification. In 2004, occupational injuries were included in the *Sistema Nacional de Agravos de Notificação* (Sinan – Information System for Notifiable Diseases) list, limited to "severe cases", i.e., fatal cases, "mutilations" or those requiring inpatient treatment, in addition to any type of injury occurring in children or adolescents under 18 years of age.[e] However, the use of these criteria has been hindered by the underlying subjectivity of the "mutilation" concept, for example, as it is not based on standardized injury severity scales.

The present study aimed to estimate the distribution and factors associated with the severity of occupational injuries.

METHODS

This was a longitudinal, prospective cohort study, carried out with all individuals who were treated in emergency rooms for occupational injuries in two large public hospitals in the city of Salvador, Northeastern Brazil, between June and August 2005. The study population size was defined according to operational feasibility. Data was collected in two phases: 1) identification and recruitment of study subjects in emergency rooms; and 2) follow-up with household visits.

In the first phase, workers from the reception and triage staff were informed about the study aims and strategy. Occupational injuries were identified at the hospital reception/triage. Due to the known under-reporting of work-relatedness when diagnosing injuries, trained field workers followed the hospital admission interview with the victims or informants. On this occasion, the interviewer used questions recommended by the International Collaborative Effort on Injury Statistics (ICE)[f] to characterize occupational-relatedness of each injured worker: "What were you doing?", "How did it happen?", "Where were you when it happened?", "Was the injury associated with an organized activity?", "Were you using any piece of equipment or tool?" and the question "Were you going to or coming from work?" was added. Based on the responses, suspected cases of occupational injuries were identified. After treatment when patients were in condition to provide information, just before hospital discharge, the study interviewer presented the study objectives and strategy and invited them to participate in the study. Among those who agreed to participate, additional information was recorded, particularly, data

[a] Ministério da Previdência Social. Anuário Estatístico da Previdência Social –2004. Brasília; 2004 [cited 2005 May 05]. Available from: http://www.mps.gov.br/conteudoDinamico.php?id=531

[b] Expert Group on Injury Severity Measurement. Discussion document on injury severity measurement in administrative datasets. Atlanta: National Center for Health Statistics; 2004.

[c] Massachusetts Department of Public Health. Inpatient Hospitalizations for Work-Related Injuries and Illnesses in Massachusetts, 1996-2000. Boston: Occupational Health Surveillance, 86pp. 2005. Technical Report OHSP-0501.

[d] Massachusetts Department of Public Health. Emergency Department Visits for Work-Related Injuries and Illnesses in Massachusetts, 2001-2002. Boston: Occupational Health Surveillance, 52pp. 2007. Technical Report OHSP-0701.

[e] Ministério da Saúde, Secretaria de Atenção a Saúde, Departamento de Ações Programáticas Estratégicas. Notificação de acidentes do trabalho fatais, graves, e com crianças e adolescentes. Brasília: Ministério da Saúde; 2006.

[f] World Health Organization. Update on the international collaborative effort on injury statistics. Brisbane: Collaborating Center for the Family of International Classifications for North America, 2002. Available from: http://www.aihw.gov.au/international/who_hoc/hoc_02_papers/brisbane37.doc

about how to reach their household for the follow-up visits. When patients were not able to provide information, a family member was interviewed.

In the second phase, after hospital discharge, monthly visits were made until the study subjects returned to work or the treatment ended. Questionnaires were used to obtain sociodemographic, family, occupational and work injury data. A total of three research instruments, specially designed for this study, were used: a hospital spreadsheet, an in-hospital identification questionnaire and a follow-up questionnaire. The hospital spreadsheet comprises the already mentioned work-relatedness questions, allowing the identification of occupational injuries from all trauma cases in the emergency room reception or during triage; the in-hospital identification questionnaire was used to gather personal and address data, detailed information about how to reach their households, job places or firms, clinical conditions, and the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10) coded diagnosis. Data on injury severity per anatomical region were also recorded for the severity score assessment. After hospital discharge, during household visits, sociodemographic, occupational, family, social security and health data were all recorded using special questionnaires. Occupational injuries were defined as cases of injuries, traumas and poisonings occurring in the workplace, while performing work-related tasks out of the work environment, or commuting to/back from work, which corresponds to the legal Brazilian definition. Occupational injury severity was estimated using the AIS and ISS, categorized on five levels: mild (1-3), moderate (4-8), serious (9-15), severe (16-24) and critical (25-75).[14] These levels were dichotomized into mild (ISS 1-8) and serious (ISS 9-75) for the final analysis.

Descriptive variables were: sex, age (analyzed in tertiles, 14-27, 28-37 and 38-69 years of age), ethnicity (white, mixed and black), education coded as low (below primary education), medium (below high school), and high (high school or above); Family and worker monthly income were analyzed in tertiles: low (less than US$254.00 per month), medium (from US$254.10 to US$424.00) and high (from US$424.10 to US$3,602.00); and worker income per month, low (less than US$140.00), medium (from US$140.10 to US$212.00) and high (over US$212.00). Socioeconomic status was based on the number of household appliances and family assets: car, computer, washing machine, VCR, laser stereo, microwave oven, dishwasher, telephone access, and beach house. The total number of items was categorized into: low (fewer than three); medium (from three to five items) and high (above five items). Occupational characteristics were: trade (manufacturing, construction, retail, domestic services, transport, and others); and job title (bricklayers, carpenters, electricians, housemaids, kitchen helpers/waiters, janitors, *motoboys* (messengers or workers in charge of delivery who use a motorcycle), health professionals, sellers, security guards, mechanic operators, drivers and managers. Workplaces were categorized into company/firm, government institutions, outdoor and domiciles. Placements in the labor market were as follows: *biscateiros* (own-account), self-employed, informal, and formally hired wage workers (those having a formal job contract registered in a national reporting card). Occupational training was analyzed as an occupational variable (yes/no). Characteristics of work injuries were: type (whether commuting or other), causes and lesions based on the ICD-10. Researchers also recorded when a legal medical declaration was issued to the worker, and when the injury was notified to the National Institute of Social Security (INSS) using the *Comunicação de Acidente de Trabalho* (CAT – Occupational Injury Claim).

Data entry was performed using EpiInfo 6.0, and statistical analyses with the SAS 9.1. Proportions and means were calculated and compared using Pearson chi-square or Student's t-test. Due to the non-normality of ISS distributions, log transformation was used and antilogarithms of the resulting geometric means were estimated for final presentation. Proportion ratios were estimated with their respective Mantel Haenszel's 90% confidence intervals for statistical inference.

The study was approved by the *Comitê de Ética em Pesquisa do Instituto de Saúde Coletiva da Universidade Federal da Bahia* (Federal University of Bahia, Institute of Collective Health, Research Ethics Committee). Information confidentiality and anonymity in data records and publications were ensured.

RESULTS

A total of 446 occupational injury cases were identified among individuals visiting the emergency rooms for external causes treatment in the selected hospitals. Among them, four (1.0%) refused to participate and households could not be located for 35 (7.4%). Family members of one of the three deceased patients declined to give information, a total of 8.9% losses (n=40), leaving 406 individuals for the follow-up. The most common severity level was mild, ISS 1-3 (n=160, 39.4%), followed by the moderate level, ISS 4-8 (n=167, 38.7%), serious, ISS 9-15 (n=70, 17.2%), severe, ISS 16-24 (n=14, 3.5%), and critical, ISS 25-75 (n=5, 1.2%), excluding deaths. Hospital lethality was 0.7%. The most frequent diagnosis among mild severity cases was cornea lesions caused by "foreign body or eye burns" (n=30, 7.4%), while among those of moderate severity, lacerations, dislocations, strains and burns prevailed. Cases considered serious were traumatic mutilations of fingers and fractures; while among severe cases, extensive lesions, fractures or multiple lesions were common. Among the five workers classified

at critical level of severity, there were four cases of multiple lesions and one of firearm wound. A total of 60 workers (14.8%) remained in inpatient hospital care, an average of 3.2 days (SD=2.8) length of stay. A total of three workers required intensive care (ICU) (mean=8.4 days; SD=1.16), and six were in coma, which lasted 2.9 days in average (SD=2.6). Approximately 45% were referred for outpatient treatment. The estimated proportion of critical cases was 2.2%. There were three cases of death (0.7%) and 13 evolved to permanent disability (2.7%). The severity of occupational injuries had an impact on hospital services, representing a total of 325 days of in-patient stay and 34 days in ICU.

Table 1 shows the sociodemographic characteristics of the study population according to the injury severity groups, categorized as mild (ISS 1-8) and serious (ISS>8). The majority of cases were males (77.8%), older than 28 years of age (69.7%), black (67.7%), and had less than secondary education (72.0%). Monthly family income below US$424.00 (67.7%) was the most common. There were no differences in injury severity, according to demographic characteristics, except for age, with serious cases more likely to occur among cases of 37 years of age or over (PR=1.63; 90% CI: 1.11;2.39). Occupational injuries were more severe among workers having family income below US$140.00 per month than those in the referent group (PR=1.52; 90% CI:1.03;2.24).

Most serious injured workers were from transport (PR=2.72; 90% CI: 1.06;4.58) and retail trades (PR=1.94; 90% CI: 1.14;3.00), when compared to management (Table 2). In addition, injuries that

Table 1. Sociodemographic characteristics of the study population, according to the Injury Severity Score. City of Salvador, Northeastern Brazil, 2005.

Variable	Total		Injury severity level[a]				PR (90% CI)
			Mild (ISS ≤8)		Serious (ISS>8)		
	n= 406	100.0%	n= 317	78.1%	n= 89	21.9%	
Sex							
Male	316	77.8	244	77.2	72	22.8	1.2 (0.81;1.94)
Female	90	22.2	73	81.1	17	18.9	1
Age (years)							
14-27	123	30.3	97	78.9	26	21.1	1.26 (0.82;1.92)
28-37	137	33.7	114	83.2	23	16.8	1
38-69	146	36.0	106	72.6	40	27.4	1.63 (1.11;2.39)
Ethnicity							
White	49	12.1	37	75.5	12	24.5	1
Mixed	82	20.2	62	75.6	20	24.4	0.99 (0.59;1.68)
Black	275	67.7	218	79.3	57	20.7	0.85 (0.54;1.33)
Education							
Low (less than elementary education)	203	50.0	163	80.3	40	19.7	0.94 (0.64;1.37)
Medium (less than secondary education)	89	21.9	64	71.9	25	28.1	1.34 (0.89;2.00)
High (secondary education or above)	114	28.1	90	79.0	24	21.0	1
Family income per month (in US$)							
Less than 254.00	141	34.7	109	77.3	32	22.7	1.15 (0.97;2.13)
254.10 – 424.00	134	33.0	103	76.9	31	23.1	1.38 (0.93;2.03)
424.10 – 3,602.00	131	32.3	105	80.2	26	19.8	1
Worker income per month (in US$)							
<140.00	136	33.5	100	73.5	36	26.5	1.52 (1.03;2.24)
140.10-212.00	138	34.0	108	78.3	30	21.7	1.25 (0.82;1.89)
>212.00	132	32.5	109	82.6	23	17.4	1
Socioeconomic status							
Low	248	61.1	192	77.4	56	22.6	1.04 (0.68;1.59)
Medium	89	21.9	71	79.8	18	20.2	0.93 (0.56;1.55)
High	69	17.0	54	78.3	15	21.7	1

[a] Severity level – Injury Severity Score (ISS): Mild= ISS 1-8; Serious= ISS>8.

occurred in domiciles (PR=2.66; 90% CI: 1.16;6.10) or outdoors (PR=2.40; 90% CI: 1.01;5.78) were more serious than those in the referent group (government institutions). No differences in injury severity were found for outsourcing, informal jobs, placement in the labor market, and job training experience.

Table 3 shows that commuting injuries represented 18.4% of all cases and were more serious than the others (PR=1.54; 90% CI:1.10;2.16). Among them, serious lesions were also more frequent among vehicle-related trauma, when compared to injuries resulting from exposure to mechanical forces. Although poisoning tend to be more serious (PR=2.24; 90% CI: 0.88;5.70) than other type of trauma, the difference was not statistically significant. Thorax injuries (PR=4.08; 90% CI: 1.24;1.50), multiple injuries (PR=3.69; 90% CI:1.63;8.47) and hip and lower limbs injuries (PR=2.39; 90% CI:1.01;5.71) were more commonly serious than those in the referent group. Moreover, CAT reports to the INSS were also more frequently issued for serious injuries than mild ones (PR=2.16; 90% CI: 1.27;2.59) (Table 3). When ISS-based severity scoring was compared to the notification criteria used by the Sinan, the majority of cases classified as severe or critical (ISS >15) would not be eligible for notification (Table 4). Among the 67 cases classified as serious by the ISS, only eight were eligible for notification.

The Figure shows the injury severity score distribution according to industry trades. The most severe cases (ISS=25-75) were observed in transport, 7.0%), followed by retail work-related injuries (1.4%). Serious or critical cases (ISS=16-75) included more retail workers (6.9%), followed by construction workers (4.7%).

DISCUSSION

Results from the present study show that occupational-injured workers treated in the two largest emergency rooms of the city of Salvador, were mostly of mild or moderate severity (77.1%). Serious, severe or critical injuries, considered under the overall category of "serious" (ISS ≥9), comprises a substantial part (21.9%) of cases, and they had at least temporary disability, and work days lost.

Higher severity levels occurred in commuting injuries, involving run-overs or collisions. More serious injuries were thorax trauma, multiple traumas and hip or lower limb lesions. Occupational injury severity was positively associated with work in domiciles or outdoors, and with transport and retail industries, regardless of the occupation. Cases above 37 years of age were more serious, although differences in ethnicity, level of education or socioeconomic variables were not observed, except for family income lower than US$254.00. Occupational Injury Claims were more frequently issued for serious injuries, even though this did not occur for legal medical declarations. Compensation claims were filed only for 50% of all cases eligible for Social Security compensation benefits while impaired to work.

These findings reveal the importance of occupational injuries for public health, as they represent a relevant number of deaths from external causes and disability resulting from preventable hazardous conditions in the workplace. Deaths and permanent disabilities are responsible for social and economic losses and great impact on the life of family members.[5] In addition, the number of serious occupational injuries reveals the impact of work-related injuries on health services, as they contribute to the demand for specialized health care and the use of hospital-beds, including in the ICU, in addition to outpatient clinical treatment, and long-term psychotherapy, physiotherapy, and rehabilitation.

The impact of injuries from external causes on hospital care has been addressed in other studies conducted in Brazil.[11] Using data from the *Autorizações de Internações Hospitalares* (AIH – Hospital Admission Authorizations) information system, it was found that 6% of all admissions were due to external causes, in the SUS (Brazilian National Health System) public hospital facilities and hired inpatient clinics,[10] although the proportion of occupational injuries were not reported. In another study of AIH data, from 1998 to 1999, 0.3% of hospitalizations were caused by occupational injuries.[10] In the state of Massachusetts, in the US, hospitalizations due to occupational diseases and injuries combined represented only 0.6% of the total,[a] but these data were restricted to cases covered by workers' health plans. With data from this same US surveillance program, based on emergency rooms recording, the proportion of visits due to occupational health problems was estimated as 4.3% in Massachusetts,[b] and 7% in Illinois.[5] However, comparisons with findings from this study are limited because not only external causes were considered, but the overall demand as well. Studies performed in Brazil show that the proportion of occupational injuries among external causes treated in emergency rooms varies between 15% and 18.7% in Rio de Janeiro[3] and 30% in the city of Salvador.[2] Apart from hospital costs, such health problems contribute to a disproportionate number of patients in highly specialized trauma services, which may result

[a] Massachusetts Department of Public Health. Inpatient Hospitalizations for Work-Related Injuries and Illnesses in Massachusetts, 1996-2000. Boston: Occupational Health Surveillance, 86pp. 2005. Technical Report OHSP-0501.
[b] Massachusetts Department of Public Health. Emergency Department Visits for Work-Related Injuries and Illnesses in Massachusetts, 2001-2002. Boston: Occupational Health Surveillance, 52pp. 2007. Technical Report OHSP-0701.

Table 2. Occupational characteristics of the study population, according to the Injury Severity Score. City of Salvador, Northeastern Brazil, 2005.

Variable	Total		Injury severity level[a]				PR (90% CI)
			Mild (ISS 1-8)		Serious (ISS >8)		
	n=406	100,0%	n=317	78.1%	n=89	21.9%	
Trades[a]							
Manufacturing	23	5.7	21	91.3	2	8.7	0.56 (0.42;1.92)
Construction	106	26.1	86	81.1	20	18.9	1.22 (0.60;1.83)
Retail	146	36.0	102	69.9	44	30.1	1.94 (1.14;3.00)
Domestic services	32	7.9	26	81.3	6	18.7	1.21 (0.55;2.44)
Transport	15	3.7	11	73.3	4	26.7	2.72 (1.06;4.58)
Others	84	20.6	71	84.5	13	15.5	1
Occupation							
Bricklayers	102	25.1	85	83.3	17	16.7	0.76 (0.39;1.47)
Carpenters	17	4.2	13	76.5	4	23.5	1.07 (0.43;2.66)
Electricians/mechanics	46	11.3	37	80.4	9	19.6	0.89 (0.43;1.87)
Domestic services and other related jobs	45	11.1	31	68.9	14	31.1	1.42 (0.73;2.75)
Janitors	30	7.4	22	73.3	8	26.7	1.22 (0.58;2.56)
Motoboys/drivers	28	6.9	22	78.6	6	21.4	0.98 (0.43;2.20)
Health workers	26	6.5	26	100.0	-	-	-
Vendors	52	12.8	38	73.1	14	26.9	1.23 (0.63;2.39)
Safety guards	14	3.4	10	71.4	4	28.6	1.31 (0.54;3.17)
Management professionals	32	7.9	25	78.1	7	21.9	1
Others	14	3.4	8	57.1	6	42.9	1.96 (0.93;4.14)
Workplace							
Company/firm	218	53.7	171	78.4	47	21.6	2.16 (0.96;4.84)
Government institutions	40	9.8	36	90.0	4	10.0	1
Outdoors	54	13.3	41	75.9	13	24.1	2.40 (1.00;5.78)
Domiciles	94	23.2	69	73.4	25	26.6	2.66 (1.16;6.10)
Outsourcing (n=361)							
Yes	306	84.8	241	78.8	65	21.2	1.26 (0.53;1.66)
No	55	15.2	44	80.0	11	20.0	1
Informal jobs							
Yes	185	45.6	143	77.3	42	22.7	1.07 (0.74;1.54)
No	221	54.4	174	78.7	47	21.3	1
Placement in the labor market							
Biscateiro (own account)	42	10.3	30	71.4	12	28.6	1.34 (0.85;2.12)
Self-employed	93	22.9	68	73.1	25	26.9	1.26 (0.88;1.80)
Informal wage worker	50	12.4	45	90.0	5	10.0	0.47 (0.23;0.98)
Formal wage worker	221	54.4	174	78.7	47	21.3	1
Occupational training							
Yes	213	52.4	168	78.9	45	21.1	1
No	193	47.6	149	77.2	44	22.8	1.08 (0.75;1.56)

[a] Severity level – Injury Severity Score (ISS): Mild= ISS 1-8; Serious= ISS>8.

in long waiting lines, reduction in the quality of care and increased dissatisfaction.

Besides the relevance to the demand of emergency rooms, occupational injuries also represent an important component of in-patient stay and bed utilization. In the present study, the average stay of 3.2 days was lower than the 5.0[7] and 5.8 days[10] estimated with AIH data for Brazil, in 1994. However, they were lower than the 4.3

Tabela 3. Characteristics of the study population according to the Injury Severity Score. City of Salvador, Northeastern Brazil, 2005.

Variable	Total		Injury severity level[a]				PR (90% CI)
			Mild (ISS 1-8)		Serious (ISS >8)		
	n=406	100.0	n=317	78.1%	n=89	21.9%	
Commuting injuries							
Yes	75	18.4	52	69.3	23	30.7	1.54 (1.10;2.16)
No	331	81.6	265	80.1	66	19.9	1
Cause (ICD-10) (N=399)							
Exposure to mechanical forces (W20-64)	190	46.8	156	82.1	34	17.9	1
Falls (W00-W19)	89	21.9	68	76.4	21	23.6	1.32 (0.75;2.10)
Transport injuries (V01-V99)	73	18.0	49	67.1	24	32.9	1.84(1.26;3.08)
Contact with heat and hot substances (X10-X19)	13	3.2	10	76.9	3	23.1	1.29 (0.54;2.38)
Contact with venomous animals/plants (X20-X29)	10	2.5	10	100.0	-	-	-
Poisoning (X40-X49)	5	1.2	3	60.0	2	40.0	2.24 (0.88;5.70)
Overexertion (X50-X57)	7	1.7	6	85.7	1	14.3	0.80 (0.17;3.74)
Assault (X85-Y09)	5	1.2	4	80.0	1	20.0	1.12 (0.25;4.96)
Others	7	1.7	7	100.0	-	-	-
Injury (ICD-10)							
Injuries to the head (S00- S19)	58	14.3	49	84.5	9	15.5	1.58 (0.63;4.03)
Injuries to the thorax (S20-S29)	10	2.5	6	60.0	4	40.0	4.08 (1.50;1.24)
Injuries to the abdomen, lower back, lumbar spine and pelvis (S30- S39)	15	3.7	11	73.3	4	26.7	2.73 (0.95;7.83)
Injuries to the upper limbs (S40- S69)	112	27.6	92	82.1	20	17.9	1.83 (0.78;4.28)
Injuries to the lower limbs (S70- S99)	64	15.8	49	76.6	15	23.4	2.39 (1.01;5.71)
Injury involving multiple body regions (T00- T07)	69	17.0	44	63.8	25	36.2	3.69 (1.63;8.47)
Effects of foreign body entering through natural orifice (T15- T19)	41	10.0	37	90.2	4	9.8	1
Burns and corrosions (T20-T32)	20	4.9	14	70.0	6	30.0	3.06 (1.17;8.05)
Toxic effects of non-medicinal substances (T51- T65)	17	4.2	15	88.2	2	11.8	1.20 (0.31;4.62)
Work ability							
No disability	269	66.3	246	91.5	23	8.5	1
Temporary disability	124	30.5	69	55.6	55	44.0	5.18 (3.6;7.5)
Permanent disability	13	2.7	2	15.4	11	84.6	9.95 (6.8;14.5)
Legal medical declaration issued							
Yes	103	25.4	80	77.7	23	22.3	1.02 (0.89;1.13)
No	303	74.6	237	78.2	66	21.8	1
Notification to the National Institute of Social Security (n=221)							
Yes	76	34.4	51	67.1	25	32.9	2.16 (1.27;2.59)
No	145	65.6	123	84.8	22	15.2	1

[a] Severity level – Injury Severity Score (ISS): Mild= ISS 1-8; Serious= ISS>8.
ICD-10: International Statistical Classification of Diseases and Health Related Problems, 10th Revision

days estimated in a US study.[a] This difference could be the result of: the type of population studied, composed by cases which remained in the hospital after emergency room visits exclusively; or the small population size. The

[a] Massachusetts Department of Public Health. Inpatient Hospitalizations for Work-Related Injuries and Illnesses in Massachusetts, 1996-2000. Boston: Occupational Health Surveillance, 86pp. 2005. Technical Report OHSP-0501

Table 4. Comparison of Sinan and Injury Severity Scale classifications of severe injuries, including deaths. City of Salvador, Northeastern Brazil, 2005.

Injury Severity Score[a]	Sinan criteria for severity of occupational injuries[b]								Total	
	Fatal		Mutilation or hospitalization		Younger than 18 years		Not serious			
	n	%	n	%	n	%	n	%	n	%
Mild (1-3)	0	-	0	-	1	0.2	158	38.6	159	39.2
Moderate (4-8)	0	-	0	-	6	1.5	154	37.7	160	39.4
Serious (9-15)	0	-	8	2.0	0	-	59	14.4	67	16.5
Severe (16-24)	1	0.2	1	0.2	0	-	9	2.2	11	2.7
Critical (25-75)	2	0.5	1	0.2	0	-	9	2.2	12	2.2
Total	3	0.7	10	2.4	7	1,7	389	95.1	409	100.0

[a] Injury Severity Score based on the Abbreviated Injury Scale (AIS);

[b] Sinan severity criteria can be seen in the Instrução Normativa and the Protocolo de Registro de Acidentes da COSAT/Ministério da Saúde (Ministry of Health, Coordination of Workers' Health, COSAT, Injury Record Protocol and Normative Guidance)

duration of ICU stay for external causes was estimated as 8.3 days on average in a study by Iunes[7] (1997), similar to 8.4 days, as estimated in this investigation.

In the present study, lethality of occupational injuries treated in emergency rooms was 0.7%, lower than the 1.0% estimate from Massachusetts by Forst et al[4] (1999). However, hospital lethality in this study was 5%, considering the 60 patients who remained for inpatient care. There is no data on hospital lethality of occupational injuries in Brazil, but the ratio of deaths/hospital admissions was estimated as 1.2:100 in 1998, 1.4:100[b] in 1999, and 1.7:100 in 2000,[a] lower than 2.2:100 in 1994, based on AIH data.[10] These findings are similar to those found in Massachusetts, where the ratio of deaths/admissions due to external causes was 1.40:100. These differences can be explained by the distinct nature of services provided by emergency rooms when compared to hospitals. In the present study, the mean ISS of 4.9 (SD=5.9) was lower than the estimate from Illinois (Mean=6.1; SD=7.4)[5] although comparison is limited because of the non-normal distributions of ISS scores. In this study, the frequency of cases with ISS≥16 was lower (4.6%) than the estimates from the Massachusetts study (7.2%),[5] even though the lethality in emergency rooms was similar. Considering the AIH-based findings from Brazil, cases of occupational injuries in emergency rooms from this study are more severe and hospital lethality higher. Because data on occupational-related diseases and injuries from the SUS are widely recognized to be underreported, occupational injury lethality estimated with AIH data may be biased, once they concentrate more severe cases. The eligibility criteria for severe occupational injures notification used by Sinan would not cover great part of severe cases flagged by the ISS. This points to the need of further assessment of other severity criteria operational feasibility, such as the ISS, for planning and prevention programs, instead of the SINAN occupational injury notification, whose main purpose is individual case investigation.

In the literature on severity of occupational injuries from emergency services, the larger number of severe cases are males and the elderly.[1,2,4,10] However, the present study shows that severity increases with age, but there were no sex differences. Moreover, in agreement with other studies, more severe cases were related to motor vehicle accidents and showed longer in-patient and ICU stay.[5,a] Nonetheless, no studies on the association of severity and trades were found, despite common reports on higher mortality among construction workers. In contrast, results from this study reveal that transport and retail showed a greater proportion of severe cases among the victims treated in the public emergency rooms of this study.

Conclusions from the present study need to be viewed with caution. It is difficult to compare hospital-based data from two emergency rooms with population-based morbidity or mortality. In a large urban area such as Salvador, even though the largest emergency rooms were used, this study population could not be representative of all cases, because special flows with overrepresentation of certain occupations or trades could have occurred. Only census data or studies based on samples of complex design of all emergency rooms could depict the overall epidemiological distribution with increased accuracy. This could also show the true pattern of occupational injury severity across trades,

[a] Serafim JA. Dados sobre a Saúde do Trabalhador segundo o DATASUS/MS. In: Anais do Seminário Nacional de Estatísticas sobre Doenças e Acidentes de Trabalho no Brasil: situação atual e perspectivas. São Paulo: Fundacentro, 2000. pp35-42.[cited 2009 Aug 18]. Available from: http://www.ibram.org.br/sites/700/784/00001034.pdf

[b] Massachusetts Department of Public Health. Emergency Department Visits for Work-Related Injuries and Illnesses in Massachusetts, 2001-2002. Boston: Occupational Health Surveillance, 52pp. 2007. Technical Report OHSP-0701.

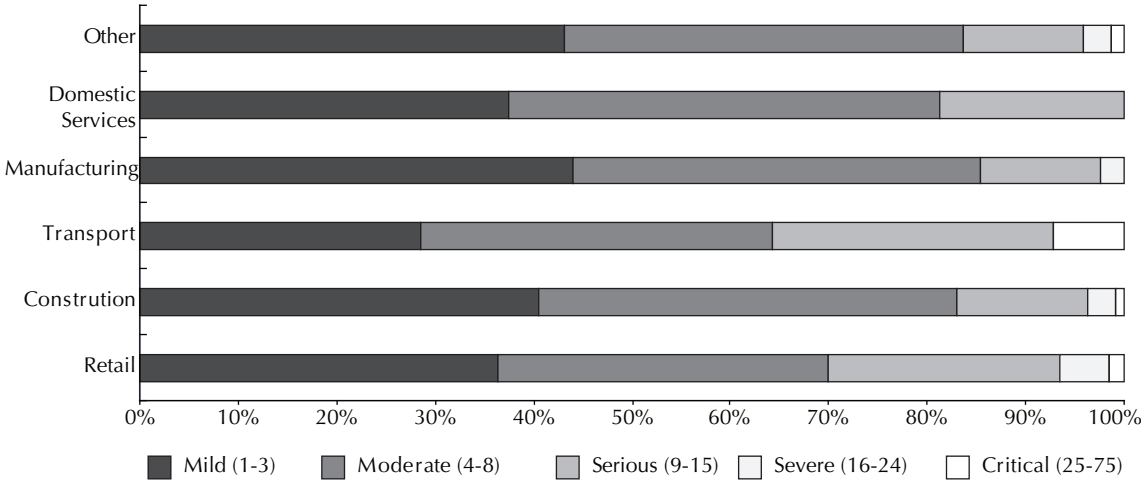

Figure. Proportion of cases by severity level and trades.

allowing the identification of those at higher risk and severity, making it possible to define priorities for prevention. Hospital-based study populations, such as the one used in this study, show only part of the phenomenon under investigation, thus limiting conclusions. Although the size of the population in this study was small, its strong points are the longitudinal design and the great detail of the information gathered.

Severity levels are important data for patient referral to other higher complexity services, helping to better organize health care services, thus increasing rationality, effectiveness and promptness and reducing cost.[5] Injury severity records from all emergency services would make it possible to estimate cumulative incidence, allowing surveillance and monitoring. This type of data allows minor errors in relation to data obtained from other services, because most severe occupational injuries are treated in emergency rooms in Brazil.[a] Injury severity is important information for health surveillance, planning and management. In addition to their being a predictor of disability, severity scores are associated with type, complexity and duration of treatment and, therefore, direct and indirect costs. However, studies on occupational injuries usually define severity based on work days lost[b] or incapacity due to sequelae for social security purposes.[12] To assess severity, full recovery or end of treatment is a required condition, limiting the adoption of timely preventive programs. The present study showed original data on occupational injury severity and its impact on emergency rooms in a large urban area of Brazil, revealing the importance of road traffic accidents among the most serious injuries. Researchers hope that, when discussing the challenges of public hospital funding, information about the high cost of injuries imposed on workers may become a relevant factor in defining prevention priorities.

Occupational injuries can be prevented, once a great part of their political, managerial and legal issues and their determinants are already known. In addition, effective and not necessarily high-cost technologies are already available and widely adopted in countries that show better epidemiological indicators as compared to Brazil. One of the first steps for occupational injuries to become a priority is to find out their full extent and severity, not only for workers insured by the *Previdência Social,* but rather to the entire working population. The improvement of occupational injuries data from SUS, especially from the emergency services network, including parameters of severity, may constitute an essential step to prevent this important public health problem.

[a] Massachusetts Department of Public Health. Emergency Department Visits for Work-Related Injuries and Illnesses in Massachusetts, 2001-2002. Boston: Occupational Health Surveillance, 52pp. 2007. Technical Report OHSP-0701.
[b] Expert Group on Injury Severity Measurement. Discussion document on injury severity measurement in administrative datasets. Atlanta: National Center for Health Statistics; 2004.

REFERENCES

1. Concha-Barrientos M, Nelson DI, Fingerhut M, Driscoll T, Leigh J. The global burden of occupational injuries. *Am J Ind Med.* 2005;48(6):470-81. DOI: 10.1002/ajim.20226
2. Conceição PSA, Nascimento IBO, Oliveira PS, Cerqueira MSM Acidentes de trabalho atendidos em serviços de emergência. *Cad Saude Publica*. 2003;19(1):111-7. DOI: 10.1590/S0102-311X2003000100012
3. Deslandes SF. O atendimento às vítimas de violência na emergência: "prevenção numa hora dessas?" *Cienc Saude Coletiva*. 1999:4(1):81-94. DOI: 10.1590/S1413-81231999000100007.
4. Forst LS, Hryhorczuk D, Jaros M. A state trauma registry as a tool occupational injury surveillance. *J Occup Environ Med.* 1999;41(6):514-20. DOI: 10.1097/00043764-199906000-00019
5. Friedman LS, Forst L Occupational Injury Surveillance of Traumatic Injuries in Illinois, Using the Illinois Trauma Registry: 1995–2003. *J Occup Environ Med.* 2007; 49(4):401-10. DOI: 10.1097/JOM.0b013e31803b9527
6. Gennarelli TA, Wodzin E. AIS 2005: A contemporary injury scale. *Injury*. 2006; 37(12):1083-91. DOI: 10.1016/j.injury.2006.07.009
7. Iunes RF. III Impacto econômico das causas externas no Brasil: um esforço de mensuração. *Rev Saude Publica*. 1997;31(4 Supl):38-46. DOI: 10.1590/S0034-89101997000500004
8. Kines P, Spangenberg S, Spyreborg S. Prioritizing occupational injury prevention in the construction industry: Injury severity or absence? *J Saf Res*. 2007;38(1):53-8. DOI: 10.1016/j.jsr.2006.09.002
9. Krause N, Frank JW, Dasinger LK, Sullivan TJ, Sinclair SJ Determinants of duration of disability and return-to-work after work-related injury and illness: challenges for future research. *Am J Ind Med.* 2001;40(4):464-84. DOI: 10.1002/ajim.1116
10. Lebrão ML, Mello Jorge MHP, Laurenti R. II Morbidade hospitalar por lesões e envenenamentos. *Rev Saude Publica*. 1997;31(4 Supl):26-37. DOI: 10.1590/S0034-89101997000500003
11. Santana VS, Nobre L, Waldvogel B. Acidentes no Brasil entre 1994 e 2004: uma revisão. *Cienc Saude Coletiva*. 2005;10(4):841-55. DOI: 10.1590/S1413-81232005000400009
12. Santana VS, Araújo-Filho JB, Albuquerque-Oliveira PR, Barbosa Branco A. Acidentes de trabalho: custos previdenciários e dias de trabalho perdidos. *Rev Saude Publica*. 2006;40(6):1004-12. DOI: 10.1590/S0034-89102006000700007
13. Stevenson M, Segui-Gomez M, Lescohier I, Di Scala C, McDonald-Smith G. An overview of the injury severity score and the new injury severity score. *Inj Prev.* 2001;7(1):10-3 DOI: 10.1136/ip.7.1.10
14. Stephenson S, Henley G, Harrison JE, Langley JD Diagnosis based injury severity scaling: investigation of a method using Australian and New Zealand hospitalizations. *Inj Prev.* 2004;10(6):379-83. DOI: 10.1136/ip.2004.005561

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