

# Health Care Costs and the Socioeconomic Consequences of Work Injuries in Brazil: A Longitudinal Study

Vilma Sousa SANTANA<sup>1\*</sup>, Luis Eugênio Portela FERNANDES DE SOUZA<sup>1</sup> and Isabela Cardoso de Matos PINTO<sup>1</sup>

<sup>1</sup>Federal University of Bahia, Institute of Collective Health, Program of Environmental and Workers' Health, Brazil

*Received January 31, 2013 and accepted May 27, 2013*

*Published online in J-STAGE June 26, 2013*

**Abstract:** Work injuries are a worldwide public health problem but little is known about their socioeconomic impact. This prospective longitudinal study estimates the direct health care costs and socioeconomic consequences of work injuries for 406 workers identified in the emergency departments of the two largest public hospitals in Salvador, Brazil, from June through September 2005. After hospital discharge workers were followed up monthly until their return to work. Most insured workers were unaware of their rights or of how to obtain insurance benefits (81.6%). Approximately half the cases suffered loss of earnings, and women were more frequently dismissed than men. The most frequently reported family consequences were: need for a family member to act as a caregiver and difficulties with daily expenses. Total costs were US\$40,077.00 but individual costs varied widely, according to injury severity. Out-of-pocket costs accounted for the highest proportion of total costs (50.5%) and increased with severity (57.6%). Most out-of-pocket costs were related to transport and purchasing medicines and other wound care products. The second largest contribution (40.6%) came from the public National Health System – SUS. Employer participation was negligible. Health care funding must be discussed to alleviate the economic burden of work injuries on workers.

**Key words:** Occupational epidemiology, Small-medium enterprises, Industrial accidents, Occupational health and safety management system, Work environments

## Introduction

Work-related injuries not only affect workers' physical and psychological health. They can have consequences for jobs, careers, and socioeconomic conditions at both the individual and family level, as well as having an important economic impact on productivity and health, and generating substantial health care and social insurance costs<sup>1–3</sup>.

Research findings show that work injuries cause earning losses<sup>4, 5</sup>, an increased use of social services, occupational disruptions<sup>1, 5</sup>, and financial difficulties<sup>5</sup>, amongst other effects. Studies about the socioeconomic consequences of work injuries are rare, and are commonly affected by limited comparability, due to differences in health care systems and funding policies<sup>1, 5</sup>. However, knowledge about the economic or social impact of diseases or injuries is relevant to decision makers, particularly in developing or emerging countries where scarce resources need to be efficiently balanced across health care demands. Unfortunately, data about occupational diseases and injuries are

\*To whom correspondence should be addressed.

E-mail: vilma@ufba.br, vilma\_santana50@hotmail.com

©2013 National Institute of Occupational Safety and Health

commonly of poor quality, have limited coverage and are largely underreported<sup>6</sup>).

In 2007, in the US, a total of 8,564,619 non-fatal occupational injuries, which constitute the majority of all work-related health problems, were estimated following adjustment for under-reporting. Non-fatal work injury costs were US\$45.95 billion, an average on medical expenses of \$5,369<sup>7</sup>). A large proportion of injuries did not cause any days away from work (88.1%) but 1,020,181 workers suffered temporary disability, corresponding to US\$82.08 million of total costs, with an average of US\$8,046 spent on medical care bills. Insurance reimbursement covered only 25% of total costs<sup>7</sup>). Furthermore, using US data for occupational injuries which occurred in industrial settings, Lander *et al.* (2012)<sup>8</sup>) estimated an average hospital cost of US\$32,254 per case (median US\$18,364, 90th percentile US \$66,607) but no costs per payer or cost components were reported.

A dual health care system is in effect in Brazil. This system is composed of a public component, the Unified Health System, SUS, which provides universal health care free of charge, and a private component partially funded by SUS. The establishment of SUS in the 1988 Constitution came about as a result of the citizens' rights movement that emerged in the form of political resistance during the military dictatorship. Its current structure and funding are a result of this historical process, underlined by struggles and negotiations between the private health care industry and the "social rights for all" movement. The SUS principles are the provision of universal health care coverage based on equitable access, which is free of charge and includes full coverage for all health needs, ranging from vaccines to organ transplants. Nevertheless, it allows for private initiatives through health insurance or the direct payment of health care services. Public funding accounts for approximately 40% of all costs, 3.14% of Brazilian GDP, while private resources comprise 60% of total funding, or 4.84% of GDP<sup>9</sup>). Given that only 25% of the population has private health insurance, public health spending is US\$500.00 per capita per year, but the figure is twice as much for private health insurance schemes<sup>9</sup>). Health insurance represents 21.7% of private costs and 34.5% of out-of-pocket expenses, mainly in the purchase of medicines<sup>10</sup>). Data from the National Household Budget Survey shows that average out-of-pocket family health care costs in 2008–2009 were US\$80.5 per month, however, although they are crucial to treatment success, transport expenses were not recorded<sup>11</sup>).

Unlike the universal coverage of the public health care

system, social insurance is based on compulsory contributions from workers and employers, estimated as a proportion of the firm's payroll. Social insurance is therefore limited to formally registered workers who comprise over half of all the employed labor force in the country. Social insurance covers a range of compensation benefits paid for sick or maternity leave, retirement, work injuries indemnity and others<sup>12</sup>). Since 1999 the proportion of informal workers has fallen in Brazil, and the number of formally hired workers has increased, either as wage workers or self-employed contributors<sup>13</sup>). However, one can safely assume that workers lack awareness about their rights to social insurance benefits, which limits their access to compensation benefits.

Data in Brazil about the direct costs of work injuries is scarce and is limited to SUS. Disability or lost workdays are usually estimated through compensation benefits, restricted to insured workers and to the most severe cases, with 15 or more disability days. In 1998, the cost to SUS of outpatient treatment for work injuries accounted for US\$281,334.00, rising to US\$386,220.00 in 2000, a 37.3% growth in only three years. Hospital costs also increased from US\$10,543,810.00 to US\$10,732,205.00, during the same period, a 1.8% increment. The average admission cost was US\$311.00<sup>14</sup>). With data from a community-based prospective study carried out between 2000 and 2006 in the city of Salvador, Bahia, Brazil, Santana *et al.* (2007)<sup>12</sup>) analyzed 628 cases of occupational injury. Of these, 49.5% received medical treatment in emergency departments, hospitals and outpatient facilities; the most common provider was SUS (71.0%), while private health insurance was responsible for only 15.1% of these patients. No data was found for the social consequences of work injuries or related health care costs. In this study we intend to estimate the health care costs and consequences to workers' lives of work injuries among users of public emergency care departments in a large urban area in Brazil.

## Subject and Methods

This is a prospective longitudinal study carried out on all cases of work-related injuries identified in the emergency health care services of the two largest public hospitals in the city of Salvador, the capital of the state of Bahia, in Northeast Brazil. Cases were recruited from June through September 2005, and visited by trained interviewers within the first week after hospital discharge. They were visited every month during the follow-up period, until recovery or treatment dropout.

The city of Salvador is the third largest city in Brazil, and the most important metropolitan area in the Northeast region. In 2011, there were 2,676,606 inhabitants, who were predominantly Afro-descendants (83%) and poor (19.5% earn the minimal wage or less), and its human development index (HDI) was 0.805, ranking 467th out of 5,561 municipalities in the country<sup>15</sup>.

Following approval of the study protocol by hospital staff and Internal Review Boards, the field work took place from June through September 2005. At the first stage we asked the reception and triage teams to collaborate in the identification and recruitment of study subjects on their arrival at the reception room. In order to select occupation-related injuries, each victim was asked about the circumstances of their trauma, as recommended by the International Collaborative Effort on Injury Statistics (ICE)<sup>16</sup>: “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 because Brazilian legislation considers commuting injuries to be work-related. Secondly, when patients were discharged, transferred for in ward treatment or were able to be interviewed, we invited them to participate in the study. We used a short questionnaire to collect data about personal information, including home address details, which are usually difficult to find in poor suburban areas, and advised them about the follow-up visits. When patients were not able to provide information, a family member was interviewed. The third phase consisted of monthly household visits to collect data about costs and treatment evolution.

Questionnaires were used to obtain socio-demographic, occupational and injury data, health and social insurance characteristics and coverage, and all direct costs related to treatment of the work injury. A total of three research instruments were used: a hospital spreadsheet, an in-hospital identification questionnaire and a follow-up questionnaire. The hospital spreadsheet was used to help identify the relationship between the causes of work injuries. Victims or their companions answered questions in the emergency admission room or during clinical triage; the in-hospital identification questionnaire was used to gather personal data, addresses, details about how to reach the household and current clinical conditions, while diagnosis was coded using the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10). Data on the nature and extension of injuries per anatomical region were also recorded, in order to estimate

a standardized severity score.

During household visits following hospital discharge other information regarding socio-demographics, occupation, family, social and health insurance, health status, and costs related to treatment were recorded using specific questionnaires. Because it is usually difficult to recall daily living expenses, a diary recording sheet was used to collect data. Cost components were: transport; the purchase of medicines or other wound treatment needs; inpatient and outpatient care which involved physical therapy for rehabilitation; clinical tests and imaging; and others, comprised of special meals, equipment rental and maintenance of, for example, wheelchairs, crutches etc. Each recorded expense was classified by main payer according to the worker’s report. Hospital costs were drawn from accountant management reports used to assess the monetary value of reimbursement under the SUS financial system. Outpatient care costs were also estimated using SUS standardized logs. All medical care expenses were totaled per payer.

Work injuries were defined as cases of lesions from external causes, drowning and poisoning occurring in the workplace, while performing work-related tasks outdoors, in remote places, or when commuting to/from work, which corresponds to the Brazilian legal definition. The relationship with work was assessed using the WHO/ICE recommendations<sup>16</sup>, as described.

The descriptive variables were: sex; age (analyzed in tertiles, 14–27, 28–37 and 38–69 years of age); ethnicity (white, mixed race and black); education, coded as low (less than elementary education), medium (incomplete high school), and high (high school or more); monthly family income, analyzed in tertiles: low (less than US\$250.00 per month), medium (US\$250.00 – US\$417.00) and high (<US\$417); as well as worker wage: low (less than US\$140.00), medium (US\$140.10 – US\$212.00) and high (over US\$212.00). Occupational characteristics were: informal jobs (yes/no), type of employment: *biscateiros* (odd-job men), self-employed, informal wage workers (non-registered), and formal wage workers (those having a formally registered job); and trade (manufacturing, construction, retail, domestic services, transport, and others). Social protection coverage was recorded for each type of contribution or membership of the Brazilian social insurance system, thus: formal wage worker, public servant, self-employed (autonomous workers), domestic worker and contributor to a private insurance company. We asked those who were eligible three questions about the use of compensation benefits: whether he (she) intended to file a compensation claim (yes/no), was unaware of how to file

a compensation claim, and whether a notification had been issued to the Social Insurance Institute's Health, which is compulsory regardless of injury severity or number of disability workdays. In order to analyze the socioeconomic consequences of the injury, we recorded data about earnings when unable to work, and job changes after returning to work – no changes, was dismissed, changed occupation at the same firm, or other; and family consequences – difficulties keeping up with daily living expenses, other family members needed to get a job, financial help from relatives, or other. Occupational injury severity was assessed using the Abbreviated Injury Score, AIS<sup>17</sup>) and ISS<sup>18</sup>) categorized on five levels: mild (1–3), moderate (4–8), serious (9–15), severe (16–24) and critical (25–75). These levels were dichotomized into mild (ISS 1–8) and serious (ISS 9–75) for the final analysis. Cost variables were totaled per payer using the diary recording sheets.

Data entry was performed using Epi-info 6.0, while we used the SAS 9.1 for statistical analyses. Proportions were compared using Pearson's  $\chi^2$  test. Because of the non-normal distribution, the continuous variables were analyzed through the median and 90% percentile. This study was approved by the Research Ethics Committee of the Institute of Collective Health at the Federal University of Bahia; each study subject agreed to participate and signed a consent form.

## Results

A total of 446 occupational injury cases were identified in emergency rooms during the study period. Four (1.0%) refused to participate, while households could not be located for 35 individuals (7.4%). Family members of one of the three deceased workers declined to give information. There were a total 40 losses (8.9%), leaving 406 individuals for the follow-up.

The study population was mostly comprised of men (77.8%), who were young (64.0% were less than 37 years old), formal wage workers (54.7%), from construction (29.3%) and service (27.8%) firms (Table 1). Male injured workers were more likely than females to be young (65.8%), less educated (53.5% with less than elementary education), have low income families (28.8%), or an individual income below US\$141.00 per month, be in informal jobs (47.8%), and work in the construction industry (36.7%). Women victims of work-related injuries were concentrated in the service industry (46.7%), in domestic work (32.2%), or in retail firms (12.2%).

### *Social insurance*

Table 2 shows that 40.6% of the work injury cases were not covered by social insurance. Uncovered cases were more likely to be male (43.9%) than female (28.9%) ( $p < 0.10$ ). Among insured workers ( $n = 217$ ), intention to file a compensation claim was limited to 35.5%, and was more commonly reported by men (39.0%) than women (24.5%) ( $p < 0.10$ ). Females were also more likely to report that they did not know how to file a compensation claim or receive benefits (96.2%) than males (76.8%), ( $p < 0.05$ ). Work injury notifications, a requirement in order to obtain compensation benefits, were consistently more likely to be issued for male (36.6%) compared to female cases (22.3%) ( $p < 0.10$ ). In the group of insured workers who were unable to work for 15 days or more and were entitled to compensation benefits, the majority of male workers duly received compensation (94.0%), a higher proportion when compared to women (40.0%) but there were only a few cases for this analysis.

More than half of the cases continued to earn or receive wages (50.8%), regardless of their work disability or whether undergoing treatment. No differences were found according to sex (Table 2). After returning to work, in most cases their job was unchanged, however 21 (5.5%) cases were dismissed, and this was more common amongst women (8.1%) than men (4.7%), although the difference was not statistically significant. A small proportion of cases changed occupation, while remaining in the same firm (3.1%). Of the 48 cases that provided data, 5 (10.42%) workers reported that at least one family member had to help them with treatment or rehabilitation. Most of these cases were male ( $n = 4$ ); only one was female.

### *Costs*

Total direct costs for the treatment and rehabilitation of all 406 work-injuries totaled US\$40,077.00 (Table 3). Over half (50.5%) of the costs (US\$20,228.00) were out-of-pocket expenses paid by relatives or the workers themselves. SUS was responsible for 40.6% (US\$16,267.00) of the total costs. Together, both payers, patients and the government, were responsible for 91.1% of all health care costs. Private health insurance corresponded to only 1.0% of these costs, while employers accounted for only 6.7% of total costs. Table 3 also reveals that costs were higher for severe/critical cases (US\$23,899.00, 59.6%), an average of US\$268.00 per case ( $n = 89$ ) compared to mild/medium severity injuries (US\$51.00,  $n = 317$ ). The proportion of out-of-pocket expenses increased from 40.0% for mild/medium to 57.6% for the most severe cases, in contrast to

**Table 1. Socio-demographic data of the study population. Salvador, Bahia, Brazil, 2005**

Variables	Male		Female		Total	
	N=316	100.00%	N=90	100.00%	N=406	100.00%
Age in years *						
14–27	104	32.9	19	21.1	123	30.3
28–37	104	32.9	33	36.7	137	33.7
38–69	108	34.2	38	42.2	146	36.0
Education ***						
Low (less than elementary)	169	53.5	34	37.8	203	50.0
Medium (incomplete high school)	72	22.8	17	18.9	89	21.9
High (complete high school or more)	75	23.7	39	43.3	114	28.1
Monthly family income (US\$)***						
≤ 250.00	113	35.8	28	31.1	141	34.7
251.00–417.00	99	31.3	35	38.9	134	33.0
> 417.00	104	32.9	27	30.0	131	32.3
Monthly worker wage (US\$)***						
≤ 141.00	91	28.8	48	53.3	139	32.2
141.00–225.00	109	34.5	25	27.8	134	33.0
> 226.00 or more	116	36.7	17	18.9	133	33.8
Informal jobs*						
No	165	52.2	56	62.2	222	54.7
Yes	151	47.8	34	37.8	184	45.3
Type of employment **						
Biscateiro (odd-job man)	35	11.1	7	7.8	42	10.3
Self-employed	81	25.6	12	13.3	93	22.9
Wage / informal worker	35	11.1	15	16.7	50	12.3
Wage / formal worker	165	52.2	56	62.2	221	54.4
Trade***						
Construction	116	36.7	3	3.3	119	29.3
Services	71	22.5	42	46.7	113	27.8
Retail	34	10.8	11	12.2	45	11.1
Manufacturing	30	9.5	1	1.1	31	7.6
Domestic services	3	0.9	29	32.2	32	7.9
Transport	36	11.4	–	–	36	8.9
Other	26	8.2	4	4.4	30	7.4

\*p&lt;0.10, \*\*p&lt;0.05, \*\*\*p&lt;0.01

a decline in SUS expenses, respectively. Employer participation was small but higher for mild/medium severity cases (11.7%) compared to serious/critical (3.3%). Transport for patients and companions accounted for 25.9% of all costs, followed by inpatient/outpatient costs (25.0%). Costs for medicines and other miscellaneous wound care items comprised 16.5% of total costs. Transport costs were mostly out-of-pocket (79.7%), while inpatient/outpatient costs were almost entirely paid for by SUS (91.1%).

#### Lost workdays

There were 2,639 (median=4, 90th percentile=14) lost workdays for the total study population, mostly among male workers (n=2,289, 86.7%), who also had a higher median=5 and 90th percentile=15 compared to women (Table 4). Among males the number of lost workdays

increased with monthly family income and worker earnings. In contrast, lost workdays among females fell with monthly family income and worker earnings, respectively. Both males and females had an increased number of lost workdays when comparing formal to informal workers. There were no major changes or clear patterns across income or informal jobs.

#### Discussion

This study shows that work injuries treated in public emergency care departments in a large city in Brazil were mostly those of formal wage workers affected by mild/medium severity lesions. Formal workers are legally insured and eligible for compensation benefits when unable to work, however our findings show that the majority of



**Table 2. Access to social insurance and the social consequences of work-related injury according to sex**

Variables	Male		Female		Total	
	N=316	%	N=90	%	N=406	%
Are you covered by social insurance (N=406)						
No**	139	43.9	26	28.9	165	40.6
Yes, as a formal wage worker	164	51.9	53	58.9	217	53.5
Yes, as a public servant**	6	1.9	7	7.8	13	3.2
Yes, as contributing self employed	4	1.3	2	2.2	6	1.5
Yes, as a domestic worker	–	–	2	2.2	2	0.5
Other	3	0.9	–	–	3	0.7
For eligible workers (n=217)						
Intend to file a compensation claim**	64	39.0	13	24.5	77	35.5
Do not know what is needed to file a compensation claim***	126	76.8	51	96.2	177	81.6
The injury was notified to Social Insurance*	60	36.6	12	22.6	72	33.2
Workers with 15 lost work days or more (20 males and 5 females)						
Received a compensation benefit	19	94.7	2	40.0	21	95.2
Earnings lost while unable to work (n=329)						
	129	50.8	38	50.7	167	50.8
When returned to work (n=384)						
There were no job changes	265	88.9	75	87.2	340	88.5
Was dismissed (lost the job)*	14	4.7	7	8.1	21	5.5
Changed occupation (same firm)	9	3.0	3	3.5	12	3.1
Other	10	3.4	1	1.2	11	2.9
Family consequences						
A family relative is helping with health care	37	18.6	18	20.4	48	19.0
Difficulties with daily expenses (n=383)	46	15.5	9	10.5	55	14.4
Family members had to start work (n=383)	3	1.0	1	1.2	4	1.0
Need financial help from relatives	4	1.4	0	–	4	1.0
Other	2	0.7	0	–	2	0.5

\*p&lt;0.10, \*\*p&lt;0.05, \*\*\*p&lt;0.01

**Table 3. Costs for treatment of work-injury by payer**

Variables	Payer										Total N=406
	Out-of-pocket worker/family N=406		SUS <sup>1</sup> N=406		Private health insurance N=6		Employer (firm) N=119		Other N=49		
	US\$	%	US\$	%	US\$	%	US\$	%	US\$	%	
Total	20,228.00	50.5	16,267.00	40.6	385.00	1.0	2,702.00	6.7	495.00	1.2	40,077.00 (100)
Severity (AIS/ISS) <sup>2</sup>											
Mild/medium (n=317)	6,465.00	40.0	7,470.00	46.2	42.00	0.3	1,901.00	11.7	300.00	1.8	16,178.00 (40.4)
Serious/critical (n=89)	13,763.00	57.6	8,797.00	36.8	343.00	1.4	801.00	3.3	195.00	0.8	23,899.00 (59.6)
Costs components											
Transport (n=367)	8,257.00	79.7	718.00	6.9	0	–	1,052.00	10.1	337.00	3.3	10,364.00 (25.9)
Medicines and other (n=295)	4,085.00	61.9	1,857.00	28.2	24.00	0.4	580.00	8.8	47.00	0.7	6,593.00 (16.5)
Inpatient/outpatient (n=406)	576.00	5.8	9,121.00	91.1	99.00	1.0	218.00	2.1	0	–	10,014.00 (25.0)
Tests/imaging (n=85)	556.00	12.9	3,394.00	78.5	254.00	5.9	117.00	2.7	0	–	4,321.00 (10.8)
Other	6,754.00	76.8	1,177.00	13.4	8.00	0.1	735.00	8.3	111.00	1.3	8,785.00 (21.9)

<sup>1</sup>SUS – National public health system providing universal coverage. <sup>2</sup>Severity was assessed using the Index of Severity Score, ISS, estimated with the Abbreviated Injury Scale, AIS. Mild/Medium corresponds to ISS<8 and %; Serious/Critical ≥8.

the study population was not aware of their rights or of how to obtain insurance benefits. Only a few workers were compensated when disabled or had a injury notification filed at the National Social Insurance Institute. For both men and women, approximately half of the cases suffered

loss of earnings following the injury. However, women were more likely to be dismissed when they returned to work than men. The need for a family member to act as a caregiver and difficulties with family budgeting were the most frequently reported family consequences. Costs for

**Table 4. Workdays lost through work injury by socioeconomic variables according to sex**

Variables	Male (n=316)			Female (n=90)			Total (n=406)		
	No. of days	Median	90th percentile	No. of days	Median	90th percentile	No. of days	Median	90th percentile
Total	2,289	5	15	350	2	11.5	2,639	4	14
Monthly family income (US\$)									
≤ 250.00	574	5	18	208	3	11	782	5	14
251.00–417.00	704	5	13	117	2	14	821	4	14
> 417.00	1,011	4	17	25	0	8	1,036	3.5	15
Monthly worker income (US\$)									
≤ 141.00	599	5	15	249	3	11	848	5	14
141.00–225.00	743	5	14	79	2	12	822	4	14
> 226.00 or more	947	4	18	22	0	8	969	3	15
Informal jobs									
No	1,392	5	15	191	0.5	11	1,583	4	15
Yes	897	4	14	159	3.5	12	1,056	4	13

all 406 cases accounted for US\$40,077.00, an average of US\$98.00, but individual costs varied widely according to severity. In fact, mild/medium severity cases (n=317) outnumbered injuries classified as serious/critical (n=89), but costs were higher for the most severe cases (59.6%), with an average cost of US\$269.00. Costs for patient transport, hospital/outpatient care, and the purchase of medicines and miscellaneous items accounted for the majority of costs. The workers’ burden of costs related to occupational injuries was higher than for other payers. Out-of-pocket costs surpassed the estimates of other payers, and was higher when injuries were more severe. Most of the out-of-pocket costs were related to transport and the purchase of medicines and other wound care products. Costs for inpatient/outpatient care and tests/imaging were mostly funded by SUS, while private health plan costs were negligible. Work injuries also caused economic losses, since we estimated 2,639 lost workdays, with males having more disability work time than females.

Work-related injuries are known for the great burden they represent worldwide, and their relevance for public health policies is well established, since they are mostly avoidable<sup>3, 5, 6</sup>. They cause suffering and disability, have an impact on health care costs, lead to economic losses, and affect the lives of workers and their families<sup>3, 5</sup>. Compensation benefits when unable to work are an important social resource in reducing the social and economic impact of injuries on workers. However, the number of uninsured workers is scaling up globally, with the growth of the informal economy, and in the number of informal wage workers, unregistered self-employed workers and the unemployed<sup>19</sup>. Although the proportion of informal jobs has been falling in Brazil since 1999<sup>14</sup>, in 2011, 43.2%

of male and 45.6% of female workers were informal, and consequently uninsured<sup>20</sup>.

Surprisingly, our findings demonstrated that most eligible workers were not aware of their rights or how to obtain compensation benefits. This reflects the lack of information and poor education of workers related to rights such as social security, even when it concerns earnings. Nevertheless, almost all injured male workers with a disability for 15 days or more received compensation benefits (19/20, 94.0%), while only two female cases granted benefits (40% out of those five eligible to claim for it. Problems related to social insurance management in Brazil are well-known and include the complexity of the procedures involved in filing a compensation claim, long waiting times, an insufficient number of facilities, as well as other barriers<sup>21</sup>. These problems need to be addressed, with a particular focus on the self-employed or micro entrepreneurs, who, as a result of inclusive policies in Brazil, have recently been included in the country’s social insurance system. Lack of awareness about compensation benefits signaled the need to enhance learning opportunities focusing on rights and access to social protection benefits for workers.

Our results demonstrate that a substantial proportion of both men and women suffered loss of earnings following injury, as a consequence of a disability that affected their work, or because employers did not want to take responsibility during the post injury period, which is more likely to occur in the case of unprotected informal workers. It is also noticeable that women were more likely to lose jobs after work injury than men, which probably reflects the more fragile labor protection mechanisms available for women in vulnerable situations and demonstrates gender-related inequality. We did not observe meaningful dif-

ferences between men and women in the impact of work injuries on the family. However, it is noticeable that relatives had to become caregivers, which obviously implies lost earnings that affect the household budget. This impact may be more significant for informal workers who have no access to compensation benefits.

As well as the impact of work injury on earnings or job losses, worker burden from work injuries involves direct costs. Although SUS is responsible for universal health care in Brazil, some related health costs are not covered, such as patient transport for follow-up visits, equipment rental etc. Although out-of-pocket costs are expected, we did not anticipate that they would be the major source of expenditure that we observed, demonstrating a higher proportion of the total costs when injuries were more severe. While surprising, this is consistent with data from the 2008–2009 National Household Budget Survey in Brazil, in which 16.0% of the family budget were spent on transport and 5.9% on health care, which is equal to the amount spend on food<sup>21)</sup>. Transport for people with a limited ability to walk, for instance, is difficult to manage given the poor public transport system in Brazil, the fact that taxis are usually expensive and that rehabilitation commonly requires several regular patient visits over long periods of time. The use of taxis is unaffordable for poor workers, who are more likely to live in neighborhoods in peripheral urban areas commonly some distance from health care facilities. Other relevant out-of-pocket costs were associated to the purchase of medicines and other miscellaneous items used for the treatment of wounds at home. These costs may increase with treatment duration, particularly for outpatient care and rehabilitation, which lasts longer in the most severe cases<sup>22)</sup>.

The heavy burden of medicine is recognized by the government as an important cause of non-compliance and treatment dropout, leading to the adoption of a National Medicine Policy to enhance access to medicines within SUS. Amongst other activities, this program is based on the increased production of low-cost generic pharmaceutical drugs, and free-of-charge medicines used for the treatment of chronic diseases, thus contributing to an alleviation of the health care burden on poor families. The implementation of primary health care based on family health strategies accounts for over 32 thousand health teams, with an estimated coverage of 80% of the entire population<sup>23)</sup>, and is a relevant opportunity for the provision of health care to all workers.

The low participation of private health care is worth noting, given that most formal workers are covered by pri-

vate health insurance paid by employers. Although costs for private health insurance premiums were not available, the remaining contribution of entrepreneurs to direct costs for work injuries was low. There were a considerable number of lost workdays resulting from disability caused by work injuries, which could affect the productivity of firms or worker earnings, particularly when these were self-employed or have informal jobs. In sum, direct costs impact more heavily on workers and their families, and on the government, which is the main source of funding for hospital and outpatient care for the poor.

We need to treat the conclusions of this study cautiously, due to a number of methodological limitations. Follow-up studies are costly, time consuming, and involve complex logistics when carried out in poor Brazilian areas where violence is common. Recruitment of injured workers in emergency rooms is challenging, because of the suffering involved, and the balance required, on ethical grounds, in dealing with patients, medical staff, and researcher needs. Patients were receptive to follow-up visits but problems with cost recall may have affected the accuracy of their records. The study population was small and some planned analysis was not feasible. Despite these limitations, the study sheds light on a rarely addressed issue, the socio-economic burden on poor workers and their families of the direct costs arising from work injuries. The longitudinal design ensured more accurate data by reducing recall bias, as did the use of diary recording sheets to obtain data related to health care costs. In addition, we used hospital accounting reports to estimate costs for inpatient and outpatient treatment based on government reimbursement logs.

This study contributes in part to the knowledge required to prioritize work-injuries in the health policies of developing or emerging countries, where they are largely under-reported, giving rise to underestimated mortality or morbidity data<sup>3, 6)</sup>. Work-related injuries may be devastating to poor families because of the consequent socio economic burden. Such injuries are rarely the focus of prevention programs, particularly given that resources for health care are insufficient to both need and demand. We also demonstrated the burden of the direct costs of work injury care on workers, their families and the government, as well as the need for greater employer involvement in supporting workers and families. Informal workers are a special case, and strategies to provide full coverage for occupational health services, including surveillance and primary prevention initiatives, need to be implemented in order to achieve a more equitable society and healthier and safer work environments.



## Acknowledgement

Brazilian National Council for Scientific and Technological Development (CNPq); Ministry of Health, Department of Science and Technology, DECIT 400896/2005-6; and CNPq grant award to Vilma Sousa Santana (Nº 304108/2011-1).

## References

- 1) Brown JA, Shannon HS, Mustard CA, McDonough P (2007) Social and economic consequences of workplace injury: a population-based study of workers in British Columbia, Canada. *Am J Ind Med* **50**, 633–45. [Medline] [CrossRef]
- 2) Boden LI (2006) Occupational injury and illness meet the labor market lessons from labor economics about lost earnings. *Ann N Y Acad Sci* **1076**, 858–70. [Medline] [CrossRef]
- 3) Concha-Barrientos M, Nelson DI, Fingerhut M, Driscoll T, Leigh J (2005) The global burden due to occupational injury. *Am J Ind Med* **48**, 470–81. [Medline] [CrossRef]
- 4) Reville RT, Bhattacharya J, Sager Weinstein LR (2001) New methods and data sources for measuring economic consequences of workplace injuries. *Am J Ind Med* **40**, 452–63. [Medline] [CrossRef]
- 5) Weil D (2001) Valuing the economic consequences of work injury and illness: a comparison of methods and findings. *Amer J Ind Med* **40**, 418–37.
- 6) Takala J (2005) Global estimates of traditional occupational risks. *Scand J Work Environ Health Suppl* **1**, 62–7.
- 7) Leigh JP (2011) Economic burden of occupational injury and illness in the United States. *Milbank Q* **89**, 728–72. [Medline] [CrossRef]
- 8) Lander L, Shah RK, Li Y, Mahalingam-Dhingra A, Smith LM, Sorock G (2013) Healthcare cost usage for hospitalised injuries sustained in industrial settings in the USA. *Inj Prev* **19**, 112–8. [Medline] [CrossRef]
- 9) Paim J, Travassos C, Almeida C, Bahia L, Macinko J (2011) The Brazilian health system: history, advances, and challenges. *Lancet* **377**, 1778–97. [Medline] [CrossRef]
- 10) Ugá MA, Porto SM (2008) Financiamento e alocação de recursos em saúde no Brasil [Funding and health resources allocation in Brazil]. In: *Políticas e Sistemas de Saúde no Brasil [Policies and Health Systems in Brazil]* Giovanella L (Org), 473–506, Ed. Fiocruz, Rio de Janeiro (in Portuguese).
- 11) Instituto Brasileiro de Geografia e Estatística. Pesquisa Nacional de Orçamento Familiar 2008–2009. [http://www.ibge.gov.br/home/presidencia/noticias/noticia\\_visualiza.php?id\\_noticia=1648&id\\_pagina=1](http://www.ibge.gov.br/home/presidencia/noticias/noticia_visualiza.php?id_noticia=1648&id_pagina=1). Accessed January 28, 2013.
- 12) Santana VS, Araújo G, Espírito-Santo J, Araújo-Filho JB, Iriart J (2007) Utilização de serviços de saúde por acidentados do trabalho. *Rev Bras Saúde Ocup*, **32**, 135–143 (in Portuguese).
- 13) Dias EC, Oliveira RP, Machado JH, Minayo-Gomez C, Perez MAG, Hoefel MGL, Santana VS (2011) Employment conditions and health inequities: a case study of Brazil. *Cad Saude Publica* **27**, 2452–60. [Medline] [CrossRef]
- 14) Serafim JA (2000) Dados sobre a saúde do trabalhador segundo o DATASUS/MS. [Workers' health data according to DATASUS, Health Ministry]. In: *Annals of the national seminar about statistics on work-related diseases and injuries in Brazil: current state and perspectives*. Fundacentro, 35–42, Ministerio do Trabalho e Emprego, São Paulo. <http://www.ibram.org.br/sites/700/784/00001034.pdf>. Accessed December 5, 2013.
- 15) Bahia. Indicadores de Desenvolvimento Econômico e Social [Economic and Social Development Indicators]. Superintendência de Estudos Econômicos e Sociais. [http://www.sei.ba.gov.br/index.php?option=com\\_content&view=article&id=98&Itemid=82](http://www.sei.ba.gov.br/index.php?option=com_content&view=article&id=98&Itemid=82). Accessed January 20, 2013.
- 16) World Health Organization (2002) Update on the international collaborative effort on injury statistics. Brisbane: Collaborating Center for the Family of International Classifications for North America. [http://www.aihw.gov.au/international/who\\_hoc/hoc\\_02\\_papers/brisbane37.doc](http://www.aihw.gov.au/international/who_hoc/hoc_02_papers/brisbane37.doc). Accessed March 23, 2010.
- 17) Gennarelli TA, Wodzin E (2006) AIS 2005: a contemporary injury scale. *Injury* **37**, 1083–91. [Medline] [CrossRef]
- 18) Stevenson M, Segui-Gomez M, Lescohier I, Di Scala C, McDonald-Smith G (2001) An overview of the injury severity score and the new injury severity score. *Inj Prev* **7**, 10–3. [Medline] [CrossRef]
- 19) CSDH (2008) Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health. Geneva, World Health Organization. [http://www.who.int/social\\_determinants/final\\_report/csdh\\_finalreport\\_2008.pdf](http://www.who.int/social_determinants/final_report/csdh_finalreport_2008.pdf). Accessed May 21, 2013.
- 20) Instituto Brasileiro de Geografia e Estatística (2012). Síntese de Indicadores Sociais. [Social Indicators Synthesis] [http://www.ibge.gov.br/home/estatistica/populacao/condicao\\_de\\_vida/indicadores\\_minimos/sintese\\_indicadores\\_sociais\\_2012/default.shtm](http://www.ibge.gov.br/home/estatistica/populacao/condicao_de_vida/indicadores_minimos/sintese_indicadores_sociais_2012/default.shtm). Accessed in January 20, 2013.
- 21) Instituto de Pesquisas Econômicas Aplicadas (2010) Políticas sociais – acompanhamento e análise 13. Edição especial [Social Policies – follow up and analysis 13 Special Edition] [http://www.ipea.gov.br/portal/images/stories/PDFs/politicas\\_sociais/BPS\\_13\\_completo13.pdf](http://www.ipea.gov.br/portal/images/stories/PDFs/politicas_sociais/BPS_13_completo13.pdf). Accessed May 12, 2013.
- 22) Santana VS, Xavier C, Moura MCP, Oliveira R, Santo JSE, Araújo G (2009) Gravidade dos acidentes de trabalho atendidos em serviços de emergência. *Rev Saude Publica* **43**, 750–60 (in Portuguese). [Medline] [CrossRef]
- 23) Brasil (2012) Atenção Básica. [Primary Health Care]. Departamento de Atenção Básica, Ministério da Saúde. <http://dab.saude.gov.br/abnumeros.php#numeros>. Accessed January 28, 2013.