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Informal Jobs and Non-fatal Occupational Injuries

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Objectives: In Brazil, workers without a formal job contract represent approximately half of the labor force but there are no official statistics on occupational injuries for them. This study estimates the annual incidence of non-fatal work-related injuries for workers with and without job contracts and examines gender differences.

Methods: This is a community-based study carried out with a random cluster area sample of the residents of Salvador, a city with 2.7 million inhabitants, the capital of the state of Bahia, northeast Brazil. Individuals from 18 to 65 years of age who reported having a paid job comprise the study population (n = 2907). Data were obtained in individual household interviews with questionnaires applied by trained field workers.

Results: The overall estimated annual incidence rate (IR) was 5.6/100 full-time equivalent workers (FTE). The incidence of injuries differed between workers with informal (IR = 6.2/100 FTE) and formal jobs (IR = 5.1/100 FTE), and according to gender (IR = 5.8/100 FTE for female and 5.5/100 FTE for male), but these differences were not statistically significant. Statistically significant positive associations between informal jobs and non-fatal work injuries were observed among women with medium education [incident rate ratio (IRR) 2.02, 95% CI 1.00–4.00] and women with black skin (IRR 1.71, 95% CI 0.99–2.97) who perceived a job as dangerous (IRR 2.00; 95% CI 1.09–3.64) or who had no occupational training (IRR 2.08; 95% CI 1.05–4.20).

Conclusions: This study shows that non-fatal work injuries are a common health problem among adults in urban Brazil, regardless of the type of job contract or gender, which points to a need to improve workers' health and safety programs for formal and informal hired workers.

Keywords: contingent work; informal jobs; occupational injuries; precarious jobs; work accidents; work injuries

INTRODUCTION

Occupational injuries are one of the most important preventable health problems throughout the world. They are potentially fatal or disabling and affect mainly individuals in their productive years causing major economic and social impact. In Brazil, the second largest country in the Western hemisphere, the economic relevance of work accidents is expressed by the annual estimated cost of R$12.5 billion for company owners and of R$20 billion for the country (Pastore, 1999), although these data are limited to legal firms and formally hired employees. For the year 1997, the Ministry of Labor and Employment estimated that 2802 workers lost their lives as a consequence of work-related injuries and that 11 152 individuals received compensation for permanent disability caused by work accidents (Ministério do Trabalho e Emprego, 2000). These statistics are recognized as being of limited quality and restricted to workers having formal job contracts (Wünsch-Filho, 1999). However, informal job contracts are held by half of the Brazilian labor force and by a growing segment of workers in several other developing and developed countries. The growth of this form of employment is described as one of the consequences of changes in the global economy and in the labor force structure (Cacciamali, 1997). According to Quinlan *et al.* (2001), normal jobs, which means full-time and relatively secure jobs, have been replaced by non-standard or atypical ones, which have received several denominations. In Brazil,

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informal jobs represent those that lack a formal contract and therefore do not officially exist. As a result, informal workers, whether employed or autonomous, are not covered by labor legislation available to formally hired individuals, which ensure regular workplace inspections, occupational hazards control and workers' health monitoring and protection (Santana *et al.*, 1997b), widely recognized as important components of effective policies in reducing occupational diseases and work injuries.

Although not covered by official protection, workers having precarious employment, such as self-employment, home-based or contingent jobs, are more likely to be in dangerous occupations than formally hired individuals. In a recent review (Quinlan *et al.*, 2001), of 17 studies focusing on the relationship between precarious work arrangements and work injuries, 16 reported higher incidences of fatal, non-fatal or more severe injuries than the referent group. Workers with precarious jobs are also less likely to report injuries or have an awareness of work hazards and they receive less training and supervision (Quinlan *et al.*, 2001). In the unregulated informal sector of the economy, where precarious job contracts prevail, illegal small enterprises are commonly involved in rudimentary operational processes, in which safety is not carefully controlled, which in turn may contribute to an even higher occurrence of work-related injuries and diseases (Loewenson, 1998). Women are more likely to be employed in the informal sector or to have informal job contracts, but research shows that they are less likely to sustain work injuries than men (Biddle and Blanciforti, 1999). However, it is possible that women's increased participation in the labor force and in traditional male jobs may cause changes (Quinlan *et al.*, 2001) that need to be studied.

In this study, based on data from a community-based survey, differences concerning the annual incidence of non-fatal work-related injuries according to the type of job contract and gender are examined in an urban area of Brazil. The incidence distribution is also estimated according to sociodemographic and occupational variables.

MATERIALS AND METHODS

This is a population-based survey carried out in the city of Salvador, capital of the state of Bahia, Brazil. At the time of the study, the year 2000, there were 2.7 million inhabitants, the third largest urban concentration in the country. Its population lives mostly in poor slum areas surrounding upper and middle class neighborhoods and have one of the highest unemployment rates in the country (IBGE, 1999). The study population comprised individuals from 18 to 65 years of age who reported having a paid job and were living in the study area. Sample size was defined based on the estimated prevalence of informal jobs in the study area and the expected incidence of non-fatal occupational injuries reported in another study (Loewenson, 1998). To identify the study population, a cluster area single stage random sample was designed using 1:12000 and 1:2000 maps provided by a state urban development company. For each sampled area, members of the research staff visited the area and drew detailed hand-made maps showing all local constructions, boundaries and landmarks to be used in undeveloped areas. The number of selected sub-areas was calculated based on the average number of domiciles (86.6) and the expected mean number of family members in the age range of the interest (3.8) (IBGE, 1999). Three of the 32 selected areas were uninhabited, leaving 29, of which local community organizations and the leadership were contacted and asked to participate in the research, and to support operational aspects. The reasons for choosing this sampling design were to overcome difficulties in identifying residential addresses, to ensure field workers' safety and to define environmental and spatial variables. Also, the ethnographic component of this study focused on neighborhood and social support networks.

Trained field workers visited each household, enlisted all family members, registered whether they had a paid job and collected sociodemographic information. All paid workers were individually interviewed, after informed consent was obtained from each participant. Data collection was carried out from July to December 2000, thus avoiding the high tourist season, when informal jobs are more intense and follow patterns distinct from those for the rest of the year. Each household was visited by a study supervisor to check the data collected by field interviewers. When needed, missing information was recorded by telephone. Research instruments were developed following a conceptual map based on relevant content identified in workshops conducted with members of health and labor institutions, non-governmental organizations and the academic community and in questionnaires utilized in previous studies (Barata and Ribeiro, 1998; Fassa, 2000). The language adequacy and operational feasibility of the overall research strategy were tested in a pilot study.

Occupational injuries are defined as 'any damage inflicted on the body by transference of energy during work or when commuting that involves a short duration between exposure and identifiable effects after the event or circumstance' (Hagberg *et al.*, 1997). Musculoskeletal injuries and poisoning were excluded. Perception and recognition of the occupational nature of accidents could be biased by workers with informal jobs, who do not obtain any direct compensation or social benefits out of occupational injuries. To minimize such bias, respondents were asked 'Have you ever had an accident of any type in

your life?', followed by other questions concerning the study reference period, the last 12 months before the interview. When the answer was positive, the respondent was invited to provide a narrative about what happened, how and when, which was recorded as a written narrative. After this, the trained interviewer classified the injury as 'typical' occupational (meaning at the place of work) or when commuting. Severe injuries were those that caused three or more days off work. When an occupational injury was reported, a questionnaire soliciting detailed information was applied. When more than one injury occurred during the referent time, only the most recent was considered. Occupational history was also recorded, considering simultaneous jobs, a common feature in this urban area. A detailed description of the main current job, defined as that involving the longest work-time or highest remuneration, was recorded. For each job, daily work hours and work days per week were also recorded to allow estimation of the total hours of work for each person. Brazilian law requires job contracts to be registered in an official booklet called the Work Card, a widely known symbol of formal placement in the labor market. The type of job contract for participants in the study was measured by whether they had job contracts registered in this Work Card. Other variables of interest were age, sex, skin color (classified as black, including mulattoes, or non-black) and educational level (categorized as: low, illiterates and those who completed junior high education; medium, high school; high, college level). Socio-economic status was defined based on which of nine assets or goods the family owned: car, computer, washing machine, dishwasher, video player, laser disc player, microwave, telephone, beach house. The total number of items was categorized as: low, less than three items; medium, three to five items; high, more than five items. Because of gender differences, trades were coded distinctively for women: services (housemaids, housekeepers, babysitters, cooks and servants), retail, administration/education and other. For men the trades were: service, retail, manufacturing, construction, transport/safety and other. Other occupational variables were type of workplace (whether a firm or plant, street or domicile), shift-work/night work, perception of the job as dangerous, occupational training and sub-contracting, all coded as yes/no.

The annual incidence rate was estimated by dividing the total number of reported non-fatal work injuries by the summation of person-time, calculated in hours of work in the last 12 months, taking 100 full-time worker equivalents (FTE) as 40 h/week in a year of 50 weeks or 200000 h of work in a year (Mital *et al.*, 1999). Although the study design is cross-sectional in nature, accidents are of short duration and it is appropriate to consider them as incident events even when based on self-reporting. Statistical inference for differences in proportions was by Pearson χ^2 test. Crude incidence ratios were estimated using Poisson regression models and confidence intervals based on the Wald test (Stockes *et al.*, 2000). Double data entry allowed a complete check of the database and corrections when needed. Data analysis was performed with SAS 8.11 (SAS Inc., 1998), adjusting the final results for sampling design using PROC SURVEYMEANS. The research protocol was reviewed and approved by the Internal Review Board of the Hospital Prof. Edgard Santos, Federal University of Bahia and the Center for Health Research, University of Texas at Houston. The research staff were informed of all ethical issues involved and their related responsibilities.

RESULTS

A total of 3528 paid workers aged 18–65 yr were identified in the original study. From them, 212 (6.0%) refused to participate, 43 (1.2%) had retired, 260 (7.4%) were public officers under special labor legislation, 48 (1.4%) were entrepreneurs and 31 (0.9%) were autonomous professionals. All of these workers, as well as seven with missing labor market placement data, were excluded. The remaining study population comprised 2907 individuals, most of whom were male (1537, 52.9%) and did not have formal job contracts (1517, 52.2%). Only one case reported two occupational injuries in the study period. The estimated overall annual incidence rate of work accidents was 5.6/100 FTE. The incidence of injuries differed between estimates for workers with informal [incidence rate (IR) = 6.2/100 FTE] and formal jobs (IR = 5.1/100 FTE) and according to gender (IR = 5.8/100 FTE for female and 5.5/100 FTE for male), but the differences were not statistically significant. Among women, the incidence rate of at-work injuries was estimated as 5.9/100 FTE in the informal sector and 3.4/100 FTE in the formal sector, a statistically significant difference [IR = 1.75, 95% confidence interval (CI) 1.02–2.99]. No differences were found for at-work injuries in the male group, or for commuting injuries across gender or type of job contract.

Women reporting informal job contracts were younger, had less education and were more likely to be of low socio-economic status than those who reported having formal contracts. They were also more likely to work on the streets or in domiciles, be a housemaid or housekeeper or have a job in the retail trade, a shift-work schedule and no occupational training (Table 1). There were no differences concerning skin color or perception of the job as dangerous. Men with informal jobs showed similar sociodemographic and occupational profiles, except that socio-economic status did not differ according to

Table 1. Characteristics of the study population according to type of job contract and gender

Variables	Type of job contract					
	Informal		Formal		Total	
	n = 1517	%	n = 1390	%	n = 2907	100.0%
Female						
Age under 22 years old[a]	101	13.1	52	8.7	153	11.2
Black skin color	484	62.7	365	61.0	849	62.0
Less than elementary education[b]	406	52.6	205	34.3	611	44.6
Low SES[b]	425	55.1	271	45.5	696	50.9
Trade[b]						
Services/ housemaids	248	32.1	166	27.8	414	30.2
Retail	211	27.3	129	21.6	340	24.8
Administration/education	103	13.3	144	24.1	247	18.0
Other[b]	210	27.2	159	26.6	369	26.9
Workplace[b]						
Firm or plant	189	24.5	467	78.1	656	47.9
Street	94	12.2	3	0.5	97	7.1
Domicile	276	35.8	23	3.9	299	21.8
Other	213	27.6	105	17.6	318	23.2
Shift-work/night work[b]	160	26.0	120	22.7	280	24.5
Perceive job as dangerous	206	26.8	167	28.0	373	27.3
Occupational training[b]	258	33.6	323	54.4	581	42.7
Subcontracting	11	4.4	30	5.7	41	5.3
Male						
Age under 22 years old[b]	89	12.0	64	8.1	153	10.0
Black skin color	460	61.7	474	59.9	934	60.8
Less than elementary education[b]	452	60.7	355	44.8	807	52.5
Low SES	404	54.5	398	50.3	802	52.3
Trade[b]						
Services	38	5.1	77	9.7	115	7.5
Retail	191	25.6	163	20.6	354	23.0
Industry	37	5.0	86	10.9	123	8.0
Construction	181	24.3	95	12.0	276	18.0
Transport/safety	78	10.5	208	26.2	286	18.6
Other	220	29.5	163	20.6	383	24.9
Workplace[b]						
Firm or plant	250	33.5	661	83.4	911	59.3
Street	183	24.6	75	9.5	258	16.8
Domicile	217	29.1	14	1.8	231	15.0
Other	95	12.8	42	5.3	137	8.9
Shift-work/night work[b]	127	17.3	234	29.6	361	23.7
Perceive job as dangerous[a]	384	51.7	428	54.6	812	53.2
Occupational training[b]	349	47.4	530	66.9	879	57.5
Subcontracting[c]	25	12.0	44	5.6	69	7.0

[a]Pearson χ^2 $P < 0.05$.
[b]Pearson χ^2 $P < 0.001$.
[c]Pearson χ^2 $P < 0.01$.

type of job contract (Table 1). Men worked primarily in trades where informal jobs prevail, notably construction and retail.

The annual incidence rate of non-fatal work injuries among women was higher in the informal job group (7.1/100 FTE) than among women with formal contracts (4.6/100 FTE), although not statistically significant (Table 2). Notable positive associations between informal jobs and non-fatal work injuries were observed among women with medium educa-

Table 2. Crude annual incidence rate of non-fatal work accidents per 200 000 hours of work a year, according to sociodemographic variables, by type of job contract and gender

Variable	Type of job contract				Crude incidence ratio[a]	95% confidence interval
	Informal		Formal			
	Person-h[b]	Incidence rate/100 FTE[c]	Person-h	Incidence rate/100 FTE		
Female (n = 1370)	123240	7.1	22518	4.6	1.54	0.97–2.51
Age (yr)						
18–21	16255	6.2	10792	3.6	1.72	0.33–8.83
22–40	70564	7.1	76323	4.2	1.69	0.90–3.16
40–65	37421	7.5	35403	5.6	1.34	0.60–3.02
Skin color						
Black	75834	9.0	758 960	5.3	1.70	0.99–2.97
Non-black	48406	4.2	467558	3.4	1.21	0.48–3.08
Education						
Elementary or less	66496	6.9	447475	5.8	1.18	0.60–2.33
High school	48836	8.3	686493	4.1	2.02	1.00–4.00
College	8908	2.5	92550	2.2	1.14	0.07–18.30
Socio-economic status						
Low	67955	7.5	595703	4.7	1.59	0.82–3.05
Medium	347655	6.9	437575	5.0	1.37	0.60–3.11
High	216630	6.5	189640	3.2	2.04	0.53–7.90
Male (n = 1537)	1525113	5.5	1690210	5.4	1.01	0.67–1.54
Age (yr)						
18–21	141560	5.7	130678	6.1	0.92	0.23–3.69
22–40	758324	6.9	1129054	5.5	1.24	0.74–2.10
40–65	625229	3.8	430478	5.1	0.76	0.33–1.70
Skin color						
Black	942315	5.7	999626	6.6	0.86	0.52–1.44
Non-black	582798	5.1	690584	3.8	1.36	0.65–2.87
Education						
Elementary or less	905964	7.1	768310	7.5	0.93	0.57–1.55
High school	518829	3.5	816936	3.4	1.01	0.44–2.34
College	100320	2.0	104964	5.7	0.35	0.04–3.35
Socio-economic status						
Low	758025	6.1	858168	7.0	0.87	0.50–1.49
Medium	477943	5.0	572150	4.9	1.02	0.47–2.22
High	280733	5.0	259892	1.5	3.20	0.67 –15.60

[a]Based on Poisson regression; confidence intervals estimated with the Wald method.
[b]Totals differ because of missing data.
[c]FTE, full-time equivalent workers a year (40 h/week, 50 weeks/yr).

tion [incidence rate ratio (IRR) = 2.02, 95% CI 1.00–4.00] and women with black skin (IRR = 1.71, 95% CI 0.99–2.97). No other statistically significant difference was observed according to the type of job contract for any sociodemographic variable among men.

Regarding occupational variables (Table 3), having an informal job was associated with non-fatal work injuries among women who did not perceive their jobs as dangerous (IRR = 2.00, 95% CI 1.09–3.64) or reported no occupational training (IRR = 2.08, 95% CI 1.05–4.20). There were no statistically significant differences for occupational variables among men. Elevated incidence ratios for non-fatal injuries were observed in the retail trade for women (IRR = 2.93, 95% CI 0.98–8.91) and men (IRR = 2.00, 95% CI 0.71–5.72) and for women in the housekeeping and cleaning trades (IRR = 1.87, 95% CI 0.87–4.00). None of the associations of non-fatal injuries with informal jobs were statistically significant in any of the trades under analysis among women or men, however (Table 4). When only severe non-fatal work injuries (those resulting in missing work for three or more days) were considered in the analysis, similarly

Table 3. Crude annual incidence of non-fatal work accidents per 100 FTE according to occupational variables, by type of job contract and gender

Variables	Type of job contract				Crude incidence ratio[a]	95% confidence interval
	Informal		Formal			
	Person-h/yr[b]	Incidence /100 FTE[c]	Person-h/yr	Incidence /100 FTE		
Female (n = 1370)	1235240	7.1	1226518	4.6	1.54	0.97–2.51
Workplace						
Firm or plant	332260	5.4	913640	4.4	1.22	0.94–2.72
Street	137946	10.1	5760			
Domicile	400008	6.5	60060	3.3	1.96	0.26–14.9
Other	365026	8.2	247058	5.7	1.43	0.59–3.56
Shift-work/night work						
Yes	186096	7.5	222370	6.3	1.19	0.42–3.41
No	776940	6.2	830196	3.9	1.59	0.31–3.00
Perceive job as dangerous						
Yes	368231	7.1	337297	7.1	1.00	0.45–2.17
No	863509	7.2	886197	3.6	2.00	1.09–3.64
Occupational training						
Yes	425323	5.6	620511	5.5	1.02	0.49–2.16
No	804997	7.7	596887	3.7	2.08	1.05–4.20
Subcontracting						
Yes	14312		51705	11.6		
No	379424	6.3	991645	4.0	1.57	0.77–3.21
Male (n = 1537)	1525113	5.5	1690210	5.4	1.01	0.67–1.54
Workplace						
Firm or plant	528027	2.7	1411982	5.4	0.50	0.22–1.10
Street	399984	6.0	66596	7.2	0.83	0.31–2.22
Domicile	429254	7.5	7908	7.2	1.04	0.14–7.84
Other	167848	8.3	83724	2.4	3.49	0.42–28.38
Shift-work/night work						
Yes	226231	7.1	500850	4.0	1.77	0.69–4.49
No	1281014	5.3	1187632	6.1	0.87	0.54–1.40
Perceive job as dangerous						
Yes	820858	6.6	932409	6.9	0.95	0.56–1.58
No	699839	4.3	752785	3.7	1.15	0.56–2.42
Occupational training						
Yes	714681	5.9	1108454	5.2	1.12	0.64–1.97
No	790356	4.8	581756	5.8	0.83	0.43–1.58
Subcontracting						
Yes	45981	8.7	81643	12.2	0.71	0.38–8.52
No	344014	4.6	1593111	5.1	0.90	0.71–1.94

[a]Based on Poisson regression; confidence intervals estimated with the Wald method.
[b]Totals differ because of missing data.
[c]FTE, full-time equivalent workers a year (40 h/week, 50 weeks/yr).

no statistically significant positive associations were observed (Table 5).

The distribution of non-fatal work injury cases according to occupation and circumstance or cause of the injury are presented in Table 6. In the retail trade, for both genders, injured workers were predominantly salespeople, with a variety of causes of injury. Among women, falls and handling cutting tools appeared to be the most common causes of work injuries in the group of informal or formal jobs. Contact with hot substances or surfaces were more common among women having informal jobs in the services or retail trade. Among men, most work injuries involved vehicles; the causes of injury included being struck

Table 4. Crude annual incidence ratios and their respective 95% confidence intervals for type of job contract and non-fatal work accidents according to trade

Variable	Type of job contract				Crude incidence ratio[a]	95% confidence interval
	Informal		Formal			
	Person-h/yr	Incidence/100 FTE[b]	Person-h/yr	Incidence/100 FTE		
Female (n = 1370)	1235240	7.1	1226518	4.6	1.54	0.97–2.51
Trade						
Services/housekeeping	392857	9.7	388843	5.2	1.87	0.87–4.00
Retail	352615	8.5	278077	2.9	2.93	0.98–8.91
Business/education	148304	5.4	261122	3.1	1.74	0.44–7.04
Other	341464	3.5	298476	6.7	0.52	0.19 –1.44
Male (n = 1537)	1525113	5.5	1690210	5.4	1.02	0.67–1.54
Trade						
Services/housekeeping	84932	2.5	158298	12.6	0.19	0.02–1.46
Construction	354077	7.9	199497	9.0	0.77	0.32–1.95
Manufacturing	83828	7.2	180201	9.9	0.72	0.19–2.65
Retail	430156	5.6	361314	2.8	2.00	0.71–5.72
Transport/safety	185124	2.2	468475	3.4	0.64	0.13–2.98
Other	394784	6.6	324045	3.7	1.78	0.68–0.43

[a]Based on Poisson regression; confidence intervals estimated with the Wald method.
[b]FTE, full-time equivalent workers a year (40 h/week, 50 weeks/yr).

Table 5. Crude annual incidence ratios and their respective 95% confidence intervals for type of job contract and severe (three or more days off work) non-fatal work accidents according to trade

Variable	Type of job contract				Crude incidence ratio[a]	95% confidence interval
	Informal		Formal			
	Person-h/yr	Incidence/100 FTE[b]	Person-h/yr	Incidence/100 FTE		
Female (n = 1370)	1235240	1.9	1226518	2.4	0.79	0.37–1.70
Trade						
Services/housekeeping	392857	2.0	388843	2.6	0.77	0.21–2.95
Retail	352615	3.4	278077	2.2	1.55	0.39–6.31
Business/education	148304		261122	2.3		
Other	341464	1.2	298476	2.7	0.44	0.08–2.38
Male (n = 1537)	1525113	2.4	1690210	2.7	0.89	0.47–1.61
Trade						
Services/housekeeping	84932	2.5	158298	5.1	0.49	0.05–4.17
Construction	354077	2.8	199497	6.0	0.35	0.12–1.70
Manufacturing	83828	4.8	180201	7.9	0.61	0.20–5.87
Retail	430156	1.9	361314	1.7	1.11	0.39–1.75
Transport/safety	185124	2.2	468475	1.7	1.29	0.23–6.91
Other	394784	2.5	324045	1.9	1.32	0.33–5.72

[a]Based on Poisson regression; confidence intervals estimated with the Wald method.
[b]FTE, full-time equivalent workers a year (40 h/week, 50 weeks/yr).

by a vehicle, falling from a vehicle and crashes, both while at work and when commuting.

DISCUSSION

This study shows that non-fatal work injuries are a common health problem among adults in urban Brazil, regardless of the type of job contract or gender. The incidence of non-fatal work injuries was estimated as 5.8/100 FTE/yr, indicating the quantitative importance of occupational injuries, all of which are preventable, in principle, by safety, hygiene and public health measures. The incidence of injury was higher among women with informal jobs compared

Table 6. Occupations and circumstances/causes[a] of non-fatal work accidents according to type of job contract and gender

Gender/occupation	Circumstances/cause	
	Informal job contract	Formal job contract
Female		
Services		
Housemaid/housekeeper	Falls (7), cutting tools (3), contact with hot substances (5) contact with cold substances (2)	Falls (4), cutting tools (2), machine transportation (1) contact with hot surfaces (1), squeezed by a vehicle (1)
Cook		Fall (1)
Cleaners	Fall (1)	
Other		Fall (1)
Retail		
Salesperson/vendor	Falls (4), struck by a moving vehicle (1), cutting tools (1), contact with hot substances (2), overextension (1)	Fall (1)
Cashier		Falls (2)
Administrative assistant	Contact with hot substances (1)	Fall (1)
Waiter	Contact with hot substances (1)	
Business/education		
Teacher	Cutting tools (1), contact with hot substances (2)	Falls (2), cutting tools (1)
Communication operator		Fall (1)
Phone operator	Car crash (1)	
Other		
Industrial operator		
Laboratory technician		Cutting tools (1)
Nurse attendants		Cutting tools (1), contact with hot substance (1)
Hairdresser	Cutting tools (1)	
Dressmaker	Cutting tools (2), machine handling (1)	
Dispatcher		
Handler		Fall (1)
Male		
Services		
Janitor		Fall (4), cutting tools (1), overexertion (1)
Gardener		Fall (2)
Construction		
Bricklayer/bricklayer assistant	Fall (2), fall from a vehicle (2), cutting tools (1)	
Scaffolders		Fall (1)
Electrician	Gas leaking (1)	Fall (2), squeezed by a machine (1)
Painter	Struck by a moving vehicle (1)	Chemical substance (1)
Carpenter		Struck by a moving vehicle (1)
Plumbers	Cutting tools (1)	
Foundry worker	Cutting tools (1)	
Overall construction		Fall (1), gunshot (1), car collision (1)
Manufacturing		
Welder		Struck by a moving vehicle (1)
Sheet metal worker	Cutting tools (2)	Struck by a moving vehicle (1)
Operator/maintenance	Machine transportation (1)	Struck by a moving vehicle (3), machine handling (2)
Electronic operator	Machine handling (1)	
Other	Cutting tools (3)	

Table 6. *Continued*

Gender/occupation	Circumstances/cause	
	Informal job contract	Formal job contract
Retail		
Salesperson	Fall from a vehicle (1), struck by a moving vehicle (1), cutting tools (2), contact with hot surfaces (2)	Cutting tools (1), overextension (1)
Cashier		Fall (1)
Waiter	Struck by a moving vehicle (1), contact with chemical substance (1)	
Supervisor	Fall from a vehicle (1)	
Stock handler		Cutting tools (1)
Administrative assistant		Fall (1)
Telephone operator	Fall (1)	
Transport		
Dispatcher	Squeezed by machinery (1)	
Motorcycle courier	Struck by a moving vehicle (1)	Struck by a moving vehicle (2)
Other		
Hairdresser	Fall (1)	
Priest	Fall (1)	
Teacher		Fall from a vehicle (1)
Communications operator		Cutting tools (1)
Butcher		Cutting tools (1)
Driver		Contact with hot substance (1), overextension (1)
Security guard		Chemical substance (1)
Print operator		Machine handling (1)
Artist	Fall from a vehicle (1), cutting tools (1)	
Artisan	Cutting tools (1)	

[a]Data on circumstance/cause for 40 individuals were missing.

with those with formal jobs, although the difference was not statistically significant. In addition, women with informal job contracts were more likely to report work accidents than those having formal contracts when they had a medium level education (high school), did not perceive their job as dangerous or had no job training. No substantial differences between formal and informal workers were found among men, however. Although few statistically significant differences in injury risk between formal and informal workers were observed, the numbers of workers in many groups were small, limiting the power of the study.

The measure of injury occurrence utilized in this study, the annual incidence of non-fatal work injuries per 100 full-time workers a year requires an estimate of hours of work, which is typically not recorded and can be difficult to assess in research. The scarcity of studies using such person-time data limits comparison with other findings. These results are close to the estimated cumulative incidence of 5.0% a year reported by Frumkim and Câmara (1991) for the entire population of Brazil, and a little higher than the estimate of 4.24% for the same age group in the state of São Paulo in a previous study using a similar methodology (Barata and Ribeiro, 2000). Manufacturing workers are widely known to have an increased risk of work accidents relative to other trades, but the estimates in this study are similar to the 5.6/100 person-yr reported for workers in a steel plant in Minas Gerais (Schoemaker and Barreto, 2000).

Comparisons with other countries are also limited, because surveys looking at non-fatal injuries are rare. Much research is based on secondary analysis of databases created for different purposes and of different natures, coverage and quality. Nevertheless, data from emergency departments in US hospitals indicated an incidence of 2.9/100 FTE/yr for individuals over 15 years of age, corresponding to 3.4/100 FTE/yr among men and 2.1/100 FTE/yr for women (CDC, 1998). The rates reported in this study are lower than those reported in a study from Costa Rica (Wesseling *et al.*, 2001), but that study included pesticide poisoning and the population was rural, where work accidents are known to be more frequent. In a study carried out in Zimbabwe, the estimated frequency of work accidents was higher, 13.1%, but the study population was both rural and urban and the

social and economic contexts are quite different from urban Brazil (Loewenson, 1998).

In contrast to the majority of the results reported in a review by Quinlan *et al.* (2001) on the health consequences of precarious work arrangements, no statistically significant association was found between informal jobs, a precarious form of labor market participation, and non-fatal work accidents, for women or men. Similar results were reported in other surveys conducted in the state of São Paulo (Barata and Ribeiro *et al.*, 2000) and in the metropolitan area of Aracaju (Dantas and Santana, 2002), both in Brazil. This negative finding may be a result of real similarities in work conditions in the informal and formal sectors in Brazil, where poor enforcement of labor legislation is widespread. Formally hired workers may also be holding precarious jobs, a possibility that points to the need to look at an improvement in work conditions for formal as well as informal workers. The weak influence of the type of labor contract on injury incidence could also be a result of increased under-reporting of work accidents among informal workers compared with formal workers, which may exist because of the compensatory perspective on work accidents among formal workers. In a Finnish study, workers having contingent employment, another form of precarious job status, showed better self-rated health and a lower sickness absence rate than permanent workers (Virtanen *et al.*, 2001), which was explained as the result of differences in the threshold for taking sick leave or working even when sick, a behavior likely to occur among workers who fear losing their jobs. This phenomenon may also exist in Brazil, where unemployment is high and competition for jobs in both the formal and informal sectors is substantial.

It is obvious that the ability to consider some occupational injury risk factors related to work processes, technologies, design of the work environment and safety level were limited in this study because of its exploratory nature and the wide range of job titles and trades involved. Nevertheless, sociodemographic, family and occupational characteristics may give clues that underscore important macrosocial aspects that are relevant to prevention. This study showed the importance of occupational training and risk awareness for the association of informal job contracts and work accidents. Nevertheless, distinct from other studies (Loewenson, 1998; Barata and Ribeiro *et al.*, 2000), younger age was not associated with increased risk of occupational injuries according to gender or type of job contract.

The failure to observe statistically significant associations of injury risk with informal work among men may be a consequence of the increased job-related risks thought to be more common in male-dominated occupations. Greater under-reporting of work injuries may also occur among men, relative to women, who are often reported as having an increased perception and promptness to speak out about health problems, compared with men (Santana *et al.*, 1997a). From this perspective, it is possible that studies that show men at higher risk of occupational accidents are indeed affected by selection bias because women are more likely to have informal job contracts. When informal workers were included in the study population, gender differences tend to disappear. These results need to be looked at with caution considering the previously mentioned tendency of women to be better informants of health-related events. It is worth noting that, in this study, detailed narratives were registered for each injured worker, as well as information about medical treatment received, procedures that should reduce overestimation of health events.

In occupational epidemiology, general population studies are traditionally conducted with secondary data obtained from official records, despite concerns about poor quality and limited coverage (Leigh *et al.*, 1997; Mital *et al.*, 1999; Wünsch-Filho, 1999). These difficulties are greater in regions where unregistered jobs account for half of the labor force, as in Brazil, and there is no information system that allows access to appropriate occupation-specific population denominators. In addition, health problems of occupational origin are not recognized or adequately registered in health services or work places (Santana *et al.*, 2002). In Brazil, it is possible that with the recent integration of workers' health actions into the scope of the Healthy Family Program, a new strategy of prevention and health promotion that covers informal workers will be implemented (Ministério da Saúde, 2001).

The purpose of this study was exploratory and limited to raising hypotheses. The community-based cross-sectional design is not traditional in occupational injury research, but in the Brazilian context it is the only feasible strategy to obtain reliable estimates of this important public health problem. Informal workers are largely neglected in both official statistics and traditional, industry-based epidemiologic studies. Population-based studies on workers' health are also affected by the dispersion of individuals among a large number of occupations, which tends to limit power. Nevertheless, these studies have the advantage that they represent an existing epidemiological profile of the workforce, which allows the identification of occupational groups that can be studied in more detail with other methodologies. Studies using secondary data and capture–recapture methods or focusing on health care services, such as hospital emergency departments, may help to draw a more complete picture of work injuries in scenarios where informal jobs are common and form a basis to develop well-tailored surveillance models, such as the strategy of sentinel areas (Santana, 2002).

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REFERENCES

Barata R, Ribeiro MC. (1998) Pesquisa Condições de Vida—1994: componente acidentes de trabalho e doenças profissionais. São Paulo: SEADE. p. 62.

Barata R, Ribeiro MC. (2000) Acidentes de trabalho referidos por trabalhadores moradores em área urbana no interior de São Paulo em 1994. Informe Epidemiológico SUS; 9: 199–210.

Biddle EA, Blanciforti LA. (1999) Impact of changing US workforce on the occupational injury and illness experience. Am J Ind Med; (Suppl.): 7–10.

Cacciamali M. (1997) O mercado de trabalho no Brasil: o aumento da informalidade nos anos 90. Notas sobre o processo de informalização no mercado de trabalho no contexto da globalização. In Seminário o trabalho informal revisitado. Brasilia: Instituto de Pesquisa Econômica Aplicada.

CDC. (1998) Surveillance for nonfatal occupational injuries treated in hospital emergency departments—United States, 1996. J Am Med Assoc; 279: 1601–2.

Dantas R, Santana V. (2002) Acidentes de trabalho e o setor informal da economia em Aracaju, Sergipe, Brazil. In Seminário nacional sobre estatisticas em acidentes de trabalho e o setor informal da economia. São Paulo: Fundacentro.

Fassa A. (2000) Trabalho infantil e saúde: o perfil ocupacional e sintomas musculoesqueléticos. Doctoral thesis, Universidade Federal de Pelotas, Pelotas, Brazil.

Frumkim H, Câmara V. (1991) Occupational and health safety in Brazil. Am J Public Health; 81: 1619–24.

Hagberg M, Christiani D, Courtney TK, Halperin W, Leamon TB, Smith TB. (1997) Conceptual and definitional issues in occupational injury epidemiology. Am J Ind Med; 32: 106–15.

IBGE. (1999) Pesquisa nacional por amostragem de domicílios, PNAD—síntese de indicadores, 1998. Rio de Janeiro: Departamento de Emprego e Rendimento.

Leigh JP, Markowitz SB, Fahs MC, Shin C, Landrigan PJ. (1997) Occupational injury and illness in the United States: estimates of costs, morbidity, and mortality. Arch Intern Med; 157: 1557–68.

Loewenson RH. (1998) Health impact of occupational risks in the informal sector in Zimbabwe. Int J Occup Environ Health; 4: 264–74.

Ministério da Saúde. (2001) Plano de ação em saúde do trabalhador. Brasília: Ministério da Saúde. p. 46.

Ministério do Trabalho e Emprego. (2000) Estatísticas sobre acidentes de trabalho. Brasília: Ministério do Trabalho e Emprego.

Mital A, Pennathur A, Kansal A. (1999) Nonfatal occupational injuries in the United States. Part I. Overall trends and data summaries. Int J Ind Ergonomics; 25: 109–29.

Pastore J. (1999) A dimensão econômica dos acidentes e doenças do trabalho. Campanha da indústria para a prevenção dos acidentes de trabalho. Brasília: Universidade de São Paulo.

Quinlan MC, Mayhew C, Bohle P. (2001) The global expansion of precarious employment, work disorganization, and consequences for occupational health: a review of recent research. Int J Health Serv; 31: 335–413.

Santana V. (2002) Morbidade por acidentes de trabalho não fatais em uma área urbana do Brasil. In Salim C, Carvalho L, editors. Saúde e segurança no ambiente de trabalho: contextos e vertentes. Belo Horizonte: Segrac Ed. and Gráfica Ltda.

Santana V, Almeida-Filho N, Rocha C, Matos A. (1997a) Confiabilidade e viés do informante secundário na pesquisa epidemiológica: análise de questionário para triagem de transtornos mentais. Rev Saúde Pública; 31: 556–65.

Santana V, Loomis D, Newman B, Harlow S. (1997b) Informal jobs: another occupational hazard for women's mental health? Int J Epidemiol; 26: 1236–42.

Santana V, Itaparica M, Amorim A, Araújo-Filho J, Araújo G, Oliveira M, Cooper S. (2002) Acidentes de trabalho não fatais entre adolescentes. Rev Saúde Pública; 6: 425–56.

SAS Inc. (1998) The SAS system. Cary, NC: SAS Inc.

Schoemaker MJ, Barreto S. (2000) Non-fatal work related injuries in a cohort of Brasilian steelworkers. Occup Environ Med; 57: 555–62.

Stockes MS, Davis CS, Kock GG. (2000) Categorical data analysis using the SAS system. Cary, NC: SAS Inc.

Virtanen M, Kivimäki M, Elovainio M, Vahtera J, Cooper CL. (2001) Contingent employment, health and sickness absence. Scand J Work Environ Health; 27: 65–372.

Wesseling C, De Joode B, Monge P. (2001) Pesticide-related illness and injuries among banana-workers in Costa Rica: a comparison between 1993–1996. Int J Occup Environ Health; 7: 90–7.

Wünsch-Filho V. (1999) Reestruturação produtiva e acidentes de trabalho no Brasil: estrutura e tendências. Cadernos Saúde Pública; 15: 41–51.