

# Occupational accidents among middle and high school students of the state of São Paulo, Brazil

## Acidentes do trabalho em estudantes do ensino fundamental e médio do Estado de São Paulo

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### Keywords

Accidents, occupational. Adolescence. Students. Child labor. Prevalence. Risk factors. Rural area.

### Descritores

Acidentes de trabalho. Adolescência. Estudantes. Trabalho de menores. Prevalência. Fatores de risco. Área rural.

### Abstract

#### Objectives

To estimate the prevalence of occupational injuries and identify their risk factors among students in two municipalities.

#### Methods

A cross-sectional survey was conducted in public schools of the municipalities of Santo Antonio do Pinhal and Monteiro Lobato, Brazil. A stratified probabilistic sample was drawn from public middle and high schools of the study municipalities. A total of 781 students aged 11 to 19 years participated in the study. Students attending middle and high school answered a comprehensive questionnaire on living and working conditions, as well as aspects of work injuries, and health conditions. Multiple logistic regression models were fitted to estimate risk factors of previous and present occupational injuries.

#### Results

Of 781 students, 604 previously had or currently have jobs and 47% reported previous injuries. Among current workers (n=555), 38% reported injuries on their current job. Risk factors for work injuries with statistically significant odds ratio >2.0 included attending evening school, working as a housekeeper, waiter or brickmaker, and with potentially dangerous machines.

#### Conclusions

The study results reinforce the need of restricting adolescent work and support communities to implement social promotion programs.

### Resumo

#### Objetivos

Estimar a prevalência de acidentes de trabalho entre estudantes adolescentes em área urbana e identificar os fatores de risco de ocorrência dos acidentes de trabalho.

#### Métodos

Um estudo transversal foi conduzido nas escolas públicas de ensino fundamental e médio, das cidades de Santo Antonio do Pinhal e Monteiro Lobato, Estado de São Paulo. Foi realizada uma amostra probabilística estratificada em duas escolas públicas

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*de ensino médio de cada uma das duas cidades pesquisadas. O total da população pesquisada foi de 781 estudantes, de 11 a 19 anos de idade. Os estudantes responderam um questionário sobre condições de vida e trabalho, incluindo as características dos acidentes de trabalho ocorridos e problemas de saúde. Foram estimados os fatores de riscos para a ocorrência de acidentes no trabalho, do passado e do presente, usando modelos de regressão logística múltipla.*

#### **Resultados**

*Dos 781 estudantes que participaram da pesquisa, 604 relataram ter experiência de trabalho. Destes, 47% relataram já ter sofrido acidentes. Entre aqueles que, no período de coleta de dados, estavam trabalhando (n=555), 38% afirmaram ter sofrido acidentes no posto que ocupavam naquele momento. Os fatores de risco para a ocorrência de acidentes de trabalho, que apresentaram razão de chances acima de 2,0, foram: estudar no período vespertino, exercer funções de empregado(a) doméstico(a), garçom ou oleiro, e trabalhar com objetos e máquinas perigosas.*

#### **Conclusões**

*Os resultados mostram a necessidade de restringir o trabalho de adolescentes, dando apoio às comunidades na implementação de programas de desenvolvimento social.*

## INTRODUCTION

Work, whether paid or unpaid, is a common activity of adolescence. Despite positive aspects of work such as development of responsibility, acquiring new skills, and economic opportunities, there is substantial and growing evidence of detrimental aspects of early work, including negative consequences on educational performance and attendance, and on health.<sup>6,7,14,19</sup> Adolescents may be more susceptible to injury at work than adults, not only because of their lack of experience and training, but also because of their anthropometric measures and physical, social and psychological development.<sup>13</sup> Although injury is a major cause of morbidity and mortality, rarely work is noted as a contributing cause.<sup>7,12</sup>

Brazilian law prohibits minors under 18 years old to work at night and in dangerous or unhealthy conditions; minors under 16 are completely forbidden to work, except for apprenticeships starting at the age of 14 years.<sup>4</sup> Despite legal prohibitions, work among children and adolescents is widespread in Brazil, and few studies have investigated the health consequences of early work. It is estimated that two million adolescents currently work in Brazil.<sup>8</sup> A study conducted by the Centro de Referência em Saúde do Trabalhador (Reference Center of Workers' Health) in the city of São Paulo, evaluating occupational injuries in the northern zone of the city from 1989 to 1991, revealed 1,074 work injuries among workers from 11 to 17 years old. There were 7 deaths and 14 cases of finger amputations. The industrial sector was responsible for the highest percentage of injuries (41%), followed by commerce (20%) and services (13%).<sup>1</sup> Westphal<sup>19</sup> described life and work conditions of minors in shoe factories in

Franca (town in the northern part of the state of São Paulo) who work at home, and are exposed to toxic chemicals and other harmful products. However, there are no published studies of health consequences involving children and adolescents in Brazil who both work and attend school.

The major aims of this study were to estimate the prevalence of occupational injuries, and to identify risk factors related to the occurrence of occupational injuries among middle and high school students (ages 11-19 years) attending public schools in two municipalities in Brazil.

## METHODS

A cross-sectional survey was conducted at four middle and high school public schools of two municipalities of the state of São Paulo, Brazil.

Stratified probabilistic sampling was carried out in two public schools in each of the study cities, Santo Antonio do Pinhal (total population: approximately 5,000) and Monteiro Lobato (total population: approximately 4,000). The sample was randomly selected and stratified by city, school, time of day in school (morning, afternoon or night), grade, classroom and gender. The probabilistic sample comprised approximately half of all students in all public schools in the two towns.

The sample size for each town was estimated assuming a minimum prevalence of 50% working students, and a total width of confidence interval of 10%, and  $\alpha=5\%$ . In this situation there was a need of 384 participants in each town, totalizing 768 students. In a previous survey conducted in both towns, it was

observed that selecting 50% of the students in each classroom, and each school (total of 4 schools), and using a stratified random sample as mentioned above, the sample size would be 862 students. This would allow losses up to 12%. In the study losses were 9%.

A comprehensive questionnaire on living and working conditions, including information on work injuries and health conditions was previously submitted to 30 students for pre-testing. These students did not answer the final version of the questionnaire. The final version was answered by 781 students, either working or not, from March to May 1999.

Work was defined as all systematic activities, permanent or temporary, paid or not, on behalf of third persons or entities, during weekdays or weekends, full or part-time.

Associations among variables were initially tested using c2 with Yeats correction, followed by multiple logistic regression to examine risk factors for occupational injuries. Stepwise forward selection was used

for the regression modeling. A 5% level of significance was used in all analyses.

Separate models were fitted based on two dependent variables: previous occupational injuries and being injured during current work. In the first case there were considered students (n=604) who previously had jobs or currently have jobs, and suffered previous occupational injuries. In the second model, those students who currently have jobs (n=555) and were injured in the present job. Though very similar, these variables indicated distinct time periods for injury occurrence: in the past (previous work injuries) and at present time (injuries during present work).

Of 1,472 students listed in both towns (808 in Santo Antonio do Pinhal and 664 in Monteiro Lobato), 862 were selected for the study. Of these, 781 (91% response rate) were present on the day of the survey and agreed to participate. Seventy-eight were absent, dropped out or transferred, and 3 refused to participate. There were 432 participating students enrolled in the two public schools of Santo

**Table 1** - Independent risk factors for injury in the previous work, adjusted by age and gender.

Variable Category	Sample size*	% of students who reported injuries	Adj. OR	CI 95% (adj. OR)	p**
Time of day in school					
Morning	204	43	1.00		
<b>Afternoon</b>	<b>214</b>	<b>59</b>	<b>2.00</b>	<b>[1.28; 3.12]</b>	<b>0.002</b>
Night	186	38	1.02	[0.56; 1.86]	0.937
Job					
Other	92	33	1.00		
<b>Domestic servant</b>	<b>262</b>	<b>48</b>	<b>2.22</b>	<b>[1.21; 4.06]</b>	<b>0.010</b>
Farmer	65	49	1.15	[0.54; 2.44]	0.724
Cattle feeder	20	60	1.77	[0.60; 5.23]	0.304
Salesperson	37	35	1.20	[0.51; 2.86]	0.676
Herdsman	11	73	3.54	[0.80; 15.60]	0.095
Gardener	12	58	1.72	[0.44; 6.66]	0.435
Waiter	11	64	2.96	[0.74; 11.92]	0.126
Brick maker/tiler***	10	80	4.24	[0.78; 23.00]	0.094
Bricklayer	16	62	1.74	[0.50; 6.04]	0.386
Helper	18	56	1.84	[0.61; 5.55]	0.276
Dangerous objects and machines					
No	443	43	1.00		
<b>Yes</b>	<b>107</b>	<b>67</b>	<b>2.02</b>	<b>[1.21; 3.39]</b>	<b>0.007</b>
Aching body					
No	275	43	1.00		
<b>Yes</b>	<b>142</b>	<b>56</b>	<b>1.59</b>	<b>[1.06; 2.39]</b>	<b>0.025</b>
Safety equipment					
No	445	44	1.00		
<b>Yes</b>	<b>119</b>	<b>61</b>	<b>1.59</b>	<b>[0.99; 2.56]</b>	<b>0.056</b>
Heat					
No	211	39	1.00		
<b>Yes</b>	<b>340</b>	<b>53</b>	<b>1.49</b>	<b>[1.01; 2.20]</b>	<b>0.045</b>
Toxic substances					
No	411	43	1.00		
<b>Yes</b>	<b>139</b>	<b>61</b>	<b>1.71</b>	<b>[1.09; 2.69]</b>	<b>0.020</b>
Age					
10-13	251	52	0.97	[0.44; 2.14]	0.935
14-17	283	44	0.76	[0.39; 1.50]	0.435
18-20	66	45	1.0		
Gender					
<b>Male</b>	<b>291</b>	<b>54</b>	<b>1.85</b>	<b>[1.13; 3.04]</b>	<b>0.015</b>
Female	313	41	1.00		

\*42 referred were unemployed. The missing data were excluded.

\*\*p: Wald test.

\*\*\*brickmaker/tiler: brick and tile maker, piling up bricks, preparing clay.

OR: odds ratio.

Antonio do Pinhal and 349 in the two public schools of Monteiro Lobato.

## RESULTS

### Frequency of risk factors for previous work injuries

Of the total sample (781), 604 (77.3%) had jobs at the time of the study or had it in the past. Of these, 399 were middle school students and 205 were high school students. Among those currently and previously working students, 47% (286) had suffered injuries in previous jobs - 53% (212) among middle school and 36% (74) among high school workers.

Work injuries were of several types and severity. The least serious injuries included finger wounds, mild hand burns, skin scratches by thorns; the most serious injuries included falls from a scaffold, tree, or roof, resulting in broken legs or arms, or sprained ankles. Other injuries were horse or cow kicks, animal stings or bites, and pesticide poisoning. Previous work injuries were often caused at home. Girls, more often than boys, had a higher risk of exposure. Domestic injuries were more often reported as condi-

tions, such as back pain instead of an acute event. These events occurred mainly while cooking, handling clothes and house cleaning.

There is no difference of prevalence of occupational injuries according to town (47% for both: OR=1.01;  $p=0.961$ ).

Table 1 presents the multivariate logistic analysis examining independent risk factors for injuries in previous jobs. Being male, attending evening school, working as a housekeeper, handling toxic substances or potentially dangerous tools or machines and using safety equipment, in hot environments, and having body pains were risk factors statistically associated with work injuries.

### Frequency of risk factors for injuries in current job

Of the total participants (781), 555 students (71.0%) reported having a current job. Among those working students, 212 (38%) reported being injured in the present job [166 (44%) were middle school students and 46 (26%) were high school students]. Table 2 presents the independent risk factors for

**Table 2** - Independent risk factors for injury in the present job, adjusted by age and gender.

Variable Category	Sample size*	% of students who reported injuries	adj. OR	IC 95% (adj. OR)	p**
Time of day in school					
Morning	184	34	1.00		
<b>Afternoon</b>	<b>201</b>	<b>52</b>	<b>2.22</b>	<b>[1.40; 3.51]</b>	<b>0.001</b>
Night	170	26	1.10	[0.58; 2.08]	0.775
Age started working					
<b>Under 11 years</b>	<b>284</b>	<b>47</b>	<b>1.65</b>	<b>[1.02; 2.68]</b>	<b>0.042</b>
12 years or more	265	29	1.00		
Job					
Other	92	22	1.00		
<b>Domestic servant</b>	<b>262</b>	<b>41</b>	<b>2.30</b>	<b>[1.16; 4.55]</b>	<b>0.017</b>
Farmer	65	35	0.98	[0.43; 2.24]	0.968
Cattle feeder	20	55	1.88	[0.61; 5.75]	0.271
Salesperson	37	30	1.84	[0.73; 4.67]	0.197
Herdsmen	11	54	2.84	[0.70; 11.58]	0.145
Gardener	12	33	1.18	[0.26; 5.32]	0.825
Waiter	<b>11</b>	<b>54</b>	<b>4.27</b>	<b>[1.08; 6.87]</b>	<b>0.038</b>
Brickmaker/tiler***	<b>10</b>	<b>80</b>	<b>7.00</b>	<b>[1.26; 8.97]</b>	<b>0.026</b>
Bricklayer	16	44	1.33	[0.37; 4.84]	0.663
Helper	18	44	2.10	[0.68; 6.49]	0.198
Dangerous objects and machines					
No	443	34	1.00		
<b>Yes</b>	<b>107</b>	<b>59</b>	<b>2.21</b>	<b>[1.31; 3.75]</b>	<b>0.003</b>
Physical effort					
No	433	35	1.00		
<b>Yes</b>	<b>119</b>	<b>50</b>	<b>1.71</b>	<b>[1.04; 2.80]</b>	<b>0.034</b>
Toxic substances					
No	411	34	1.00		
<b>Yes</b>	<b>139</b>	<b>53</b>	<b>1.92</b>	<b>[1.22; 3.04]</b>	<b>0.005</b>
Age					
10 — 13	233	44	1.13	[0.49; 2.64]	0.769
14 — 17	259	34	1.02	[0.49; 2.13]	0.965
18 — 20	60	33	1.00		
Gender					
<b>Male</b>	<b>255</b>	<b>42</b>	<b>1.80</b>	<b>[1.07; 3.01]</b>	<b>0.026</b>
Female	300	38	1.00		

\*The missing data were excluded.

\*\*p: Wald test describing level.

\*\*\*brickmaker/tiler: brick and tile maker, piling up bricks, preparing clay.

being injured in the present job. Being male, attending evening school, working as a housekeeper, waiter or brick maker, and starting to work under the age 11 were significant risk factors for injuries associated to their current job. Handling dangerous objects and machines, toxic substances, and high physical job demands were all additional significant risk factors related to hazardous exposures in the work environment.

## DISCUSSION

This study documents that more than three-fourths middle and high school students of these two municipalities of São Paulo, Brazil, work while also attending school. Although work under the age 16 and unhealthy and dangerous work is forbidden to minors under 18 years old in Brazil, it was found adolescents in these jobs. Further, this study underestimates the prevalence of work and work-related injuries in adolescents in the study towns because children who do not attend school were not included.

The results show an alarming situation: 47% of the working students stated they had experienced a previous work injury and nearly 40% reported a work-related injury on their current job. Risk factors for work-related injuries in these adolescents in their current or previous jobs included being male, attending evening school, working as housekeeper, waiter, brick maker, and complaining of body pains. Work conditions with higher risks were thermal discomfort (heat), working with potentially dangerous machines and equipment, use of toxic products, and jobs demanding physical efforts. The presence of safety equipment did not prevent occurrence of work injuries. It is likely that jobs with safety equipment were more hazardous ones, and either young workers did not use them or used them incorrectly. Working as a waiter was a risk factor for previous work injuries in the study. Restaurant work among young workers has also been noted as hazardous in a number of U.S. studies.<sup>10,11</sup>

In the study, boys had more severe work injuries than girls. Girls' injuries were mainly associated with domestic work, while those from boys were associated with rural activities, cattle or brick making. Girls, however, reported body pains more often than boys. Children work usually does not comprise working at home, since this is an unpaid job, especially among girls who see housekeeping or babysitting younger

brothers and sisters as a family obligation, limiting their educational and future professional opportunities. Further, back pain in particular is of concern in adolescence, and may place these young workers at greater risk for future musculoskeletal problems. Risks of severe and even fatal injuries occur most frequently among boys rather than girls,<sup>2,3,5,6,10,18</sup> indicating different types of employment activities and possibly job demands.<sup>6,18</sup> In this study, data regarding fatal injuries were not collected.

The qualitative description of mental and physical stress associated with work was reported by Sato<sup>16</sup> and in a companion study conducted by the authors based on individual interviews. Adolescents reported demanding work experience and having pain, fatigue and stress.

There is growing scientific literature documenting the magnitude and severity of injuries of working youth in the United States<sup>3,5,10</sup> and worldwide,<sup>7,17</sup> and the often unlawful circumstances of their employment.<sup>7,15</sup> Recognizing the need to address the issue of child and adolescent work, Brazil has taken several promising steps. In 1997, the state of São Paulo enacted a law barring companies that employ child labor from bidding on public contracts, and the "*Ministério de Assistência e Promoção Social*" (Brazilian Ministry of Welfare and Social Security) sponsored the Eradication of Child Labor program consistent with the International Labor Office.<sup>12</sup>

However, based on the results of this and other studies, more assertive efforts are needed.

Child and adolescent work is an international problem, and hazards associated with working youth are not limited to developing countries. The United States and other developed countries are also recognizing risks involved with early work, and researchers recommend strengthening of child labor laws.<sup>9</sup> Adolescents in Brazil often work in non-traditional or informal work settings, making surveillance of occupational injuries problematic and underreported. Long working hours and attending school are not a healthy association. The frequency and severity of occupational injuries reinforces the need to intervene in the communities, restricting work hours, encouraging school attendance, implementing social promotion programs and social support to allow the progressive phasing out of child and adolescent work in the types of jobs and settings many minors work today.

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