ORIGINAL ARTICLE

Occupational injuries identified by an emergency department based injury surveillance system in Nicaragua

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Injury Prevention 2004;10:227-232. doi: 10.1136/ip.2004.005165

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Objectives: To identify and describe the work related injuries in both the formal and informal work sectors captured in an emergency department based injury surveillance system in Managua, Nicaragua.

Setting: Urban emergency department in Managua, Nicaragua serving 200-300 patients per day.

Methods: Secondary analysis from the surveillance system data. All cases indicating an injury while working and seen for treatment at the emergency department between 1 August 2001 and 31 July 2002 were included. There was no exclusion based on place of occurrence (home, work, school), age, or gender.

Results: There were 3801 work related injuries identified which accounted for 18.6% of the total 20 425 injuries captured by the surveillance system. Twenty seven work related fatalities were recorded, compared with the 1998 International Labor Organization statistic of 25 occupational fatalities for all of Nicaragua. Injuries occurring outside of a formal work location accounted for more than 60% of the work related injuries. Almost half of these occurred at home, while 19% occurred on the street. The leading mechanisms for work related injuries were falls (30%), blunt objects (28%), and stabs/cuts (23%). Falls were by far the most severe mechanism in the study, causing 37% of the work related deaths and more than half of the fractures.

Conclusions: Occupational injuries are grossly underreported in Nicaragua. This study demonstrated that an emergency department can be a data source for work related injuries in developing countries because it captures both the formal and informal workforce injuries. Fall prevention initiatives could significantly reduce the magnitude and severity of occupational injuries in Managua, Nicaragua.

Annually throughout the world, an estimated 250 million people suffer occupational injuries and 300 000 die from their injuries.¹ The heaviest toll of occupational injuries is in the developing world where the greatest concentration of the world's workforce is located. In these countries, many people work in hazardous industries such as agriculture, logging, and mining that are not governed by any safety standards or regulations.¹⁻³ The estimated economic loss caused by occupational injuries and diseases is equivalent to 4% of the world's gross national product.³

The workforce can be broadly categorized as either formal or informal. The formal sector typically includes workers who are employed on a regular basis for salary; and the majority of them appear in employment and other administrative databases. The International Labor Organization (ILO) defines the informal sector as three broad groups: "owner-employers of microenterprises, which employ few paid workers; own-account workers, who own and operate one-person business and dependant workers; paid and unpaid, including unpaid family workers, contract labor and home-workers".⁴ These groups "for the most part are unregulated and unrecorded in official statistics, with little access to organized markets, formal credit and training or public services and amenities".⁵ Worldwide, occupational injury statistics are derived from workers covered by governmental bureaus of social security or labor insurance, thus they are more likely to reflect the formal rather than the informal sectors.^{2,4} With less than 10% of the formal sector in the developing world receiving health coverage; generally the available data sources grossly underestimate the burden of occupational injury in these countries.^{2,5,6}

In Nicaragua (population five million), only 17% of the 1.8 million economically active population receives social

security/labor insurance coverage.⁷ Forty five percent of the country's gross domestic product comes from the service industry, 31% from agriculture, and 22.9% from industry.⁸

Surveillance of work related injuries in developing countries is increasingly more difficult due to the rapid expansion of the informal work sector caused by economic globalization.⁹⁻¹² For example, in the urban areas of Nicaragua, 76% of women and 55% of men work in the informal sector.¹³ Because this sector is marginalized, there are no mechanisms to measure the magnitude or nature of risk factors, and as a result, the burden of occupational injuries and their mechanisms remains unknown.

The purpose of this study was to identify and describe the work related injuries in both the formal and informal work sectors in Managua, Nicaragua. Because of the limitations of official labor statistics, we used an emergency department based injury surveillance system.

METHODS

Study design and location

This study was a secondary analysis of data collected from an emergency department based injury surveillance system implemented in 2001 collaboratively by the Nicaraguan Ministry of Health, the Pan American Health Organization and the Centers for Disease Control and Prevention (CDC). The study data were from one participating emergency department, at the Hospital Escuela Antonio Lenin Fonseca (HEALF), located in capital city of Managua (population 959 000), Nicaragua. HEALF is the national referral center for

Abbreviations: CDC, Centers for Disease Control and Prevention; HEALF, Hospital Escuela Antonio Lenin Fonseca; ILO, International Labor Organization

trauma and the emergency department serves 200–300 patients a day.

Study population and data collection

All persons sustaining a work related injury and who were seen at HEALF emergency department between 1 August 2001 and 31 July 2002 were included in the analysis. All injured patients entering the emergency department had a two page intake form completed by the doctor which was based on the World Health Organization/CDC injury surveillance guidelines.¹⁴ The form consists of 18 data elements (box 1) in a check off format which includes an injury severity score. The work relatedness of an injury was assumed if the patient was recorded “injured while working” on the injury intake form. Both intentional and unintentional work related injuries (first time visit only) were included in the study, and there was no exclusion based on place of occurrence (home, work, school) age or gender. The general injury event data and specific information on traffic injuries, assaults, and self inflicted injuries were recorded.

Every 24 hours the surveys were collected and reviewed in the epidemiology office by a head nurse. Incomplete surveys (20%) were returned to the emergency department medical director, who obtained the missing data. Once completed, the forms were sent to the statistical department where the data were entered into the database using Epi-Info (version 2000, CDC). This study was granted an exemption from review by the University of Washington institutional review board.

Employment categories

Job titles of the subjects were identified and grouped into the following employment categories: home based worker, farm worker, construction, transport operator, sales, public/personal services, manufacturing, finance and business, underemployed, and undetermined. Proportions were calculated (table 1). We attempted to categorize by occupation when possible for more specific analysis of potential risk factors. The categories were modeled after established occupational or industrial groups in labor statistics except for home based worker and underemployed.^{15 16}

The *home based worker* category was used to describe the job title “Ama de casa”, which translates literally as “housewife”. In developing countries, the home based workforce is a large part of the informal sector and consists of women whose work is usually linked to home based enterprises which are interwoven into their domestic duties.^{5 10 12} For the purpose of this study, “Ama de casa” was categorized as home based worker.

Underemployed categorized those whose occupations were either “students” or “unemployed”, yet they reported their injury occurred while working. These two categories, home based worker and underemployed, often are in the informal sector in developing countries and therefore are not part of a particular industry.^{5 12}

RESULTS

Demographic data

Of the 20 425 injuries captured by the surveillance system during the 12 month study period, 3801 (18.6%) were identified as work related. Twenty seven work related fatalities were recorded accounting for 10% of all fatalities recorded in the surveillance system during the study period. The majority of the patients were male (69%). The mean (SD) age at injury was 34 (16.4) years). More than three quarters of the work related injured were 10–44 years old.

Location of occurrence

Injuries occurred outside a formal work location for more than 60% of the cases. Almost half of these occurred at home,

Box 1: Data elements, Nicaraguan injury survey form, used in the analysis of work related injuries, HEALF emergency department based injury surveillance system, Managua, Nicaragua, 2001–02

Sociodemographic data

- Age.
- Sex.
- Occupation: free text answer.

General injury data

- Intention of the injury (unintentional, intentional, or self inflicted).
- Activity or what the person was doing when injured (for example, work, sports).
- Location where the injury occurred (for example, street, home, work).
- Object that caused the injury (for example, person, knife, animal).
- Mechanism of injury (for example, traffic injury, fall, blunt force).

Specific injury modules

1. Road traffic injury
 - Type of user (for example, pedestrian, driver, passenger).
 - Type of transport (for example, bicycle, truck, bus).
2. Assaults
 - Relationship of the perpetrator to the victim (for example, current or ex-partner).
 - Context (for example, fight, robbery, drug related).
3. Self inflicted
 - Precipitating factors (for example, conflict with family, financial problems).

Outcomes

- Nature of the injury (for example, fracture, burn).
- Severity (mild = superficial, moderate = sutures/fractures, severe = surgery/intensive care unit).
- Disposition (for example, treated/released, admitted, died).

while 19% occurred on the street (table 2). Both sexes were more likely to be injured outside of a formal work location. This was especially true for females, 76% of whom were injured in the home. Injuries to 15–44 year olds occurred equally at work (40%) and at home (39%), whereas in all other age categories the injuries occurred primarily (>50%) in the home.

Description of work related injuries

Home based worker and public/personal services workers had the greatest number of work related injury events, accounting for 46% of the overall injuries in the employment categories (table 3). The third largest employment category for work related injuries was underemployed (17%). Eighty percent of the injuries were due to falls, blunt force trauma, and stabs/cuts (table 3). Severity of injuries (see box 1: severity scale) were mostly mild to moderate (91%) with farm worker category having the highest percentage of severe injuries (10%).

Table 1 Employment categories, criteria/definition, and frequency of study sample (n = 3678), HEALF emergency department based injury surveillance system, Managua, Nicaragua, 2001–02

Category	Criteria/definition	No (%)
Home based worker	All responses recorded as "Ama de casa"	772 (21)
Farm worker	Working in the fields or with cattle	211 (6)
Construction	Working in construction industry—for example, mason, painters, carpenters, and occupations recorded as "construction"	439 (12)
Transport operators	Only occupations on the road—for example, car, taxi, bus drivers, and driver assistants	254 (7)
Sales occupations	Purchase and sale of goods in stores, restaurants, warehouses	279 (8)
Public/personal services	Personal services, business services, auto repair, health and educational services, public service	836 (23)
Manufacturing	Making durable and non-durable goods and occupations recorded as "machine operator"	108 (3)
Finance, business	Lawyer, business administrators/owners, professional engineers, self employed	107 (3)
Underemployed	"None" reported but documented activity while injured was "working", all "students", and "retired"	617 (17)
Undetermined	All responses with incomplete or misspelled occupations or recorded only as "helper or assistant" or "don't know"	55 (2)

Surveys missing occupation = 123.

Falls

Falls were the leading mechanism of injury, representing almost 30% of the total injuries (table 3). Falls occurred most in home based workers (393/1052 = 37%), followed by the public/personal services category (200/1052 = 19%). Additionally, 15% (154/1052) of falls were recorded in the underemployed category and 12% (121/1052) in the construction category (table 3). Work related falls occurred most often in the home (62%) and with the home based worker category, causing a variety of injuries including fractures (33%), strain/sprain (23%), hematoma (15%), and cut/wound/bite (8%) (data not shown). Of the 653 work related fractures recorded in the study, 53% (n = 342) were fall related (data not shown).

An almost equal number of males (n = 584) and females (n = 510) fell, however, falls accounted for 44% of the total burden of work related injuries among females (table 4) compared with 22% for males. The largest number of work related falls were recorded in the age group 15–44 years, yet among elders (age >65) falls were responsible for more than half of the workplace injuries (table 5). Thirty seven percent of the fatalities and 10% of the hospital admissions were a result of falls (data not shown).

Blunt force

The second leading mechanism of work related injury was blunt force trauma. This occurred most commonly in services employment category (245/1000 = 25%), underemployed (170/1000 = 17%), home based worker (149/1000 = 15%), and construction (130/1000 = 12%) categories (table 3). Work related injuries by blunt force mechanism occurred most often at work (44%), in the home (35%), and in the street (20%). The vast majority of this injury mechanism was seen in males, in the 15–44 age group (tables 4 and 5).

Stab or cut

Stabs or cuts were the third leading cause for work related injuries. Over one quarter (n = 208/805) of the stab or cut

Table 2 Location of work related injury, by persons and sex, captured in HEALF emergency department based injury surveillance system, Managua, Nicaragua, 2001–02

Location	Total No (%)	No (%) males	No (%) females
Home	1664 (44)	794 (30)	870 (76)
School	7 (0.18)	5 (0.19)	2 (0.17)
Street	735 (19)	578 (22)	157 (14)
Workplace	1358 (36)	1244 (47)	114 (10)
Other/unknown	34 (2)	25 (0.95)	9 (0.78)
Total	3798 (100)	2646 (70)	1152 (30)

Missing data = 3. Numbers in parentheses are column percentages.

related injuries recorded were in the public/personal services category, 19% (163/805) in underemployed, and 16% (132/805) in construction (table 3). Only 68 and 28 stab or cut injuries were recorded in the farm worker and manufacturing categories, respectively (table 3). Stabs or cuts occurred mainly in two locations: at a workplace (49%) and at home (41%). Almost all (90%) were caused by a knife, blade, or cutting instrument and were treated and released (94%) (data not shown). Males outnumbered females four to one and 25% of the stab/cut injuries were in the 15–44 age group (tables 4 and 5).

Traffic injury

Most traffic injuries occurred in the public/personal services category (26%) and transport operators (18%) (table 3). Injuries were evenly distributed between pedestrians (30%), drivers (36%), and passengers (29%) (data not shown). Males and those ages 15–44 had the largest number of work related injury from the traffic injury mechanism (tables 4 and 5).

Intent of work related injuries

Of the work related injuries, 89% were unintentional, less than 0.1% were self inflicted, and 11% were intentional. Intentional injuries (n = 400) occurred during a quarrel or fight (n = 138), during a robbery or burglary (n = 116), and 75 injuries were related to gang activity (data not shown). In more than half of the assaults (60%) the perpetrator was unknown to the victim. Twenty three percent were friends or known persons, 6% were current or ex-partner, and 5% were family members. The major types of mechanism of intentional injury were blunt force (n = 230) and stab or cut (n = 102).

Work related mortality

Most fatalities were male (85%) and occurred during the persons' most productive years (15–44 years old). There were seven deaths in the public/personal services employment category, four in both farm worker and construction, three in each of the transport operator, sales, and underemployed categories, and two home based workers.

Most of the fatalities occurred outside a formal workplace location, which is consistent with the non-fatal injury findings in this study. Seventy percent of the fatalities occurred in the street and in the home, while 30% occurred in the workplace and "other" locale. More than a third of the work related deaths were caused by falls, followed by traffic injury (19%), and another 19% by fire/smoke/heat. Poisoning, blunt force, gunshot wound and other/unknown, collectively were responsible for the remaining seven fatalities.

DISCUSSION

The purpose of this study was to describe the burden and mechanisms of work related injuries in a developing country

Table 3 Mechanism of work related injury, by employment category, captured in HEALF emergency department based injury surveillance system, Managua, Nicaragua, 2001–02

Mechanism	Employment categories									Total
	Home based worker	Farm worker	Construction	Transport operator	Sales occupations	Public and personal services	Manufacturing	Business	Underemployed	
Traffic injury	23 (3)	20 (10)	15 (4)	51 (20)	26 (9)	71 (9)	8 (7)	16 (15)	48 (8)	278 (8)
Fall	393 (51)	47 (22)	121 (28)	41 (16)	55 (20)	200 (24)	18 (17)	23 (22)	154 (25)	1052 (29)
Other blunt force	149 (19)	44 (21)	130 (30)	96 (38)	96 (34)	245 (29)	39 (36)	31 (29)	170 (28)	1000 (28)
Stab or cut	84 (11)	68 (32)	132 (31)	37 (15)	63 (23)	208 (25)	28 (26)	22 (21)	163 (27)	805 (23)
Gunshot	4 (0.5)	3 (1)	2 (0.5)	6 (2)	5 (2)	19 (2)	2 (2)	5 (5)	17 (3)	63 (2)
Fire/smoke/heat	29 (4)	2 (1)	3 (0.7)	9 (4)	5 (2)	17 (2)	6 (6)	0	11 (2)	82 (2)
Contact with a foreign body	41 (5)	10 (5)	14 (3)	5 (2)	16 (6)	25 (3)	3 (3)	7 (7)	28 (5)	149 (4)
Poisonings	18 (2)	7 (3)	1 (0.2)	0	3 (1)	13 (2)	1 (1)	0	14 (2)	57 (2)
Other/unknown	30 (4)	10 (5)	12 (3)	5 (2)	10 (3)	338 (4)	3 (3)	3 (3)	12 (2)	123 (3)
Total	771	211	430	250	279	836	108	107	617	3609

Missing data = 192. Numbers in parentheses are column percentages. Text uses row percentages.

and to raise awareness of occupational health and safety needs. Before drawing conclusions, the limitations of the study must be addressed.

The data were from a single emergency department that did not cover a defined geographical population. Therefore, calculating injury rates were not possible. It is unclear what factors influenced people with work related injuries to access care in this hospital. The proximity of the emergency department to the scene of the injury might have affected the numbers or types of injuries described here. HEALF is known as a trauma hospital in Managua, and this distinction most likely increased the rate of referrals, particularly the more severe.

Data were collected through self reporting and proxies for those severely injured. The validity of responses regarding work relatedness and the mechanism of the injury could not be verified. In addition, the surveillance system did not determine whether those with work related injuries were performing paid or unpaid work. Without this information it was impossible to separate injuries that occurred at home and in the street while performing income generating work from those that occurred while performing work such as chores or odd jobs without compensation. Therefore, the sample probably includes some injuries that occurred during non-income generating activities.

The employment categories created for this study have two limitations. First, it was assumed that all work related injuries occurred while the person was performing the tasks of his or her stated occupation. Secondly, the categorization was difficult due to the lack of standardization and vagueness of many of the occupations recorded. Therefore, a combination of occupational and industry categories were used and makes comparisons with other studies difficult. Further, injury severity comparisons are not possible because the form did not use a standard severity score. Despite these limitations, some conclusions can be made of the importance of work related injuries and which mechanisms appreciably contribute to the burden of injury.

One fifth of the injuries captured in the HEALF emergency department surveillance system were work related. Few studies in the literature describe occupational injuries in developing countries.^{3, 17, 18} Other general injury studies have mentioned occupational injuries, but detailed analysis was lacking.¹⁸

This injury system captured more work related fatalities (27) than was reported by the ILO (25) in 1998 in Nicaragua.⁸ This study included both the formal and informal worker

sectors, while the ILO statistics did not. However, considering that the study sample was only one hospital and the ILO statistics are for the entire country, it is evident mortality from occupational injuries in Nicaragua is grossly under-reported.

One third of the work related injuries occurred within the informal sector, defined as home based worker or underemployed. This finding was not unanticipated because of the documented large informal workforce in the urban areas of Nicaragua¹³ and the country's high underemployment rate (73%).⁷ But until now the work related injuries attributed to this population have not been quantified. This one third finding is likely an undercount because it is possible that the other occupational categories created in this study include workers from the informal sector. This hypothesis is supported by the finding that most of the work related injuries and the fatalities in this study occurred outside a formal workplace (home, street, or other). It is reasonable to conclude that workers hurt outside a formal workplace are often part of the informal workforce.

Lastly, intentional occupational injuries were identified. Injuries caused by violence have been noted in other emergency department based injury surveillance systems both in Nicaragua¹⁹ and in Bangladesh,²⁰ but neither study reported any intentional injury events as occupational related.

In this study, falls were the leading mechanism of work related injuries and the most severe, responsible for more than a third of the deaths and more than half of the fractures.

Table 4 Mechanism of work related injury, by sex, captured in HEALF emergency department based injury surveillance system, Managua, Nicaragua, 2001–02

Mechanism of injury	No (%) males	No (%) females
Traffic injury	246 (9)	47 (4)
Fall	584 (22)	510 (44)
Other blunt force	798 (30)	252 (22)
Stab or cut	692 (26)	156 (14)
Gun shot	58 (2)	8 (7)
Fire/smoke/heat	42 (2)	45 (4)
Contact with a foreign body	87 (3)	69 (6)
Poisonings	33 (1)	24 (2)
Other/unknown	93 (5)	40 (3)
Total	2633	1151

Missing data = 17, n = 3784. Numbers in parentheses are column percentages.

Table 5 Mechanism of work related injury, by age, captured in HEALF emergency department based injury surveillance system, Managua, Nicaragua, 2001–02

Mechanism (of injury)	Age (years)					Total
	<10	10–14	15–44	45–65	>65	
Traffic injury	6(21)	7 (9)	221 (8)	40 (8)	18 (5)	292 (8)
Fall	9(31)	24 (30)	641(23)	224 (43)	195 (54)	1093 (29)
Other blunt force	10 (35)	18 (23)	840 (30)	113 (22)	69 (19)	1050 (28)
Stab or cut	1(4)	19 (24)	707 (25)	78 (15)	42 (12)	847 (23)
Gunshot	1 (4)	1 (1)	58 (2)	5 (1)	1 (.3)	66 (2)
Fire/smoke/heat	1 (4)	0	70 (3)	10 (2)	6 (2)	87 (2)
Contact with a foreign body	0	7 (9)	120 (4)	22 (4)	7 (2)	156 (4)
Poisonings	0	2 (3)	41 (2)	6 (1)	8 (2)	57 (2)
Other/unknown	1 (4)	2 (3)	92 (3)	20 (4)	16 (4)	131 (3)
Total	29	80	2790	518	362	3779

Missing data = 22. Numbers in parentheses are column percentages.

These findings are consistent with general injury results from a Nicaraguan study,¹⁹ where falls were the leading mechanism of injury and accounted for almost a quarter of the deaths. A community based survey in Ghana found that falls in the urban areas were the leading cause of injury morbidity.²¹

Notably, in our study the morbidity burden of traffic related injuries was considerably lower than the fall mechanism. This is a curious finding, but because the data collection tool had “traveling” for an option of the “activity” data element, it is possible that transport workers selected the “traveling” response versus the “working” response for this element, causing misclassification bias. Even with this uncertainty, the traffic related injuries in this study were similar to past research findings which found a predominance of males between the ages of 15–44 years and traffic mechanism as a major contributor of fatalities. In addition, most injuries were caused by motorized vehicles either as drivers, pedestrians, or passengers. A mortuary data study by London *et al* in a developing country found similar results except that more than half of the fatalities were pedestrians and another 34% were occupants of cars.²²

Blunt force mechanism as a large contributor to work related injury for males has not been demonstrated in the literature. A study from emergency department based data in Nicaragua, noted the external cause, “strike/struck/caught” comprised only 7% of all injuries seen.¹⁹ Additionally, our stab/cut findings supported the prevention priorities expressed by Wesseling *et al*. These priorities were that construction and agriculture sectors should be targeted because both sectors are “hazardous and have the highest potential for an impact from intervention programs within a reasonable time”.⁷ Lacerations in the agriculture and carpentry sectors were also reported in urban Ghana.²¹

CONCLUSION

This study found that one in five non-fatal injuries and 10% of all fatal injuries recorded in the emergency department surveillance system in Managua were work related. The burden of occupational injuries in developing countries remains relatively unknown. However, it is likely to be larger than currently considered, given the expanding informal work sector in developing countries where occupational health and safety regulation and standards are virtually non-existent.

Clearly, mechanisms of work related injuries must be studied further to validate the accuracy of these findings related to falls, blunt force, and stabs/cuts. Falls in particular demand further study, as it represents the majority of the fatalities, and therefore should be a priority for further research to identify unique risk factors and hazardous jobs.

Key points

- Almost 20% of all non-fatal injuries and 10% of all fatal injuries recorded in the emergency department surveillance system in Managua were occupationally related.
- More work related fatalities (27) were captured in this one emergency department than were reported to the ILO (25) for the entire country of Nicaragua, suggesting severe undercounting of the true burden of work related fatalities in Nicaragua.
- Falls were responsible for the largest single group of occupational fatalities (37%) and should be a priority for further research to identify risk factors and hazardous jobs.
- The data collection tool needs to record whether work related injury occurred during paid or unpaid activities, and whether the injury was related to the stated occupation. A standardization method for categorizing occupations/industries on emergency department injury forms should be used (for example, SIC).
- The burden of occupational injuries in the developing world remains relatively unknown. However, it is likely immense especially given the expanding informal work sector due to globalization and the nearly complete lack of safety standards in this sector.

Further research is needed to better understand the magnitude and mechanisms of occupational injuries in Nicaragua and in the developing world. Above all this study documents the need to address these injuries in the informal sector. Armed with this information, public health professionals can solicit governments to enforce existing occupational health and safety policies and begin targeting interventions to the informal workforce. The World Health Organization reports that eight out of the 10 of the world’s workers currently live in developing countries, but only 5%–10% of them have access to professional occupational hygiene and safety services.²³

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REFERENCES

- 1 **World Health Organization**. *Occupational health: ethically correct economically sound*. June 1999. Fact Sheet No 84. Available at: <http://www.who.int/inf-fs/en/fact084.html> (accessed 1 March 2003).
- 2 **Somavia J**. Decent work, safe work. *The Global Occupational Health Network Newsletter* Issue 1, 2002. Available at: <http://www.who.int/oeh/OCHweb/OCHweb/OSHpages/Gohnet/GOHNET1/No1english.pdf> (accessed 11 February 2002).
- 3 **Takala J**. *Introductory report: decent work-safe work*. May 2002. Available at: <http://www.ilo.org/public/english/protection/safework/wdcongrs/index.htm> (accessed 30 March 2003).
- 4 **World Bank**. *Concept of informal sector*. Available at: <http://lnweb18.worldbank.org/eca/eca.nsf> (accessed 16 October 2003).
- 5 **Loewenson RH**. Health impact of occupational risks in the informal sector in Zimbabwe. *Int J Occup Environ Health* 1998;4:254-74.
- 6 **Barrs P**, Smith G, Baker S, et al. *Injury prevention: an international perspective—epidemiology, surveillance and policy*. Oxford: Oxford University Press, 1998.
- 7 **Wesseling C**, Aragon A, Morgado H, et al. Occupational health in Central America. *Int J Occup Environ Health* 2002;8:125-36.
- 8 **International Labor Organization**. *SafeWork—global estimates of fatalities and other occupational accidents*. Available at: http://www.ilo.org/public/english/protection/safework/accidis/globest_2002/reg_amer.htm (accessed 30 March 2003).
- 9 **Kromhout H**. Introduction: an international perspective on occupational health and hygiene. *Int J Occup Environ Health* 2002;8:111-12.
- 10 **Giuffrida A**, Iunes R, Savedoff W. Occupational risks in Latin America and the Caribbean: economic and health dimensions. *Health Policy Plan* 2002;17:235-46.
- 11 **London L**, Kisting S. Ethical concerns in international occupational health and safety. *Occup Med* 2002;17:587-603.
- 12 **Quinlan M**, Mayhew C, Bohle P. The global expansion of precarious employment, work disorganization, and consequences for occupational health: a review of recent research. *Int J Health Serv* 2001;31:335-414.
- 13 **Agurto S**. Situación del mercado de trabajo en las ciudades de Managua, Leon y Granada (1992-2000). *El Observador Economico* 2001;107:12-23.
- 14 **Holder Y**, Peden M, Krug E, et al. *Injury surveillance guidelines*. Geneva: World Health Organization, 2001.
- 15 **International Labor Organization**. *International standard classifications of occupations: ISO-88*. Geneva, International Labor Office, 1990.
- 16 **Executive Office of the President, Office of Management and Budget**. *Standard industrial classification manual*. Springfield, VA: US Government, 1987.
- 17 **Murray D**, Wesseling C, Keifer M, et al. Surveillance of pesticide-related illness in the developing world: putting data to work. *Int J Occup Environ Health* 2002;8:243-8.
- 18 **Mock C**, Gloyd S, Adjei S, et al. Economic consequences of injury and resulting family coping strategies in Ghana. *Accid Anal Prev* 2003;35:81-90.
- 19 **Tercero F**, Andersson R, Rocha J, et al. On the epidemiology of injury in developing countries: a one-year emergency room-based surveillance experience from Leon, Nicaragua. *International Journal of Consumer and Product Safety* 1999;6:33-42.
- 20 **Rahman F**, Yusuf A, Andersson R, et al. Epidemiology of injury: results from a injury registration at a district level hospital in Bangladesh—implications for prevention in low-income countries. *Inj Control Saf Promot* 2001;8:29-36.
- 21 **Mock C**, Abantanga P, Cumming P, et al. Incidence and outcome of injury in Ghana: a community-based survey. *Bull World Health Organ* 1999;77:955-64.
- 22 **London J**, Mock C, Abantanga F, et al. Using mortuary statistics in the development of an injury surveillance system in Ghana. *Bull World Health Organ* 2002;80:357-64.
- 23 **World Health Organization**. *Global strategy on occupational health for all*, 1995. Available at: <http://www.who.int/oeh/OCHweb/OCHweb/OSHpages/GlobalStrategy/GlobalStrategy.htm> (accessed 17 October 2003).

BOARD MEMBER BIOGRAPHY

Shanthi Ameratunga

Dr Shanthi Ameratunga is a Senior Lecturer in Epidemiology based at the School of Population Health at the Faculty of Medical and Health Sciences, University of Auckland, New Zealand. Following her early education in Sri Lanka, Shanthi qualified as a paediatrician in New Zealand. Her clinical work in urban and rural settings and interest in young people stimulated a career in injury prevention. Funded by a fellowship from the Accident Compensation Corporation of New Zealand, she trained in Auckland and subsequently, Baltimore, graduating with distinction from the Masters in Public Health program at the Johns Hopkins School of Public Health. After completing a postdoctoral fellowship at the same institution, Shanthi returned to New Zealand where her work has focused on road traffic trauma and injury related disability using epidemiological and qualitative research methods.

Shanthi is particularly interested in supporting research and training activities that enhance the capacity of low and middle income countries to address local injury issues. She is a partner of the Road Traffic Injury Network of the Global Forum for Health Research and the public health representative on the New Zealand Trauma Committee of the Royal Australasian College of Surgeons. She has been an invited contributor to injury research and policy programs in New Zealand and overseas, an external reviewer of national disability surveys, and a member of research review panels and the Injury and Rehabilitation Portfolio Advisory Group of the Health Research Council of New Zealand. She is currently leading a major collaboration between the Fiji School of Medicine and the University of Auckland investigating traffic related injury in the Pacific, funded by the Wellcome Trust (UK) and the Health Research Council (NZ).