Use of a National Reporting System for Occupational Injuries in Costa Rica

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Occupational injury surveillance in developing countries may be hindered by the lack of health data infrastructure as well the large numbers of informal-sector workers. The goal of this study was to elucidate the scope of occupational injury in the Monteverde district of Costa Rica using data collected through the national workers social security system. A list of occupational injuries occurring in the district reported to the National Insurance Institute (INS) central office between 1998 and 2002 was taken to the regional INS office, and the original injury reports for the cases were pulled. Specific data on the injuries were collected. There were 184 injuries reported during the five year period. Occupations with the highest number of injuries included production, building and grounds maintenance, and agricultural/forestry/fishing. Descriptive data showed that prevention efforts in this rural region should target food manufacturing, hotels, and construction. *Key words*: occupational injury; developing country;surveillance; Costa Rica.

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Developing countries face unique challenges in the control of occupational disease and injury. Unregulated exposures to chemical and physical hazards, work that may begin in childhood, poverty and hunger, and scarce workplace health and safety resources contribute to high incidences of occupational injuries. A low level of commitment to occupational health at the national level, common in many developing nations, results in a lack of enforcement of standards; this situation also permits the operation and proliferation of hazardous workplaces.[1,2]

The control of occupational illness and injury in developing countries is also hindered by the lack of adequate surveillance. Estimating the magnitude of hazards, identifying sentinel occupational health events, and focusing preventive efforts depend on the collection and analysis of occupational surveillance information.[3] In Latin America, surveillance of occupational hazards and injuries is limited,[4] with the exception of pesticide-poisoning surveillance systems.[5] In Costa Rica, pesticide-related illness and death have been studied using hospital discharge data, death certificates, and injury reports to a workers' compensation system.[6] The reports to the workers' compensation system, specifically, have yielded information on high-risk pesticide-related activities[6] and trends in pesticide-related illness over time.[7] The workers' compensation system, however, has not been used previously for surveillance of occupational disease and injury in the nation as a whole or in distinct geographic regions of Costa Rica.

The Monteverde (MV) district, located at the continental divide in central Costa Rica, is traditionally a dairy and coffee-farming region. In recent years it also has become an increasingly popular eco-tourism destination, which has resulted in a growth in construction, as well. These economic sectors (farming, cheese and coffee manufacturing, tourism and construction) have attendant occupational health risks, but nothing is known about the work-related disease and injury rates in this region.

This study used data collected through the national workers' compensation system to evaluate the scope of occupational disease and injury in the MV region. The goals of the study were: 1) to elucidate the types of injuries occurring in the MV district, 2) to determine rates of occupational disease and injuries in the MV district, 3) to compare MV disease and injury rates with national and international rates, and 4) to evaluate the accuracy and completeness of the centralized occupational injury database in Costa Rica.

METHODS

This study consisted of a secondary data analysis using an existing national database and individual incident

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reports. The National Insurance Institute (Instituto Nacional de Seguros—INS), located in San Jose, is the Costa Rican national insurance system that applies to all wage-earning workers and covers medical costs and compensation for occupational injuries as well as motor vehicle, fire and life insurance. Employers are required by law to pay premiums for all workers, although self-employed workers and those in family businesses are exempt. The INS maintains a centralized database of all occupational injuries.

When a worker is injured, the employer fills out an incident report, which contains information such as demographic and occupational characteristics as well as circumstances of the injury. The employer sends this handwritten report to the provincial INS office, where a paper file is generated. At the provincial office, the report is coded for external cause of injury (International Classification of Diseases Version 9 E-code[8]), and eventually, total work days lost due to injury. The case is entered into a central computerized INS database maintained in San Jose, the capital.

For this study, a list of all cases of occupational disease and injury occurring in the MV district between 1998 and 2002 was generated from the central INS database. This list was taken to the provincial INS office in Puntarenas, which is capital for the MV district. The files of all cases on the central list were pulled, and the original handwritten incident reports were reviewed at the provincial office. Information on the handwritten reports—the employee's date of birth, company's name, the date of injury, external cause code, and number of days of work lost due to injury—were compared with the corresponding information in the central INS database. Additional information in the handwritten reports, including the narrative description of the injury and salary, were added to create a final, combined dataset from the computerized database and the incident reports. This study was approved by institutional review boards in Costa Rica and the United States.

To test whether all reports filed in the provincial office are accounted for in the central computerized database ("capture rate"), all files for cases presenting to the Puntarenas INS office in the first six months of 2001 for any reason (fire, life insurance, occupational injury) were pulled. Reports of occupational incidents not included in the central INS database were added to the final dataset. Incident reports for 17 cases listed in the central INS database had been sent to other provincial capitals (presumably since the company offices were located in those provinces), so their files were not located in the Puntarenas office. However, these incidents occurred in the MV district so they were included in the final dataset.

Three variables were coded using previously established systems: 1) "business activity," assigned a two-digit code using the United States Department of Labor (USDOL) standard industrial classification (SIC) coding system[9]; 2) "job title," assigned a two-digit standard occupational classification (SOC) code used by the USDOL[10]; and 3) "external cause" variable, which had already been assigned an external-cause code (E-code) by the INS provincial office. The latter was reviewed for correctness using the narrative descriptions of the incidents. A major discrepancy between the narrative and the assigned E-code resulted in correction of the E-code to one more closely representing the circumstances of the incident. In the same manner, E-codes were assigned to cases for which none had been assigned by the INS. The corrected and new E-codes were used in the data analysis.

Analysis

Analysis of the data was performed at three levels. Descriptive data were used to quantify and describe occupational injuries occurring in the MV region from 1998 through 2002. In addition, the data were analyzed for accuracy and the capture rate was determined by comparing the cases from the central computerized database with the handwritten incident reports reviewed in the provincial office.

National occupational injury rates are available in Costa Rica for workers covered by the INS. To compare MV rates with national rates, two methods were used to calculate the number of workers at risk (the denominator): 1) the number of employed persons in the MV district obtained from the 2000 Census[11] multiplied by the national rate of compensation insurance (the percentage of workers covered by the INS), and 2) the number of employed persons in the district estimated using reports of businesses registered with the local chamber of commerce multiplied by the national rate of compensation insurance.

RESULTS

Description of Injuries

A total of 184 injuries occurring in the MV district were reported to the INS between 1998 and 2002. The average number of injuries per year was 37 (range 28–42). Males accounted for 75%, females 15%, with the remaining 11% unclassifiable by the available data. The mean age at injury was 33 years for both men and women, with a range for the whole of 18–64 years. No occupational diseases and no fatalities were reported.

Distributions of the injuries by industry and occupation are shown in Tables 1 and 2. The highest frequency of injuries occurred in food manufacturing, followed by the hotel industry and construction. Occupations with the highest frequencies of injuries included production; building and grounds cleaning and maintenance; and farming and forestry. Over 90% of the injuries occurring to workers in the broad occupational category of

TABLE 1 Occupational Injury Cases in Monteverde, Costa Rica, by Standard Industrial Classification, 1998–2002

Standard Industrial Classification	Cases	
	No.	%
Manufacturing—food	64	35
Hotels and hostels	31	16
Construction	20	11
Amusement and recreation	12	7
Engineering, accounting, and research	11	6
Agriculture and forestry	9	5
Eating and drinking places	7	4
Electric, gas, and sanitary	6	3
Social services	5	3
Educational services	3	2
Business services	3	2
Food stores	2	1
Auto dealers and gas stations	2	1
Private households	2	1
Public order	2	1
General government	2	1
Cargo transit	1	<1
Highway construction	1	<1
Unknown	1	<1

TABLE 2 Occupational Injury Cases by Standard Occupational Code in Monteverde, Costa Rica, 1998–2002

Standard Industrial Classification	Cases	
	No.	%
Production (food processing)	52	28
Building and grounds, cleaning, maintenance	23	13
Farming, forestry, fishing	19	10
Construction	16	9
Food preparation and service	11	6
Transportation and moving	5	3
Office administration and support	4	2
Installation, repair, maintenance	3	1
Personal care	3	1
Production services	3	1
Management	3	1
Sales	2	1
Business	1	<1
Education	1	<1
Healthcare support	1	<1
Unassigned	37	20

TABLE 3 "External Causes" of Injuries in Monteverde, Costa Rica, 1998–2002

External Cause	Cases	
	No.	%
Overexertion and strenuous movements (E-code 927)	36	20
Fall from slipping, tripping, or bumping into object (E-codes 885–888)	27	15
Incident caused by cutting or piercing object (E-code 920)	20	11
Struck by falling or stationary object (E-codes 916–917)	20	11
Fall from stairs, ladder, scaffolding, or other level (E-codes 880–884)	17	9
Incident caused by machinery (E-code 919)	10	5
Caught in or between objects (E-code 918)	8	4
Motor vehicle collision (E-codes 812–819)	6	3
Foreign body entering eye (E-code 914))	5	3
Caustic substance (E-code 924)	4	2
Animal being ridden (E-code 828)	3	2
Other	7	4
Unassigned	21	11

"production" occurred in food processing. Characterizing injuries by industry or occupation alone may be somewhat misleading in this study: cross-tabulation of SIC by SOC shows that of 21 injuries occurring in the hotel industry for which an occupation was recorded, 14 occurred in workers performing "building, grounds cleaning, and maintenance." Similarly, of the injuries occurring in the amusement and recreation industry for which an occupation was recorded, half were sustained by workers performing "building, grounds cleaning and maintenance," and half were sustained by tour guides ("personal care" SOC category).

Distribution of the injuries by external cause may be found in Table 3. Overexertion and strenuous movements (E-code 927) accounted for the largest percentage of injuries (20%). This was followed by falls from slipping, tripping, or bumping into an object (E-codes 885-888)—(15%). External-cause codes were analyzed for the three industries with the highest frequencies of injuries. In manufacturing, overexertion and strenuous movements were most common (29%), followed by falls from slipping, tripping, or bumping into an object (13%), accidents involving machinery (11%) (E-code 919), and being struck by an object (11%) (E-codes 916-917). In the hotel industry, all types of falls caused over one third of the injuries, followed by overexertion and strenuous movements. In construction, injuries caused by cutting or piercing objects (E-code 920), being struck by falling or stationary object, being caught in or between objects (E-code 918), and overexertion and strenuous movements were equally distributed.

In several cases, the narrative descriptions of the injuries provided additional details that were not reflected in the external-cause codes. For example, work involving clearing a path with a machete resulted in six injuries. Three injuries involved portable cement mixers. Of five injuries involving animals, three occurred while riding a bull, one was caused by being thrown from a horse, and one involved inoculating a cow. Of the ten eye injuries, three were soldering injuries, two were lacerations, two were caused by caustic substances, two were caused by being struck by an object, and one was caused by a foreign body.

TABLE 4 Occupational Injuries by Body Site, Monteverde, Costa Rica, 1998–2002

Location	%
Fingers and hand	24
Back	23
Knee, leg, ankle	21
Foot	8
Head	7
Eye	5

All of the reports included information about the body site of the injury (Table 4). The most serious injuries were an arm amputation and a finger amputation, which both occurred in food manufacturing. Injury severity was evaluated using the number of lost work days due to injury. There was no apparent association between body site of injury and number of lost work days or between E-code and lost work days. Likewise, distributions of lost work days by SIC and SOC did not reveal any trends.

Completeness and Accuracy of the Central Database

A systematic review of files from all cases presenting to the INS in Puntarenas for any reason during the first six months of 2001 revealed no additional occupational injury cases, indicating a 100% capture rate of the central INS database. Evaluation of the handwritten incident reports revealed fairly high levels of completeness for industry type (99%), job title (89%), and inclusion of narrative description of the injury (87%). External cause was recorded in 78% of the cases. However, when E-codes were evaluated for correctness, 27% of the codes were found to be inconsistent with the narrative descriptions of the injuries. Body site of injury was correct (when compared with the narrative description of the incident) in 94% of cases.

Comparison with National and U.S. Rates

A total of 42 injuries occurred in INS-covered workers in the year 2000 in the MV district. In the 2000 Census of Costa Rica, there were 1,154 employed persons in the district.[11] During this period the national rate of INS coverage was 72.6%.[12] This yields an injury rate of 5.0 injuries per 100 employed persons. Using an estimate of the number of workers employed by all businesses registered in the MV district in the denominator results in an injury rate of 3.5 per 100 workers. These two injury rates, calculated by two different methods, may be compared with the Costa Rica national injury rate for the same year of 20 per 100 employed persons.[13] United States Bureau of Labor Statistics for the year 2000 reported an occupational injury rate of 6.1 per 100 full-time-equivalent workers.[14] Industry specific rates could not be calculated because the number of workers per industry was not available at the district level.

DISCUSSION

This study characterizes the occupational injuries reported to the National Insurance Institute (INS) from the MV district of Costa Rica. In the year 2000, this rural area had an injury rate of 3.5–5.0 per 100 insured workers, depending on the method used to determine workers at risk. While this rate may seem low compared with the injury rate in the United States, an assessment of the role of under-reporting, a well-recognized phenomenon in occupational surveillance, is warranted. From previous investigations using the Costa Rican INS for injury surveillance, several reasons for under-reporting have been proposed.[6,15] First, companies in Costa Rica started to contract medical services at the workplace in the early 1990s which may have resulted in earlier treatment and recovery of minor injuries, which would not then need to be reported. Second, employers may send workers through the universal health care system instead of the INS in order to avoid higher insurance premiums, so injuries would not be reported as work-related. As in other developing countries with large numbers of informal-sector workers, many workers in Costa Rica who are self-employed or involved in family-owned businesses are not covered by compensation insurance systems.[11] In addition, many small businesses may be neglecting to carry required insurance coverage and therefore would not report injuries to the INS. Typically, informal-sector workers, particularly immigrants, may fall into this category. In MV specifically, over 90% of the businesses employ fewer than 15 workers, so coverage may be incomplete or nonexistent. Similarly, rural areas such as this also may employ undocumented workers from neighboring countries who are likely to be unaware of their rights to compensation and medical treatment. Costa Rica employs a considerable number of Nicaraguan agricultural workers in the MV region. Finally, the low injury rate found in this study may also be due to the fact that many workers in this district are employed by the service and tourism industries, which may be inherently safer.

In MV, the majority of injuries occurred in food manufacturing, hotels, and in the construction industry. Given that "service" and "construction" are two of the biggest employment sectors in the region, this would be expected. The most common external causes of injury were overexertion and strenuous movements; falls from a slip, trip, or bumping into an object; incidents with cutting and piercing objects; and being struck by a stationary or falling object. Food production is well known to be associated with repetitive and acute injuries of the extremities, as reflected in this dataset.[16] In Great Britain, food production accounts for 25% of all manufacturing injuries, with musculoskeletal injuries ranking the highest.[17] Worldwide, construction is one of the leading economic sectors for occupational fatality and injury.[18]

Agriculture/forestry/fishing probably employ a significant percentage of the population in this region; however, many of the farms are family owned, and workers may fall outside those reported to INS. Indeed, undocumented Nicaraguan workers comprise an unknown but substantive proportion of agriculture workers.[19]

Regarding the utility of the central INS database to capture all incidents reportedly occurring in MV, our review of one six-month period resulted in a capture rate of 100%. The accuracy of the data was excellent for certain variables: information found in the INS database regarding age, industry type, date of injury, and location of injury showed a high degree of accuracy when compared with the original incident reports. In the case of E-codes, 27% coded at the provincial office were found to have major discrepancies when study investigators compared them with the original descriptions of the incidents.

The number of employed persons in the MV district used in the denominator of the first injury rate calculation was defined in the 2000 census as those who worked at least one hour during the reference week, including those who gave aid to a family member or were employed but were on vacation, or strike, or incapacitated.[11] This comprehensive definition may lead to an inflated denominator, which would result in a lower injury rate. (Although this does not explain the low injury rate compared with national data.) The second injury-rate calculation used an estimate of the number of employees of businesses registered with the local chamber of commerce. However, businesses report numbers of employees within ranges. The midpoint of the range was used for the denominator calculation, which might result in an inaccurate injury rate. Comparison of MV injury rates with U.S. rates may not be informative, since the U.S. Department of Labor uses full-time workers in the denominator of the injury-rate calculation. Denominator data would need to be harmonized in order to compare MV rates with national and international rates.

Using INS injury reports to evaluate occupational injury rates at the district level in Costa Rica requires knowledge of the number of insured workers per industry at the district level. This is not easily determined from currently collected data, and may require a survey of MV employers. Future surveillance efforts of this type in Costa Rica or any other developing nation should anticipate the data needs revealed in this study in order to maximize the utility of disease and injury reporting.

Despite the uncertainties introduced by underreporting and the lack of a precise denominator for calculating injury rates, the injury characterizations produced by this study can be used to direct efforts at prevention. Workers performing food processing, grounds work, agricultural work, and construction occupations suffer the majority of injuries reported in this district, and could be specifically targeted for safety education. Further collaboration with the National Insurance Institute will allow for better surveillance to target prevention to the industries and occupations most in need.

References

1. Frumkin H. Across the water and down the ladder: occupational health in the global economy. Occup Med State of the Art Reviews. 1999;14:637-63.
2. Ong CN, Jeyaratnam J, Koh D. Factors influencing the assessment and control of occupational hazards in developing countries. Environ Res. 1993;60:112-23.
3. Maizlish N, Rudolph L, Young C. Design of a state-based workers' compensation information system. Am J Ind Med. 1999; 35:564-73.
4. Choi BC, Tennassee LM, Eijkemans GJ. Developing regional workplace health and hazard surveillance in the Americas. Rev Panam Salud Publica. 2001;10:376-81.
5. Murray D, Wesseling C, Keifer M, Corriols M, Henao S. Surveillance of pesticide illness in the developing world: putting the data to work. Int J Occup Environ Health. 2002;8:243-8.
6. Wesseling C, Castillo L, Elinder G. Pesticide poisonings in Costa Rica. Scand J Work Environ Health. 1993;19:227-35.
7. Wesseling C; Hogstedt C, Fernandez P, Ahlbom A. Time trends of occupational pesticide-related injuries in Costa Rica, 1982–1992. Int J Occup Environ Health. 2001;7:1-6.
8. International Classification of Diseases 9_CM for Physicians. Volumes 1 & 2. Ingenix, 2005. <www.ingenixonline.com>.
9. United States Department of Labor, Occupational Safety and Health Administration. <http://www.osha.gov/cgi-bin/sic/sicser5>. Accessed August 2004.
10. United States Department of Labor, Occupational Safety and Health Administration. <http://www.bls.gov/soc/>. Accessed August 2004.
11. Instituto Nacional de Estadisticas y Censos. National Population Census 2000, Economic Characteristics. San Jose, Costa Rica, November 2002.
12. Personal communication, INS. Costa Rica, 2003.
13. Instituto Nacional de Estadisticas Y Censos. Boletin Estadistico del Seguro de Riesgos del Trabajo, 2003. <http://www.inec.go.cr/>. Accessed August 28, 2004.
14. United States Department of Labor Bureau of Labor Statistics . <www.stats.bls.gov>. Accessed August 28, 2004.
15. Wesseling C, Aragon A, Morgado H, Elgstrand K, Hogstedt C, Partanen T. Occupational Health in Central America. Int J Occup Environ Health. 2002;8:125-36.
16. US Bureau of Labor Statistics. 2004. Food Manufacturing. <http://www.bls.gov/oco/cg/cgs011.htm>. Accessed May 9, 2005.
17. Health and Safety Executive. 2005. Food Manufacturing <http://www.hse.gov.uk/food/202.htm>. Accessed May 9, 2005.
18. International Labour Organization. Encyclopaedia of Occupational Health and Safety. 3rd ed. 2002; Vol 2, Chapter 93.
19. International Labour Organization. Committee of Experts on the Application of Conventions and Recommendations. 1999. <http://webfusion.ilo.org/public/db/standards/normes/appl/appl-displayAllComments.cfm?conv=C117&ctry=0150&hdroff=1&lang=EN>. Accessed <au 11. 2005.