Economic and Health Effects of Occupational Hazards in Latin America and the Caribbean

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Foreword

Latin America and the Caribbean are going through a series of major transitions — economic, social, political, demographic, and epidemiological. One area of public health concern clearly touches on them all, namely, occupational health.

Until recently, occupational safety and health was relegated to the background, as countries in the region focused on more visible endemic diseases. Yet, occupational illness and injury is now a leading cause of morbidity among adults in the region and cannot continued to be ignored. Addressing occupational safety is extremely complex; it requires dealing with overlapping responsibilities between ministries of labor and health, and between private insurers and social security institutes. It also requires involvement with business associations and unions, international trade negotiators, and environmentalists. Lastly, it requires making decisions with significant distributional and health consequences.

This study is the result of a joint effort by the IDB's Region 3 and Sustainable Development Departments which was undertaken to identify the major trends and issues related to improving occupational safety in Latin America and the Caribbean. It shows that the region has a very high disease burden in this area, and that economic patterns of employment and public regulatory responses make these health problems more acute than in Europe or North America. The paper was discussed at an IDB conference entitled "International Conference on Occupational Safety and Health" in June 2000, and served to draw attention to these important issues. The study provides a firm grounding from which to address the dearth of policies in occupational safety, and it will help guide future IDB activities in this sector. It represents one modest step along the way to a future of safer working conditions and better health in the region.

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Introduction

Occupational safety and health (OSH) is increasingly recognized by Latin American and Caribbean governments and international organizations as an important part of public health. People spend one-third or more of each day at work, so working conditions necessarily have a strong effect on their health. But OSH concerns extend well beyond the obvious health consequences of work-generated illnesses, accidents, and deaths. OSH is a key element in the process of social and economic development, with direct and indirect impacts on such areas as the labor market, labor productivity, household income, poverty, social security systems, international trade, and the environment.

The Latin American and Caribbean labor force is one of the fastest growing in the world. In 1980 there were 112 million workers (IDB, 1982), by 1998 the workforce almost doubled reaching approximately 202 million (see Table 1 overleaf). The most recent data produced by the International Labor Organization (ILO, 1998) show that, despite recent privatization efforts in the region, the public sector continues to concentrate the largest portion of the workforce, followed by the service sector, manufacturing and the primary sector. The differentiated growth experienced by these sectors has changed the relative distribution and the nature of the labor force. The percentage of the labor force employed in the primary sector decreased by more than 2 percent in the last five years and in the same period the manufacturing sector showed a less marked reduction of 1.5 percent. On the other hand, both the service sector and the public sector experienced an increase in the percentage of the workforce employed of 2.5 percent and 0.8 percent respectively.

Although OSH has a direct impact on more than 200 million workers and their families in the region the situation in the region is far from adequate, largely due to three main factors. First, there is a general lack of awareness regarding the importance of a safe and healthy work environment. Second, data on occupational accidents, illnesses, and deaths tend to underestimate the magnitude of the problem. Finally, the region lacks the institutional capacity and infrastructure needed to develop and sustain a safe and healthy working environment. The region's failure to implement or enforce appropriate safety laws translates into lost production, lost wages, medical expenses, disabilities, and deaths.

This study describes the health dimension and some economic aspects of occupational safety in Latin America and the Caribbean. Section 2 gives a brief description of the main occupational hazards in the region. Section 3 presents the available figures about occupational accidents and diseases in the region. Section 4 explores in detail the occupational risks in agriculture, mining, and the construction industry. Section 5 discusses the costs for Latin American and the Caribbean countries. Section 6 considers policy actions to improve OSH regulation and to improve compliance with these rules. Section 7 concludes with a discussion of the main results.

Table 1 Population, Economic Activity Rate and Employment in LAC

Country	Population 15+ (1998)	Economically Active Population 15+ (%)	Total Employment	A (%)	B (%)	C (%)	D (%)	E (%)	Year
Argentina	25,960,000	-	10,542,000	2	25	36	30	8	96
Bahamas	213,000	-	135,255	5	13	47	-	35	94
Barbados	204,000	61.7	109,900	0	20	27	38	11	95
Belize	138,000	52.5	62,570	23	18	13	4	41	95
Bolivia	4,770,000	64.7	1,354,540 (2)	4	27	44	18	7	96
Brazil	116,209,000	66.1	69,332,000	25	19	19	37	0	97
Chile	10,531,000	54.4	5,432,350	16	24	34	26	0	98
Colombia	25,128,000	64.0	5,654,900	1	26	42	31	0	98
Costa Rica	2,414,000	58.1	1,300,010	22	23	29	25	1	98
Dominican Republic	5,439,000	62.4	2,652,000	15	23	35	27	0	97
Ecuador	7,932,000	64.2	3,151,200 (2)	8	21	42	29	0	98
El Salvador	3,871,000	58.7	2,076,000	26	24	28	23	0	97
Guatemala	6,531,000	49.8	830,500 (1)	-	-	-	-	-	96
Guyana	591,000	-	-	-	-	-	-	-	-
Haiti	4,503,000	-	-	-	-	-	-	-	-
Honduras	3,530,000	63.2	2,134,922	35	23	26	17	0	98
Jamaica	1,757,000	-	954,300	22	18	34	27	0	98
Mexico	63,196,000	60.7	38,617,500	21	24	31	20	5	98
Nicaragua	2,594,000	58.5	259,510 (1)	-	-	-	-	-	98
Panama	1,877,000	61.5	903,133	20	18	35	22	6	98
Paraguay	3,110,000	-	1,190,400 (2)	5	22	43	29	0	96
Peru	16,264,000	65.7	6,833,877 (2)	10	19	51	15	4	98
Suriname	293,000	48.0	87,209	11	19	29	37	5	96
Trinidad & Tobago	953,000	60.5	479,300	12	24	33	31	0	98
Uruguay	2,462,000	-	1,114,400	4	25	33	39	0	98
Venezuela	15,118,000	63.2	8,286,802	12	23	36	29	0	97
LAC	325,588,000	-	201,541,888 (3)	19	22	28	29	2	
Change from 89-91 (%)				-2.03	-1.51	2.51	0.78	0.24	

Calculations based on data from ILO (1998) and UN (1999).

A. Agriculture, Hunting, Forestry, Fishing, Mining and Quarrying.

B. Manufacturing, utilities and construction.

C. Wholesale and retail trade, Hotels, restaurants, transport, storage, communications, financial intermediary, real estate, renting and other business activities.

D. Public administration, defense, education, health and social worker, other community, social and personal service activities.

E. Private households with employed persons, extra-territorial organizations and not classifiable economic activities.

(1). Only employed, which excludes persons temporarily not at work, own-account workers, some types of self employed, etc.

(2). Only, urban area.

(3). Calculated applying the employment rate estimated excluding Nicaragua and Guatemala (see note 1).

Occupational Hazards in Latin America and the Caribbean

Millions of workers in Latin American and Caribbean countries are at risk from exposure to *physical, chemical, biological* and *psychosocial hazards* in the workplace and many of them are exposed to a combination of these.

Heavy *physical workloads* or *ergonomically poor working conditions* can lead to injuries and musculoskeletal disorders. Those most affected include miners, farmers, lumberjacks, fishermen, and construction workers. It is estimated that between 50 percent and 70 percent of the workforce in developing countries is exposed to these types of hazards.

Other *physical hazards* such as noise, vibration, ionizing and non-ionizing radiation, heat and other unhealthy microclimatic conditions can adversely affect health. It is estimated that between 10 percent and 30 percent of the workforce in industrialized countries and up to 80 percent in developing and newly industrialized countries are exposed to a variety of these potential hazards.

Dangerous work conditions include activities that may damage a worker's health or put his/her life at risk. Examples include deficiencies in the design of the workspace, lack of or insufficient security devices, high level of risk in the type of work and lack of protective equipment, procedures, or training.

In addition to physical hazards, workers are exposed to a variety of chemical hazards. Exposure to *toxic chemicals* poses serious health threats, potentially causing cancer, respiratory and skin diseases, as well as adverse effects on reproductive functions. Workers are often exposed to hazardous chemical agents such as solvents, pesticides and metal dusts.

Exposure to *mineral and vegetable dusts* represents other chemical and biological hazards. For example, silica, asbestos and coal dust cause irreversible lung diseases, including different types of pneumoconiosis. Silicosis is the most widespread cause of occupational lung diseases such as tuberculosis and lung cancer, but it is preventable. Vegetable dusts can cause a number of respiratory conditions (such as byssinosis) and allergic reactions (such as asthma).

The *risk of cancer* from workplace exposure is of particular concern. Around 350 chemical substances have been identified as occupational carcinogens. They include benzene, hexavalent chromium, nitrosamines, asbestos and aflatoxins. In addition, the risk of cancer also exists from exposure to physical hazards such as ultraviolet (UV) and ionizing radiations. The most common occupational cancers include lung, bladder, skin and bone cancer, leukemia and sarcomas.

Biological hazards are also widespread. Exposure to biological agents (viruses, bacteria, parasites, fungi and molds) occurs in many occupational environments from agriculture to offices. The Hepatitis B and C viruses, HIV/AIDS and tuberculosis infection among healthcare workers, and chronic parasitic diseases among agricultural and forestry workers, are examples of these types of occupational diseases.

Exposure to thousands of *allergenic agents*, including vegetable dusts, is a growing cause of work-related illness. A large number of allergens have been catalogued which can cause skin and respiratory diseases (e.g., asthma).

Finally, *social conditions* at work can also damage workers' health. Frequently, these conditions manifest themselves in stress and its consequences. Social conditions that can be injurious to health include inequality and unfairness in the workplace; management style based on the exclusion of workers from the decision-making

process; lack of communication and poor organization of work; and, strained interpersonal relationships between managers and employees. Stress at work has been associated with elevated risks of cardiovascular diseases, particularly hypertension, and mental disorders.

Some economic activities do not produce health risks only for people at the workplace, but also affect the surrounding community through environmental contamination. Unquestionably, many economic activities have seriously contaminated water, air and foods, which, in turn, have negatively affected the health of surrounding populations.

DEFINING OCCUPATIONAL RISKS

Occupational health risk can be described as the possibility of suffering health impairments from exposure to a hazard that originates in the working environment. In the risk-assessment literature, the term *hazard* typically refers to the source of risk. The likelihood of harming health from exposure distinguishes *risk* from *hazard:* a risk is created by a hazard. For example, a toxic chemical that is a hazard to human health does not constitute a health risk unless humans are exposed to it.

In relation to events that affect workers' health, it is possible to distinguish between work-related accidents and occupational diseases. A *work-related accident* refers to an event that directly affects a worker's health during the performance of work activities or activities that are directly connected with work such as commuting. They usually refer to physical injuries that have a clear causal relationship between the acute event and the work activity. *Occupational diseases* indicate the pathological process caused by the repetition of a work-related activity, such as prolonged exposure to hazards at work whose effects are only manifest after long periods of time. The effects on worker's health are slow and not clearly linked to work conditions. In general, many of these diseases have multiple potential sources, including life-style factors, which make it difficult to establish whether or not the condition is directly work related. Moreover, the long latency period that characterizes many occupational diseases complicates the determination of the causal relationship between work, the work environment and the disease. In the region, recognition of occupational diseases is further complicated by the lack of training of health care providers in occupational medicine.

PROBLEMS SPECIFIC TO LATIN AMERICA AND THE CARIBBEAN

It is often argued that workers in Latin America and the Caribbean pay a higher toll of deaths and injuries than in other regions of the world. There are various factors that have a negative effect on work safety in the region: the labor market structure, the availability of resources, unions, the exposure level and the hazard profile, and the presence of vulnerable groups in the workforce.

Labor Market: Informal Sector, Small Enterprises and Unemployment

In Latin America and the Caribbean, a large proportion of the economically active population works in the informal sector of the economy, which includes, according to the ILO definition, the self-employed, domestic servants and micro-businesses. Informal employment increased significantly in the last decade, growing from 44.6 percent in 1990 to 47.9 percent in 1998 (Lora and Marquez, 1998; ILO, 1999). In the formal sector, small and medium enterprises constitute an important portion of the region's economies. Employment in small enterprises (6-20 workers) represents 25 percent of the total workforce; small and medium business with less than 100 workers employ 57 percent of the total workforce in the formal industrial sector (ILO, 1999; Hiba, 1997).

There are a variety of factors that increase exposure to occupational hazards in the informal sector and in small enterprises. First, when firms

are small, the fixed costs of reducing occupational hazards may be prohibitively high since the firm cannot benefit from scale economies. Along with other factors, this leads to the conclusion that "generally, the smaller the industry is, the higher the rate of workplace injury and illness" (Loewenson, 1994; p.97). Second, when firms have high turnover, they have less incentive to invest in the training and attention to their workforce (Foley, 1998). Third, informal economic activities may be in sectors that are particularly hazardous such as construction, agriculture and small-scale mining, although other sectors, like retail sales may be among the less hazardous. A fourth factor is the absence of monitoring of work conditions, which is a particular problem in informal workplaces that, often by definition, operate outside formal legal standards and regulation. In such firms, workers are also less likely to organize and monitor work conditions themselves. Fifth, workers in informal firms are less likely to be insured through their employers. This eliminates the business' incentive to address occupational hazards as a way to reduce insurance premiums or avoid litigation. Sixth, whenever workers are less educated or informed, they are more vulnerable to occupational hazards. Often, informal sector workers, particularly those who work in agriculture or construction, are among the least well educated. Finally, particularly vulnerable populations, such as children and the elderly, are disproportionately employed in informal activities.

The labor market in Latin America and the Caribbean is also characterized by high unemployment and underemployment rates and the general absence of unemployment insurance, social security insurance and income maintenance for the unemployed and for those working in unregulated sectors of the economy. As a result many workers may tolerate hazardous working conditions rather than risk losing their main source of income. This makes it difficult for workers to undertake collective action to improve working conditions, including limiting the ability to mobilize strikes.

Fewer Resources for Enforcement, Prevention and Research

Despite the fact that some countries have made occupational medicine a required subject in graduate courses for physicians, and that specialized courses train occupational health physicians, safety engineers and nurses (Bedrikow et al., 1997), OSH in Latin America and the Caribbean is still in its infancy and there are fewer experts available, less safety equipment, less monitoring equipment, fewer inspectors and less enforcement than in developed nations (Delclos et al., 1999). In addition, OSH research is probably underfunded. Estimates show that only about 5 percent of occupational health research in the world takes place in developing countries, which clearly demonstrates a severe imbalance, between the share of the population, the severity of the problem and the resources available in these countries (Partanen et al., 1999).

Labor Unions

The history of occupational safety reflects a long struggle by workers to establish rights to a healthy working environment and employers who have sought to deny or limit liability. Unions have played an important role in helping workers to solve a number of issues and problems through collective actions that could not have been achieved individually. In particular, even though each individual worker has an incentive to demand better working conditions, he or she also faces a high risk of being individually sanctioned or dismissed by their employer. By contrast, organized workers are better able to express their views and make demands. While these collective actions can be directly against the interests of employers, in many cases they can promote increases in productivity that serve both workers' and employers' interests. Studies have shown that, in certain circumstances, unions can be effective channels of communication and information for improvements in the organization of work and productivity increase. Usually, to play this kind of constructive role, union activities have to be specific to an industry or firm and the

union itself must be accountable to its membership through effective and democratic processes.

However, unions are not always independent organizations that speak for the interests of their rank and file, even in highly unionized countries (Frumkin, 1999; Laurell, 1989). In fact, unions in Latin America and the Caribbean have a checkered history. Some have faced severe repression under dictators and military regimes, while others have been coopted to serve political interests that do not necessarily reflect the best interests of their membership and have not been immune to the corruption. In many cases, unions represent only a minority of workers, namely those employed in formal workplaces. For these and other reasons, unions in the region may not have been able to play the same positive role in improving working conditions as have their counterparts in more developed countries.

Longer Exposure and Higher Hazard Profile

Occupational risk is determined both by the level and the duration of exposure to hazards. Workers in developing countries tend to work longer in the presence of occupational hazards than those in more developed countries. For example, it is common for employees in many Latin American and Caribbean countries to work 50 or more hours per week. Thus, even when work is done in environments that are considered safe by standards established in industrialized countries, where the typical exposure is a 40-hour work week, the longer work week may result in exposure levels that exceed safety levels.

To some extent, occupational hazards are related to national geography and natural resource endowments. For example, particularly dangerous occupations, like mining, play a relatively large role in the region because it is endowed with primary commodities such as tin, copper and gold. Moreover, high altitude or tropical climates may exacerbate the risk of certain occupational injuries or diseases. The impact of such broad factors varies significantly across occupations, sectors and types of hazards. An evaluation of their net impact requires detailed studies, but it has been argued that the particular geography and resource endowments of the region exacerbate workers' exposure to occupational risks (Michaels et al., 1985).

More Vulnerable Groups

In healthy people, exposure to occupational health hazards may occur up to a certain level without apparent effects because the human body has the capacity to deal with such challenges. However, some individuals can be more vulnerable because of their physical condition, age or gender. For example, toxicological evidence suggests that the health effects of exposure to hazardous chemicals are increased by malnutrition, and that a low protein diet increases the toxic effects of pesticides (Calabrese, 1978). A large proportion of Latin America and the Caribbean is less healthy and, therefore, more vulnerable to occupational exposure to toxic chemicals or biological agents. Researchers have also documented the increased susceptibility of children and adolescents to toxic substances, particularly those such as pesticides that affect growth and development of the reproductive system (Hunt et al., 1982). In addition, children and adolescent workers may be at a greater risk for injuries because of their lack of training and experience (Root, 1980). Child labor is still widespread in the region. It is estimated that there are around 17 million children at work (Tokman, 1997).[1] Many of the activities they carry out are dangerous for their health and inhibit their development. Documented examples include child labor in charcoal production in Brazil, gold and coal mining in Colombia and Peru, and manufacturing fireworks in Guatemala and Colombia (Salazar, 1998; Harari et al., 1997).

[1] A household survey carried out in Paraguay in 1990 showed that 5% of 12 years old were working (Patrinos and Psacharopoulos, 1995) and even higher proportions of child labor were reported in Brazil and Mexico (Forastieri and Matos, 1993).

Women have been joining the workforce in increasing numbers and currently account for about 40 percent of the economically active population in the region (ILO, 1999). Although the increased participation of women in the labor force has improved their social and economic well being, as well as the education and health of their children (IDB, 1998), women are exposed to greater health risks than their male coworkers, and their increased role in the workplace has not generally been met by an adequate adaptation of working conditions to gender differences (Cabrera, 1978). For example, women of fertile age are more susceptible to occupational hazards that affect reproductive functions. When pregnant, occupational hazards pose risks to the growing fetus, which may lead to congenital defects and miscarriages, as well as long-term impairments to children's health and development. Women may suffer from musculoskeletal disorders when the tasks or equipment used are designed for the "average man" and not adjusted to their different builds and physiology. Women appear to suffer from specific stress disorders that result from gender discrimination in the labor market, a double burden of work (workplace and home) imposed by traditional and cultural roles, and also sexual harassment (WHO, 1999). For example, La Botz (1994) in her study of the *maquiladoras* (firms in Mexico's northern free trade zone) showed that working conditions for women were worse than for men. Virtually all supervisors and technicians were men, while more than three-quarters of the operational employees were women. Women were more exposed to toxic chemicals and dangerous work processes than men, and sexual harassment was defined as "endemic."

Occupational Accidents and Diseases in Latin America and the Caribbean

The rate of occupational injury and illness in Latin America and the Caribbean is difficult to quantify for two main reasons. First, there is underreporting of accidents and illnesses in firms and sectors that are legally obligated to report these events. Second, a large proportion of the economically active population is employed in sectors that are not required to report such incidents. Thus, for a large portion of the workforce information is not systematically collected.

The ILO is the principal source of statistics in this area and publishes occupational accident figures based on the national registration and notification systems of the majority of the countries in the world (ILO, 1998). Tables 2 and 3 present ILO data on the number of fatal and nonfatal occupational injuries and their distribu-

Table 2 **Fatal Injuries by Country and Economic Activity**

Country	Total	A (%)	B (%)	C (%)	D (%)	E (%)	Year
Barbados	0	-	-	-	-	-	98
Belize [3]	4	25	50	0	0	25	95
Bolivia	22	32	18	9	41	0	98
Brazil [3]	4,488	-	-	-	-	-	98
Colombia [1]	370	12	30	31	25	2	95
Costa Rica [3]	49	-	-	-	-	-	97
Ecuador [1]	185	9	41	28	22	0	94
El Salvador [1]	175	-	-	-	-	-	98
Guatemala [3]	285	19	21	-	-	-	92
Guyana	7	29	43	10	19	0	97
Honduras [2]	1	100	0	0	0	0	92
Jamaica [2]	0	-	-	-	-	-	97
Mexico [3]	1,568	7	39	37	-	-	97
Nicaragua [3]	25	8	48	8	36	0	98
Panama [1]	82	5	43	34	18	0	98
Peru	95	-	-	-	-	-	96
Suriname [1]	6	0	33	67	0	0	96
Trinidad & Tobago	5	60	20	20	0	0	98
Uruguay [2]	50	-	-	-	-	-	92
Venezuela [1]	30	-	-	-	-	-	97
Total	7,443	11	43	37	8	0	
% accidents / % employed		0.60	2.01	1.31	0.28	0.23	

Calculations based on data from ILO (1998).
See Notes in Table 1

Table 3 Persons Injured by Country and Economic Activity

Country	Total	A (%)	B (%)	C (%)	D (%)	E (%)	Year
Barbados	522	15	41	33	7	4	95
Belize [3]	1,449	59	27	4	9	0	95
Bolivia	1,227	27	43	7	23	0	98
Brazil [3]	397,150	-	-	-	-	-	97
Colombia [1]	17,689	22	46	17	14	2	95
Costa Rica [3]	115,344	31	37	14	13	5	97
Ecuador [1]	5,021	4	56	22	18	0	94
El Salvador [1]	20,335	3	60	29	8	0	98
Guatemala [3]	184,386	19	22	-	-	-	92
Guyana	3,790	74	13	9	3	0	97
Honduras [2]	4,655	79	15	4	3	0	92
Jamaica [2]	1,200	35	45	16	4	0	97
Mexico [3]	428,873	5	47	36	-	-	97
Nicaragua [3]	8,697	6	63	8	22	0	98
Panama [1]	15,391	25	35	27	13	0	98
Peru	8,165	-	-	-	-	-	96
Suriname [1]	1,664	27	50	22	1	0	96
Trinidad & Tobago	469	45	48	7	0	0	98
Uruguay [2]	34,086	-	-	-	-	-	92
Venezuela [1]	5,218	11	83	6	0	0	97
Total	1,255,331	17	50	29	4	1	
% accidents / % employed		0.89	2.30	1.02	0.13	0.41	

Calculations based on data from ILO (1998).
See Notes in Table 1

tion across economic activities. International comparisons are difficult because registration and notification systems are not consistent across counties. In some countries the data cover occupational diseases and accidents associated with commuting, whereas in others they do not. In addition, while for most countries the figures refer only to the number of compensated accidents, data for few countries include all reported accidents. In general, it is likely that inconsistencies are greater in the comparison of nonfatal than fatal accidents.

Most fatal (43 percent) and nonfatal (50 percent) occupational accidents occur in manufacturing, utilities and construction activities. Moreover, the ratio between the proportion of the workforce employed in these sectors and the distribution of accidents shows that workers in such sectors are twice as likely to suffer accidents. Wholesale and retail trade, hotels, restaurants, transport, storage and communications, financial intermediaries, real estate, renting and other business activities represent the second grouping for the number of both fatal (37 percent) and nonfatal accidents (29 percent). In third place, we have activities in agriculture, hunting, forestry, fishing, mining and quarrying, where 11 percent of fatal and 17 percent of nonfatal accidents take place. The last group is

likely to be subject to serious underreporting because workers in this group have a high incidence of occupational illnesses (e.g. silicosis in mining) that manifest themselves only after a long period of exposure, and that are less likely to be diagnosed as work-related. Moreover, official reporting systems and social security programs do not cover a large proportion of the workers in this sector.[2]

Table 4 reports the fatality rate for occupational accidents in Latin America and the Caribbean for which data are available and compare it to some nonregional countries such as Canada, the United States, Finland and South Korea. Overall, the average fatality rate in Latin America and

Table 4 Occupational Fatality Rates

Country	Fatality rate per '000 workers	Employed & covered by ILO data %	Year
Barbados (b)	0.000	-	95
Bolivia (a)	0.111	23	97
Brazil (3, a)	0.150	33	96
Colombia (2, b)	0.077	85	96
Costa Rica (3, a)	0.069	55	97
Ecuador (1, a)	0.168	35	94
El Salvador (1, a)	0.330	26	98
Mexico (3, b)	0.120	34	97
Nicaragua (3, a)	0.096	-	98
Panama (1, a)	0.140	65	98
Peru (a)	0.186	7	98
Trinidad & Tobago (b)	0.010	-	97
Venezuela (1, b)	0.006	60	97
Average LAC (c)	**0.135**	-	-
Canada (2, a)	0.071	84	97
USA (2, b)	0.005	-	97
Finland (a)	0.027	82	96
Republic of Korea (3, a)	0.290	38	98

Source: ILO (1998).
(1): indicates that commuting accidents are included.
(2): indicates that occupational diseases are included.
(3): indicates that both commuting accidents and occupational diseases are included.
(a): indicates compensated injuries
(b): indicates reported injuries
(c): average weighted by the number of workers covered in each country

the Caribbean is 0.135 per 1,000 workers, which is just between the rates experienced by the two biggest countries in the sample: Brazil and Mexico.[3]

However, there is a large variation in fatality rates across the region, which vary from the absence of fatal accidents reported by Barbados in 1995, to the 0.33 accidents per 1,000 workers recorded in El Salvador in 1998. The absence of fatal accidents in Barbados can be explained, at least partially, by the fact that its economy is largely based on activities, such as tourism, which present lower occupational risks. On the other hand, the low accident rates in countries like Trinidad and Tobago, and Venezuela may simply reflect the deficiencies of the reporting systems since primary extraction plays a large role in both economies.

Looking outside the region, the occupational fatality rates in established market economies were significantly lower than the average rate for Latin America and the Caribbean. In 1997, Canada experienced a fatality rate that was almost half that of Latin America and the Caribbean, and even lower rates were recorded in Finland and the United States. By contrast, South Korea had a fatality rate in 1998 that was twice the average for Latin American and the Caribbean. This could be due to better registration or a heavier reliance on risky sectors (such as heavy manufacturing). On the other hand, the relatively higher fatality rate observed in South Korea could also be explained by the very rapid process of industrialization experienced under a regime that, until recently, was quite repressive of workers unions and workers' rights.

Estimates for the Entire Population

As noted previously, disability compensation systems in Latin America and the Caribbean do not cover all sectors of employment. For example, occupational accidents in peasant farming, and domestic and urban informal sector employment were not included in the figures reported in Tables 2 and 3. Indeed, Table 4 shows that information on fatal injuries was based on a relatively small proportion of the workforce; for example, accidents were reported for only one third of the workforce in Brazil and Mexico. However, even in countries where the workforce is covered by reporting systems, the poor identification of occupational diseases and the legal and bureaucratic features of the systems, raise questions about the validity and accuracy of the estimates. For example, Keifer et al. (1996) used a community questionnaire to estimate the degree of underreporting in a regional pesticide poisoning registry in Nicaragua and showed that even in a region with a strong emphasis on reporting illness in targeted conditions, 65 percent of the cases went unreported.

An important reason for this underreporting is that the employer's contribution to the social security fund for occupational injuries is often adjusted for the firm's actual risk experience as revealed by reported occurrences (see Appendix). In some countries the insurance premium is based on the broad rating of risk within the particular industry; that is, more dangerous industries have to pay higher premiums than less dangerous industries, but all firms in the same industry pay the same insurance premium. In other countries the insurance premium is based upon the safety records of each company, so that if a firm is able to show that it has few accidents, it pays lower insurance premiums, even if it belongs to one of the more dangerous industries. This mechanism is designed to encourage employers to improve safety standards. However, it encourages underreporting since firms have a

[2] For example, during the recent gold rush in Brazil, 90% of gold production was coming from informal mining or *garimpos* (Malm, 1998).

[3] Since we have weighted the national rate by the number of workers covered, the importance of the outliers is reduced.

financial incentive to hide these events (Villegas et al, 1996).[4]

In order to estimate the total number of work-related impairments in the region we use the methodology suggested by Takala (1999), which is based on applying the rates of the population covered by reporting systems to the whole workforce. The average rate of fatal occupational accidents is 0.135 per 1,000 workers and the estimated workforce in Latin America and the Caribbean was around 202 million in 1998. Thus, about 27,270 fatal occupational accidents are estimated to occur each year in the region.[5] This figure is more than three times larger than the 7,443 fatal injuries reported in the official ILO (1998) statistics for the region. Presumably, 27,270 is a conservative estimate of the actual number of fatal occupational accidents as it is based on the following assumptions:

- In the workforce covered by reporting systems all fatal occupational accidents were reported.
- Fatality rates in the formal and in the informal sectors of the economy were the same.
- 50 percent of the workforce was employed in the formal sector of the economy.

The estimate is quite sensitive to these assumptions. If any of the above factors is changed, the estimate rises dramatically. In Table 5, we modify these parameters so that only half of occupational fatalities are reported and the rate of occupational fatalities in the informal sector is

Table 5 Estimating Annual Occupational Fatalities

Fatal accidents	Conservative Estimate	Alternative Estimate
Reported	7,443	7,443
Total Unreported	19,827	60,704
Total fatal accidents	27,270	68,147
Excess of fatal accidents compared to EME	16,588	57,465
Attribution of unreported fatal accidents		
Workers covered by the recording system	0	7,443
Workers in the formal sector not covered by the recording system	6,192	12,356
Workers in the informal sector	13,635	40,905
Non-fatal accidents with 3 or more days out of work (millions)	20-27	51-68
Assumptions:		
Reported rate of fatal occupational accidents [(a)]	0.135	0.135
Rate of reporting in the formal sector [(c)]	100%	50%
Rate of fatal injuries in the informal sector [(c)]	0.135	0.2
Share of the informal sector [(b)]	50%	50%
Nonfatal / fatal accidents ratio [(c, d)]	750-1000	750-1000
Rate of fatal injuries and occupational accidents in EME [(d)]	0.053	0.053

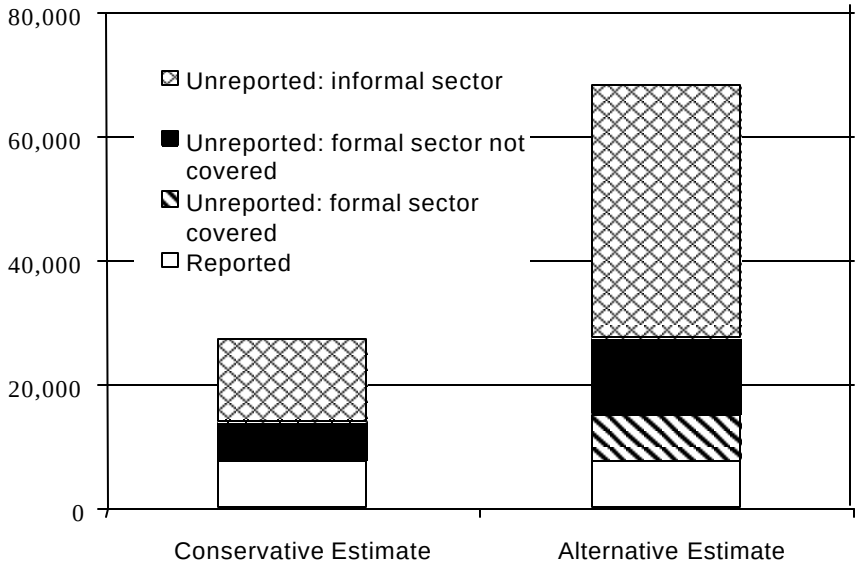
EME: Established Market Economies

Sources: (a) ILO (1998); (b) ILO (1999); (c) authors' assumptions; (d) estimated by Takala (1999).

[4] Other effects of the use of experience-based insurance premium are discussed in section 6.

[5] This figure is very close to the 26,374 fatalities per year in Latin America and the Caribbean estimated by Takala (1999) using data from 1994.

Figure 1 Alternative Estimates of Annual Fatal Occupational Accidents



50 percent higher than in the formal sector. Under these assumptions, the estimate of total annual occupational fatalities is 68,147 (see Table 5 and Figure 1).

Table 6 compares the rates of fatal occupational accidents across different regions of the world as estimated by Takala (1999). The lowest fatality rate was observed in the established market economies: 0.053 per 1,000 workers. If workers in Latin America and the Caribbean were exposed to the same risk of dying from occupational factors as those in the established market economies, more than 16,500 lives could have been saved (using the conservative assumptions). Although India, the former socialist economies of Europe, and China have lower estimated fatality rates than Latin America and the Caribbean, the region's safety record is better than that of Sub-Saharan Africa, the Middle Eastern crescent and other Asia countries and islands.

In addition, to show the sensitivity of estimates

Table 6 Fatal Occupational Accidents in Different Regions

	Fatality rate per '000 workers	Total Employment	Estimated fatalities
EME	0.053	366,437,000	19,662
IND	0.110	334,000,000	36,740
FSE	0.110	140,282,000	15,563
CHN	0.111	614,690,000	68,231
LAC	**0.135**	**201,541,888**	**27,270**
SSA	0.210	218,400,000	45,864
MEC	0.225	186,000,000	41,850
OAI	0.231	339,840,000	80,586

Source: Calculation for LAC is based on data from ILO (1998). Other regions are from Takala (1999)
EME: established market economies; CHN: China; FSE: former Socialist economies of Europe;
IND: India; OAI: other Asia and Islands; SSA: Sub-Saharan Africa; MEC: Middle Eastern Crescent

for fatal accidents, it is possible to derive a more likely figure for nonfatal accidents using information about fatal accidents. Various studies have demonstrated that if the reporting system is reliable, a roughly constant ratio between fatal and nonfatal accidents exists (see Takala, 1999). We use two ratios: 1 fatal accident per 750 nonfatal accident is a conservative estimate and 1 fatal accident per 1,000 nonfatal accidents is the observed ratio in countries with a more sophisticated reporting system, such as Finland and the United States (Leigh et al., 1996a; ILO, 1998). Using this methodology, we conservatively estimate between 20 and 27 million occupational accidents causing 3 or more days' absence from work in Latin America and the Caribbean. A less conservative estimate, using the alternative ratio leads to an estimate of 51 to 68 million nonfatal accidents each year.

Global Burden of Disease Estimates

An alternative way to look at the impact of occupational hazards and risks on health conditions is to consider how many of these accidents and fatalities are avoidable. Leigh et al. (1996b) undertook an ambitious study aimed at estimating the burden of injuries attributable to occupational factors in a comparable manner across major regions.[6]

The burden of such injuries was estimated using direct reports of occupational injury rates in Scandinavia as a minimum attainable level and applying them to each region. The study then used data from some countries to extrapolate the burden of disease in their respective regions. Mexican data was used as the basis of the estimates for Latin America and the Caribbean. The study estimated about 97,700 occupational fatalities in the region in 1990, which accounted for 3.2 percent of all deaths (see Table 7).

According to this study, the region has the highest share of deaths attributable to occupational factors in the world, which testifies to the excessive level of life-threatening hazards that workers face in the region. Note that this estimate of fatalities is almost three times higher than the figure estimated in the previous section. Given the different methods that were applied, the figure of 27,270 fatalities previously calculated must be viewed as an extremely conservative estimate.

The number of fatalities gives only an imperfect measure of the severity of the problem because

Table 7 Burden of Disease and Injury Attributable to Employment, 1990

Region	Death ('000)	As % of total deaths	YLLs ('000)	As % of total YLLs	YLDs ('000)	As % of total YLDs	DALYs ('000)	As % of total DALYs
EME	154.0	2.2	2,826	5.7	2,144	4.4	4,971	5.0
CHN	247.1	2.8	4,937	4.2	3,295	3.6	8,232	3.9
FSE	76.2	2.0	1,409	3.9	951	3.6	2,359	3.8
LAC	97.7	3.2	1,973	3.5	1,708	4.1	3,681	3.7
IND	185.2	2.0	3,671	1.8	2,159	2.5	5,830	2.0
OAI	148.1	2.7	3,060	2.7	1,940	3.1	5,001	2.8
SSA	111.8	1.4	2,323	1.0	1,537	2.2	3,860	1.3
MEC	109.2	2.4	2,294	2.2	1,659	3.6	3,954	2.6
World	1,129.3	2.2	22,493	2.5	15,394	3.3	37,887	2.7

Source: Murray and Lopez (1996; p.313)
EME: established market economies; CHN: China; FSE: former Socialist economies of Europe; IND: India; OAI: other Asia and Islands; SSA: Sub-Saharan Africa; MEC: Middle Eastern Crescent.

Table 8 Burden of Disease Attributable to Major Risk Factors in LA

	1990							
Risk Factor	Death ('000)	As % of deaths	YLLs ('000)	As % of YLLs	YLDs ('000)	As % of YLDs	DALYs ('000)	As % of DALYs
Alcohol abuse	136.1	4.5	3,319	5.9	6,201	1407	9,520	9.7
Poor water supply	135.3	4.5	4,254	7.6	929	2.2	5,183	5.3
Malnutrition	135.0	4.5	4,540	8.1	520	1.2	5,059	5.1
Occupation	**97.7**	**3.2**	**1,973**	**3.5**	**1,708**	**4.1**	**3,681**	**3.7**
Unsafe sex	73.9	2.5	2,003	3.6	1,642	3.9	3,645	3.7
Hypertension	242.5	8.1	1,674	3.0	134	0.3	1,808	1.8
Illicit drug use	16.0	0.5	449	0.8	1,140	2.7	1,589	1.6
Tobacco use	99.4	3.3	952	1.7	388	0.9	1,340	1.4

[6] The results of this study are summarized in Murray and Lopez (1996) and Leigh et al. (1999).

occupational fatalities tend to occur earlier in life, on average, than other causes of death among adults. Using years of life lost (YLLs) as the unit of measurement adjusts for this fact and yields a work-related burden of disease and injuries of 1,973,000 YLLs. Even so, the relative importance of occupational fatalities increases only slightly, to 3.5 percent of the total. When adjusting for the impact of occupational injuries on quality of life, the share increases further. Measured in terms of years lived with disabilities (YLDs), occupational factors represent 1,708,000 YLDs, equivalent to 4.1 percent of the total. Using these figures, occupational hazards account for a loss of about 3.7 million disability adjusted life years (DALYs), representing 3.7 percent of all DALYs in the region. Table 7 ranks the world's regions according to the burden of disease and injury attributable to employment. It shows that the established market economies have the highest proportion of DALYs attributed to occupational factors, followed by China and the former socialist economies of Europe. Latin America and the Caribbean ranks fourth. These results can be explained by the inverse relationship between economic development and the overall burden of diseases with high DALYs such as those observed in early life.

Murray and Lopez (1996) compared the disease burden attributable to occupational exposures with nine other major health risks whose relative importance for the region is presented in Table 8. From this perspective, occupational hazards account for a large share of DALYs that could be reduced through modifying behavior or environmental factors. It is surpassed only by alcohol abuse (9.7 percent); poor water supply, sanitation and hygiene (5.3 percent); malnutrition (5.1 percent); and unsafe sex (3.7 percent).

Two caveats should be considered when interpreting these figures. First, the estimates of the burden of diseases are based on notification systems that cover only a small portion of the regions; therefore, the results have to be interpreted in light of the uncertainty and inaccuracy of such extrapolations. Second, the estimates of the risk factors are based on different methodologies, making comparisons between risk factors subject to considerable measurement error.

Agriculture, Construction, and Mining

This section explores in greater detail occupational risks in agriculture, construction, and mining. These three sectors have been chosen for the particular importance that they have for the economy of the region and for the relatively large proportion of occupational injuries and diseases that occur in them. However, the majority of the epidemiological studies presented in this section may be subject to so-called "healthy worker effect" bias. This problem is likely to affect cross sectional studies producing an underestimate of injury rates because only workers who are still working (or alive) can be counted (Monson, 1986). Hence, more accurate studies would require gathering work histories over time.

OCCUPATIONAL HAZARDS IN AGRICULTURE: PESTICIDE POISONING

Until recently, most OSH activities took place in the industrial sector. However, according to the latest ILO figures, approximately 19 percent of the region's workforce is engaged in agriculture and other primary sector activities. In some countries (e.g. Honduras and El Salvador), this share reaches one third of the total workforce. Some types of occupational injuries, which are related to heavy physical work, have the same general characteristics as the accidents that take place in the industrial sector. Other types of occupational accidents and diseases, such as pesticide poisoning, are more specific to the agriculture sector. Moreover, the exposure to these hazards in the region is aggravated by the presence of nonoccupational factors such as chronic parasitic diseases, infectious diseases and malnutrition.

Changes in land use have greatly increased the use of pesticides in the last decade. Between 1988 and 1993, world pesticide consumption increased by an average of 20 percent across countries. During the same period, Latin America and the Caribbean experienced an increase of 40 percent. While, most pesticide consumption occurs in the region's largest countries (e.g. Brazil), the intensity of pesticide use is greater in smaller countries. For instance, Costa Rica consumes 14 kg of pesticide per worker each year; Panama uses 10 kg per worker; Colombia, 6.0 kg; Mexico, 4.5 kg; Ecuador, 2.5 kg; El Salvador, 2.5 kg; Brazil, 2.3 kg; Honduras, 2.1 kg; and Guatemala, 1.7 kg. It has been estimated that 5 percent of the people who are economically dependent on agriculture in the region work or live in areas where intensive pesticide use occurs (McConnell et al., 1993) and that 99 percent of all deaths due to pesticide poisoning occur in developing countries (Kogevinas et al., 1994).

Acute pesticide poisoning is recognized as a major public health problem in much of Latin America and the Caribbean (Repetto and Baliga, 1996).[7] Numerous reports have been made of acute poisoning from pesticides, along with estimates of fatalities. Although poisoning may also result from intentional ingestion, occupational exposure appears to be the major cause of acute pesticide poisoning in the region (Forget, 1991). For instance, a recent study in Costa Rica (Leveridge, 1998) showed that occupational exposure was the most frequent cause of pesticide poisoning (38.5 percent), followed by accidental situations (33.8 percent) and suicide attempts (22.5 percent). Furthermore, excessive or improper use of pesticides can also have a negative impact on the health of the general population

[7] Workers may also be exposed to pesticides in the industrial sector. A recent survey in a firm producing organophosphate pesticides in Guanajuato (Mexico) found that 63% of the workers presented persistent symptoms and that 15% suffered from acute poisoning from pesticides (Palacios-Nava et al., 1999).

through the consumption of agricultural products highly saturated with such chemicals.

Studies in Latin America and the Caribbean indicate that most workers who spray and apply pesticides do not use adequate protective clothing. It has been suggested that protective clothing made of plastic or rubber material is designed for colder climates and may cause excessive discomfort in hot, humid climates. Regardless of the reason, several authors have noted that safety instructions regarding changes of clothing and bathing after spraying are not followed properly in the region (Condarco Aguillar et al., 1993; Arroyave, 1993). Moreover, illiteracy among agricultural workers probably reduces the usefulness of written or printed instructions.

Table 9 summarizes the studies we have identified on the occurrence of illnesses associated with the use of pesticide in the region. Cases of pesticide poisoning among agricultural workers are frequent, but rates vary widely. A recent survey in the state of Yucatan (Mexico) found that 40 percent of the sample sought health care in one year because of illnesses due to occupational exposure to pesticides. A study in Brazil estimated that lifetime incidence of pesticide poisoning among diversified farmers was "only" 12 percent. High levels of pesticide poisoning were reported by agricultural workers in both Costa Rica and Nicaragua, but were much lower in the former (4.5 percent per year) than in the latter (25 percent per year). Beyond acute poisoning, pesticide exposure can lead to permanent peripheral nervous system damage. This was demonstrated in a study in Ecuador that showed that exposed agricultural workers had a higher incidence of neurobehavioral dysfunction than town residents who were not exposed to pesticides (Cole et al., 1998). It must be noted, however, that there are conditions in which reduced pesticide use can lead to actual improvements in agricultural productivity (see Box 1 below).

OCCUPATIONAL HAZARDS IN THE CONSTRUCTION INDUSTRY

The construction industry accounts for a large number of occupational accidents in Latin America and the Caribbean (Castors de Pontes, 1999). Construction workers perform dangerous activities such as working on foundations, scaffolding, laying concrete and moving earth. The most common types of accidents are:

? *Injuries caused by falls from ladders, lifts and scaffolds*. Falls consistently account for the greatest number of fatalities in the construction industry. These types of accidents often involve a number of factors including

Box 1 – Workers' Health and Productivity: The Case of Potato Production in Ecuador

In a recent study, Antle et al., (1998), estimated the effect of a policy to reduce pesticides use in potato production in Ecuador. To examine the health impacts of pesticides use, the authors conducted a survey of the farm population and a control group not exposed to pesticides, which revealed serious neurobehavioral damage was being caused by exposure to pesticides. Next, they estimated the impact of workers' health on potato production, which turned out to be negative and statistically significant, indicating that farmers with higher neurobehavioral problems had higher costs of production per hectares, and thus, lower productivity. The authors performed a simulation analysis and showed that restricting the use of pesticides that posed the greatest health risks was a "win-win" policy. In other words, farmers would be healthier and more productive if the use of some pesticides (e.g. *carbofuran*) were reduced. Because the productivity gains obtained from the improvement in workers' health outweighed the negative productivity effects of the reduction in pesticide use, both workers and employers would be better off. However, the win-win outcome can be obtained only when the policy targets the insecticides that pose the greatest health risk. When the effects of a policy aimed at reducing the use of all pesticides was considered, a trade-off between health and productivity emerged. In such cases, an increase in workers' health could only be obtained at the cost of a reduced harvest.

Table 9 Pesticide Hazards Among Agricultural Workers in LAC

Country	Outcome	Type of study	Reference
Bolivia	Between 5.3% and 16.7% with depressed Cholinesterase Level (CL) [(a)]	Analysis of CL level of agricultural workers in different regions of Bolivia	Condarco Aguillar et al., 1993
Brazil	16% (lifetime) looked for healthcare due to pesticide	Survey among agricultural workers in the State of S. Paulo	Garcia-Garcia, 1999
Brazil	12% (lifetime) experienced pesticide poisoning	Survey among agricultural workers in Campinas	Trapé et al., 1984
Colombia	34% with depressed CL	Analysis of CL level of agricultural fumigators exposed to organophoshate pesticides	Ministerio de Salud Publica, 1978
Costa Rica	4.5% (yearly) experienced pesticide poisoning	Descriptive epidemiological study among agricultural workers	Wesseling et al, 1993
Ecuador	Peripheral nerve symptoms [(b)] OR = 3.1 Signs of poor coordination OR = 4.3 Abnormal deep tendon reflexes OR = 2.9 Reduced power OR = 2.1	Cross-sectional survey of rural population exposed to pesticides compared to unexposed population of town residents	Cole et al., 1998
Mexico	20% (per season) experienced pesticide poisoning	Survey among seasonal farm workers in the north-west of the country	Chain Castro et al., 1998
Mexico	40% (yearly) suffered from pesticide intoxication	Rate of pesticide intoxication among agricultural workers in the State of Yucatan	Drucker et al., 1999
Mexico	13% (yearly) experienced pesticide poisoning	Survey among cotton farmers	Hayes and Laws 1991
Nicaragua	25% (yearly) and 48% (lifetime) experienced pesticide poisoning	Survey among agricultural cooperatives worker	Keifer et al., 1996

unstable working surfaces, the misuse of fall protection equipment, workers slipping or being struck by a falling object. Studies have shown that the use of guardrails, fall arrest systems, safety nets, covers, and travel restriction systems can prevent many such deaths and injuries.

- *Injuries caused by defective or negligently operated cranes, hoists and derricks.* The most common cause of fatal accidents in this category is cranes coming into contact with power lines. Other major causes of crane accidents include assembly and dismantling the crane, boom buckling, rigging failure and upset, and crane overturning. Many of these accidents are preventable and are usually caused by poor safety procedures and negligence.
- *Accidents related to dangerous equipment, tools and machines*. Moving machine parts have the potential for causing severe workplace injuries, such as crushed fingers or hands, amputations, and burns and blindness, among others. Equipment with appropriate design and protective features, along with training in safe operation, are essential for protecting workers from many of these needless and preventable injuries.
- *Injuries caused by explosive, corrosive and poisonous gas*. Many operations and construction projects require the use of compressed gases, which may be combustible, explosive, corrosive, poisonous, inert or pose some combination of hazards. The safe design, installation, operation and maintenance of pressure vessels in accordance with the

appropriate codes and standards are essential to worker safety and health.

Table 10 Occupational Hazards Among Construction Workers in LAC

Country	Outcome	Type of study	Reference
Brazil	Construction industry 8.2 % Manufacture of metal products and machinery 7.3% Manufacture of paper, printing and publishing 4.3%	Injuries reported during the period Oct.-Dec. 1988 in S. Paulo City by economic activity	Santos et al., 1990
Brazil	5.98 deaths per 10,000 workers/year	Fatal accidents by economic activity from Ministry of Labor data	De Lucca and Mendes, 1993
Chile	Construction 17% Transport 12.6% Manufacturing 12.3%	Accidents rates by economic activity	Asociación Chilena de Seguridad, 1999
Colombia	140 cases per 1,000 workers/year	Occupational injury rates in construction in the province of Antioquia	Nieto-Zapato, 1992

While these risks are common to construction in all countries, the region's climate (heat and humidity) plus the lack of adequate protection and training exacerbate risks in this industry (Amaral et al., 1999). Table 10 presents a summary of studies that have analyzed occupational hazards in the region's construction industry showing just how dangerous it is to work in this sector. For example, between October and December 1988 the largest share of all work-related accidents (i.e. 8.2 percent) in Sao Paulo, Brazil occurred in the construction industry (Santos et al., 1990). Studies also found that the construction industry has the highest occupational risk in Chile (Asociación Chilena de Seguridad, 1999) and high injury rates were also reported among builders in the province of Antioquia, Colombia (Nieto-Zapato, 1992).

OCCUPATIONAL HAZARDS IN MINES

Primary extractive industry is an important economic activity in many countries in Latin America and the Caribbean. It is estimated that currently there are between 543,000 and 1,039,000 miners in the region, while during the peak of the gold rush there were more that 1.6 million miners in Brazil alone (Malm, 1998).

The extractive industry presents a high incidence of occupational illness and injuries. A mine is an extremely dangerous environment. Accidents may occur from collapsing roofs, falls, electrocution, use of dangerous equipment, and explosives. Inadequate engineering controls, protective equipment and medical surveillance compound the occupational risks of mining and related activities in the region (see Table 11). For instance, a study of occupational injury among coal miners in the province of Antioquia, Colombia, estimated a rate of 522 accidents per 1,000 full-time workers per year, while the rate for similar mining activity in the United States was only 152 accidents per 1,000 workers (Frumkin, 1999).

Silicosis, recognized as a major occupational health problem among miners, deserves special attention. It results from the accumulation of silica dust in the lungs and the reaction of the tissue to its presence. A strong association between silicosis and lung cancer after occupational exposure to dust containing crystalline silica has been established (Boffetta et al., 1994). Exposure to silica dust measured among workers in the crushing plant of a copper mine in Chile showed that the level of respirable silica dust was 189.5 mg/m^3, well above safe levels (Romo-

Table 11 Occupational Hazards Among Mine Workers in LAC

Country	Outcome	Type of study	Reference
	Silicosis		
Bolivia	22.2%	Prevalence of silicosis in tin mines	Pinell, 1976
Chile	21.4%	Prevalence of pneumoconiosis (mainly silicosis)	Prenafeta, 1984
Colombia	15.0%	Prevalence of pneumoconiosis (mainly silicosis) among coal miners in	Ministerio de Salud Publica, 1978
	Exposure to metals and dust		
Chile	189.5 mg/m^3	Exposure to silica dust among workers in crushing plant of a copper mine	Romo-Kroger et al., 1989
Chile	Chronic asymptomatic Manganese (Mn) exposure resulted in detectable abnormalities of movements	Manganese miners in Andacollo were compared to unexposed population for dystonic rigidity and proximal tremor	Hochberg et al., 1996
Chile	0.065 mg/L grill workers 0.125 mg/L roaster operators 0.17 mg/L packers	Concentration of arsenic among workers in a copper, arsenic, gold and silver mine complex.	Harper and Possel, 1990
	Injuries		

Kroger et al., 1989).[8] Table 11 shows that silicosis is a major occupational disease in the region, which affects between 15 percent and 22 percent of miners in countries like Bolivia, Chile and Colombia.

Silicosis is not the only health threat faced by miners. They are also exposed to coal dust that can cause black lung disease, and high concentrations of metals that can cause neurological damage. Exposure to manganese, for example, has been associated with a measurably higher prevalence of abnormalities in physical movement, such as dystonic rigidity and proximal tremor (Hochberg et al., 1996). The large quantity of mercury released into the environment during gold extraction, particularly prevalent in the Amazon region, constitutes an increasing concern for its potential danger both to the miners and the population living in the immediate area. Metallic mercury is used for the amalgamation of gold, and mercury is released by evaporation at reburning sites. The first extraction (burning) is performed in the field by the *garimpos* (informal miners) and the second (reburning) in gold shops in towns. This practice may expose workers to health risks from inhaling elemental mercury. Moreover, mercury is released in substantial amounts into rivers and lakes and may accumulate as methylmercury in aquatic food chains.

Mercury has been used in gold extraction in Brazil, Venezuela, Colombia, Bolivia, Guyana, Suriname, Ecuador and Peru since the 1980s (Malm, 1998).

The best documented case is Brazil, where five million people are estimated to be exposed to health hazards derived from the occupational use of mercury. This figure includes people living along rivers who eat contaminated fish, as well as those exposed to metallic mercury released in the mining areas and in the urban shops (Câmara and Corey, 1992).

[8] The permitted exposure levels for crystalline silica allowed by the US's Occupational Safety and Health Administration is much lower than the level registered in Chile: only 10 mg/m^3 respirable silica dust divided by the percent of silica in the dust and 30 mg/m^3 of total dust.

Whenever mining is done informally, proper oversight is lacking and occupational hazards tend to be more severe. And when international prices of primary products fall, reducing profit margins, expenditures to protect workers' health may be the first ones to be cut. All in all, these factors make mining one of the riskiest sectors in the economy.

Costs and Economic Aspects of Occupational Health

Data on the economic consequences of occupational accidents and diseases are very scarce, both in developed and developing countries. The most rigorous available study of the economic costs of occupational injuries and illnesses at the national level was produced in the United States, where it was estimated that they represent approximately 3 percent of the gross domestic product (GDP) in 1992 (Leight et al., 1996a). The ILO and the WHO have produced estimates of the total burden of occupational accidents suggesting that their cost may reach as much as 10 percent of the GDP of developing countries (PAHO, 1999; p.11).

The only information available for Latin America and the Caribbean derives from the national social security systems, which include health care expenditure and pensions for work-related disabilities and deaths. The Pan American Health Organization (PAHO) has recently produced a report with information from several Latin America countries (PAHO, 1998), summarized in Table 12. The situation among countries varies. In Costa Rica, where the National Insurance Institute covers 68.4 percent of the country's workforce, direct expenditures (care and indemnification for occupational injuries and diseases) and administrative costs amounted to US$47.9 million in 1995, representing nearly US$70 per insured worker. In other countries expenditures were significantly lower. For instance, expenditures in Chile were US$33.80 per insured person in 1996, and Mexico showed the lowest expenditure with just US$21.26 per insured worker. Considering data from all the countries, the average social security expenditure per insured person amounted to US$30.62 per year.

Almost nothing is known about the costs borne by other social actors such as the private sector, families and the rest of the community. The "hidden costs" for firms from work-related accidents are estimated to be, on average, four times the immediate direct costs related to workers compensation (Heinrich et al., 1980). These hidden costs include loss of production due to time spent recovering, lower productivity upon returning to work, and lost production caused by the reduction of other workers' productivity, either because their work depends on and complements that of the injured worker or because the injury reduces morale and increases stress.

Table 12 Social Security Expenditure for Occupational Injuries and Diseases

Country (year)	Costs for the social security (millions of US$) [(a)]	Workers insured [(a)]	Proportion of the workforce that is insured % [(b)]	Cost per person insured (in US$)	Cost per person insured/ GDP per capita % [(c)]
Chile (1996)	122.5	3,624,129	68.40	33.80	0.90
Costa Rica (1995)	47.9	687,114	58.52	69.71	3.29
Mexico (1996)	196.7	9,251,639	26.26	21.26	0.67
Panama (1996)	12.8	522,698	60.27	24.49	0.93
Peru (1996)	12.7	509,234	8.31	24.94	1.19
Venezuela (1995)	118.2	2,087,225	27.21	56.63	1.75

Sources: (a) PAHO (1998); (b) calculation based on ILO (1998); (c) IDB (1998)

In addition, there may be damage to equipment, machinery, materials, or facilities caused by the accident and official figures do not include compensation that may be paid out by the firm in addition to social security.

Second, even when workers or survivors receive social security benefits due to occupational accidents, these benefits may not compensate them completely for the economic costs (e.g. loss of income, extra expenditures on medicine), and nonmonetary costs (e.g. contribution to home activities, pain and suffering) incurred. Moreover, around 50 percent of the regional workforce is employed in informal activities and is typically excluded from social security and labor legislation. Thus, the costs related to this part of the workforce are primarily borne by the workers and their families.

Finally, costs for occupational injuries also spill over to other sectors of the economy. For instance, occupational accidents may increase the demand for public health services and services from other welfare agencies. These public health care services are usually financed out of general revenues and are borne by taxpayers.

This cost is not easy to estimate. However, a recent study found that agrochemical poisoning in Yucatan (Mexico) cost the regional economy US$2.7 million per year (equivalent to 2 percent of the value of agricultural production), and 30 percent of this cost was borne by the state medical system (Drucker et al., 1999).

Table 13 and Figure 2 present some independent estimates of the economic costs of occupational accidents and injuries. Using the average social security expenditure of US$30.62 per insured worker yields a conservative estimate of US$24 billion in social costs due to occupational accidents and injuries, representing about 1.8 percent of GDP annually.

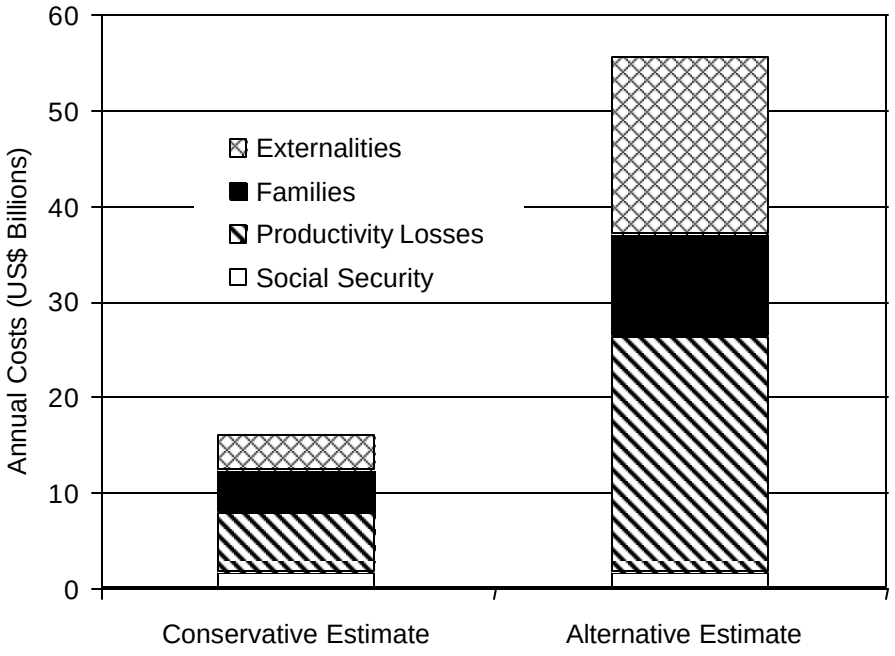
After adjusting for certain factors (namely the actual costs to formal sector workers beyond social security benefits, the ratio of productivity to social security costs, and the ratio of externalities), we get an alternative estimate of social costs of about US$55.5 billion. This represents about 4 percent of annual GDP, which is not quite as high as the ILO and WHO estimates, but still represents a considerable cost to society.

Table 13. Estimating Costs of Occupational Disease and Injuries

US$ Billions	Conservative Estimate	Alternative Estimate
Social security	3.09	3.09
Private sector (lost production, etc)	12.34	24.68
Families	3.09	9.26
Externalities	5.55	18.51
Total	24.07	55.54
Share of GDP (%)	1.77%	4.07%
Parameters:		
Social security (US$ per insured person) [(a)]	30.62	30.62
Share of the informal sector [(b)]	50%	50%
Private productivity losses (US$ per insured person) [(c)]	30.62	122.48
Ratio private loss to Social Security Costs [(c)]	1	2
Ratio of externalities to other costs [(c)]	0.3	0.5

Sources: (a) PAHO (1998); (b) ILO (1999); (c) authors' assumptions

Figure 2 Estimated Annual Costs of Occupational Accidents, 1996



Regulation and Incentives to Promote Occupational Safety

We have shown that the rate of occupational injuries and diseases in Latin America and the Caribbean are high. The burden is likely to be heavier for those who can least afford it, such as persons employed in informal activities with lower wages, fewer opportunities for advancement, and that lack compensation for occupational accidents and diseases. Above all, the price paid for occupational injury, disease and death is unnecessary, as countries in other regions show that it is possible to achieve higher levels of safety.

What, then, should be done to improve safety? How much should occupational hazards levels be reduced before the workplace can be considered safe?

There are two broad views regarding the need for public interventions to introduce and enforce OSH standards. Some authors have argued that in a world of perfect markets and complete information workers in riskier jobs would receive higher wages to compensate them for the risk. Thus, public interventions such as OSH regulation and mandatory insurance for occupational accidents would be unnecessary. For example, Thaler and Rosen (1976) developed a theoretical model, with a perfectly competitive labor market, risk averse workers, perfect information about risks of accidents and perfect worker mobility, in which firms had different risks of accidents but could influence the probability of accidents by undertaking safety expenditures. They showed that under these assumptions, workers' compensation insurance was unnecessary and government regulation was harmful.

However, because there are labor market inefficiencies and incomplete information reality is quite different (see Rea, 1981). For example, employers and insurers may not be able to identify workers who are accident-prone and this type of misinformation leads to a problem of adverse selection. Moreover, in the working environment there are serious monitoring constraints: workers do not have the technical capacity to estimate occupational risk accurately and to monitor whether employers are taking proper precautions. Thus, employers may not have adequate incentives to reduce risks in the workplace. The presence of involuntary unemployment undermines the assumption that workers receive a "fair" compensation for higher risks. In general, it has been demonstrated that if the labor market presents imperfections, mandatory insurance and safety regulation raises the expected utility of risk-averse workers (Diamond 1977; Oi, 1974). Thus, the state or some collective agency should be in charge of evaluating safety and introducing regulations, norms, standards, incentives, or sanctions to enforce them when necessary.

HOW MUCH SHOULD OCCUPATIONAL RISK BE REDUCED?

Even if the need to introduce regulations, norms and standards to reduce occupational risk is recognized, it is not clear what the desirable outcome should be. In some cases, the answer is simplified because there is no trade-off between improved safety and costs. When reducing occupational hazards improves productivity, then the decision to dedicate funds, provide incentives, regulate or take legal action is unequivocal. For example, the study summarized in Box 1 demonstrates that the loss of productivity in potato production from decreasing pesticide use could be more than offset by the increases in productivity resulting from improvements in workers' health.

A seemingly attractive approach would be to aim for the *minimum* level of risk. However, the "minimum risk" for occupational hazards is difficult to define without relating it to some other objective. If "minimum risk" is defined as "no risk," then it is unattainable and could only be achieved in a society where no one worked (Murray and Lopez, 1999). In practice, we can only hope to reach an efficient level of risk, that is, a level of risk that takes into consideration both the potential benefits of greater safety along with the expected costs or problems that emerge from achieving that reduced level of risk. Alternatively, we could aim for some *threshold of risk*, for example 1 in a million or "the same risk as in the average home." Such thresholds are difficult to set because they may appear arbitrary. But they also fail to address the societal costs of prevention, which preclude others beneficial uses of those resources. A third option is to aim for a *socially efficient level of risk* where the potential benefits of a marginal improvement in safety equal the expected costs that result from that reduced level of risk.

If the costs of attaining an improvement in occupational safety are trivial and the benefits are large, the decision to proceed is obvious. However, in other cases, it becomes more difficult to judge whether or not safety improvements that go beyond a certain level of risk reduction cost more than they are "worth." Presumably, the countries of the region have many opportunities to improve occupational health and safety in ways that are cost-effective given the generalized lack of safety provisions and the excessive rates of fatalities and nonfatal injuries that were documented above. Simple measures such as adequate ventilation and unobstructed work areas can go a long way toward reducing occupa-

Box 2 – Cost-Effectiveness Study on Health Interventions to Prevent Work Injuries

In a recent paper, the Instituto Mexicano del Seguro Social (Salinas et al., 1999) reviewed the relevance of conducting a cost-effectiveness study to improve safety in the workplace. The study, based in Northern Mexico in the metal working industry, covered 82,034 workers registered in this type of industry in 1998. Health interventions were ranked according to the estimated cost-effectiveness, where effectiveness was measured through the number of healthy life years (HEALY) gained from each intervention.

Intervention	Total cost of the intervention (US$)	HEALY gained	Cost-effectiveness ratio
Education	239,742	376.11	637
Training	1,567,701	752.22	2,084
Inpatient care	856,104	386.56	2,215
Helmet	353,690	112.40	3,147
Protective apron	383,051	107.90	3,550
Protective gloves	168,468	3.55	47,432
Protective glasses	147,653	3.09	47,736
Lumbar support	737,164	18.62	92,766
Protective shoes	1,727,072	0.33	1,147,770

Education was revealed to be the most cost-effective intervention and security shoes the least cost-effective in preventing injuries in the metal-working industry. This type of analysis can help decision-makers to set priorities between different interventions when resources are constrained and select the most cost-effective interventions to increase safety at work.

tional risks in the region (see Box 2).

However, when policies to reduce occupational hazards generate a trade-off between workers' health and productivity or jobs, weighing the costs and benefits of improved occupational safety may be difficult, both technically and politically. Some public agencies have sought to be explicit in quantitatively evaluating the risks that can be avoided by a particular measure and assigning them a monetary value that can be directly compared to the costs of implementing the measure. By law, the United States government is required to perform such quantitative analyses, which has led to efforts to estimate the "value" that should be attributed to saving a life. Viscusi (1993) surveyed the US literature and found that the implicit value of life was estimated between US$600,000 and US$16.2 million – a wide range of values that is also subject to a variety of methodological, if not ethical, critiques (see, for example, Dorman, 1996).

When such technical evaluations of occupational safety measures are undertaken, there are at least two issues that are rarely addressed, but which are of great importance. First, an evaluation cannot assume that *technology* will remain static. In fact, we know that technology changes constantly in ways that change the relative costs of production, generating safer materials and processes even while it may introduce new and unknown dangers. But more importantly, establishing standards and imposing requirements can actually induce technological advances. Many examples are available from cases where new materials have been developed to replace ones that were harmful to human health or the environment, such as PCBs, Freon, and lead in paint.

The second major issue is related to the *distribution* of benefits and costs. In cases where a trade-off between worker safety and productivity occurs, the benefits of improved safety will go to the affected workers, while the costs of improvements may be borne by shareholders (through reduced earnings), consumers (through higher prices), and/or other workers (through higher unemployment). Where the benefits are large and costs are small, the distributional consequences will be minor. But in cases where the benefits and costs are of similar magnitudes, distributional consequences will be of greater importance and cannot be ignored.

In reality, few decisions about safety measures and regulations are made purely through technical analysis. In fact, existing occupational safety levels are really the outcome of many social forces, at different levels and in many places. Workers have struggled for improved working conditions both through direct negotiation with firms and business associations and through political pressure (Dorman, 1996). Collective action can solve a number of problems that individual initiatives cannot. Two of these problems are related to competitive pressures and information costs. *Competitive pressures* make it difficult for individual firms to take the lead in improving occupational safety standards when these raise their costs over those of their competitors. Thus, collective enforcement of certain occupational safety standards, by the government or even by private industry associations, may be the only way to assure that socially beneficial standards are followed and "defections" from the common agreement are limited.

Information costs are another impediment to the adoption of better occupational safety measures. It can be costly for a single firm or a single worker to investigate occupational hazards and remedies. By banding together in industry associations or unions, collective actions can be taken to research these issues and find effective ways to better working conditions. "Induced technology," referred to earlier, can be one result of such collaborations. In many cases, governments take on this role of improving the amount and kinds of information that are available to workers and firms. Ashford (1976) provided a justification of imposing OSH regulation based on the argument that these standards represent a "public good."

Public information about occupational hazards and collectively established standards can assist workers in several ways. On the one hand, the existence of public standards can provide moral backing to unions or groups of workers who are trying to negotiate changes with a particular firm or industry. On the other hand, the provision of better information can improve decisions made by workers regarding how much risk they are willing to assume when taking a job or choosing careers. One study simulated the effects of tighter enforcement of safety standards in the Mexican economy and demonstrated that more stringent regulations can be beneficial to firms and workers alike (Maskus et al., 1995). The authors pointed out that this policy would improve information in the market and better disclose the true level of hazards. Thus, tighter safety standards had a positive impact on workers and firms also benefited because pricing of goods and wages incorporated more accurately the occupational hazards of the various industries. Indeed, this effect was empirically demonstrated in a study of Quebec's manufacturing, showing that the enforcement of occupational safety and health regulations had a positive effect on productivity growth in the mid-1980s (Dufor et al., 1998). Therefore, better occupational health and safety standards in the region may benefit both employers and firms.

HOW TO INDUCE COMPLIANCE WITH OCCUPATIONAL SAFETY REGULATIONS

Information and promulgation of OSH standards alone are not enough. Simply passing a law commanding occupational safety does not automatically reduce workplace hazards. Some countries in the region have a reasonably complete set of OSH laws and regulation, but enforcement is usually erratic and often absent (see Frumkin and de Câmara, 1991).

Occupational safety agencies have often been regarded as toothless tigers, unable to achieve their stated goal because of the small number of inspectors, few inspections, and the low fines for noncompliant firms. However, there is some empirical evidence that regulation, such as exists in the United States, may have a relatively large impact on business compliance behavior despite a low regulatory profile (Well, 1996). These studies indicate that government regulatory agencies can substantially change private sector behavior even with limited resources. This can happen when firms make compliance decisions on the basis of potential, rather than actual, penalties. In this case, enterprises that believe they will be subjected to the maximum possible penalty arising from noncompliance may choose to comply, even when the chance of detection and sanction may be relatively small. Another way that compliance is encouraged is through the functioning of insurance markets and civil liability. For example, industrial accidents that can be attributed to a failure by the firm to protect workers may subject that employer to costly litigation and judicial awards, or to increased workers compensation premiums. This suggests that compliance with safety standards is the outcome of a large suite of regulatory pressures formed by workers compensation systems, private insurers and the civil/criminal justice system.

Other important elements to consider are the financial incentives created when there is insurance for occupational accidents. Typically, the presence of insurance, if the insurer cannot monitor the precautions taken by the insured, generates a problem of *ex ante moral hazard*. That is, firms that know they are insured against loss may take fewer precautions and actually end up with a higher level of occupational risks. In the case of insurance for occupational accidents it is argued that there is the possibility of ex ante "double moral hazard" (Lanoie, 1991) as a workplace accident depends on precautions taken by both workers and firms.

However, insurance incentives can also be used to improve workplace safety. Occupational safety agencies can promote a higher level of safety in the workplace when they base the insurance premiums paid by the employer on the firm's previous safety record. In this case, in-

surance provides different incentives. It still decreases the cost of an accident to the worker, which might cause him/her to be less careful, but it increases the cost of an accident to the firm because any accident leads to an increase in future premiums. The net result depends on the substitutability or complementarity of precautions taken by workers and firms, the level of insurance, and the insurance premium and the marginal increase associated with having a bad occupational safety record.

Empirical evidence regarding the impact of being insured in Latin America is, to our knowledge, limited to a single study for Mexico (Giuffrida et al. 2000). In that case, workplace safety was not strongly affected by insurance, at the given level of experience rating, or at least was offset by the moral hazard effect for workers and employers. Since that data was collected, the Mexican Social Security Institute (IMSS) increased the sensitivity of the insurance premium to experience rate, changing employers' contribution from a range of 0.348-10.035 percent to a range of 0.025-15 percent of payroll, going in the suggested direction. And, the anecdotal evidence from aggregate data (see ILO, 1998) suggests that this policy has significantly reduced the number of work-related accidents as reported in the official registry.

Finally, there may be other factors that lead employers to be more responsive to occupational health concerns that are less directly related to economic incentives. In fact, there is an extensive literature arguing that characteristics of the firm itself will make it more or less receptive to internal and external pressures for safer working conditions. For instance, one study argued that the most important determinant of a company's response to new occupational safety regulations was its existing "safety culture" (Saari et al., 1993). This was defined as a combination of the importance that the company attaches to safety, and its ability and willingness to take effective action. Other characteristics of the work environment that affect compliance is the degree of workers' participation, the presence of labor unions, the relative power of the union, and the union's level of internal democracy. In general, studies in developed nations find that occupational safety is greater in countries and industries where there is an open social and political dialogue about safe and healthy working conditions. Also, when unions effectively represent workers, occupational safety is enhanced both by creating a favorable climate for protective measures and by creating mechanisms to ensure compliance with safety standards. In these terms, occupational health policies need to explicitly address improvements in relations between workers and management, and toward greater "democratization" of industrial relations (see Dorman, 1996).

Conclusion

The countries of Latin America and the Caribbean have a very high incidence of occupational injuries and diseases. This is due, in part, to particularly high risks in many of the region's economic activities, but also to limited collective efforts to improve workplace safety. In fact, if workers in Latin America and the Caribbean were exposed to the same risk of dying from occupational factors as workers in established market economies, at least 16,500 lives per year could be saved.

Furthermore, occupational injuries and illnesses are seriously underreported in the region, a problem that is even worse with nonfatal incidents than with fatal ones. This is due to data collection systems that are restricted to places of formal employment, to reliance on employers for notification in the face of incentives that discourage such notification, and to regular misattribution of occupational diseases to other sources of illness by physicians. More consistent and standardized injury and disease surveillance is clearly required.

It is apparent that occupational safety progresses most rapidly in those economic sectors and firms that employ vocal and politically organized workers. A review of the limited evidence is sufficient to identify key segments of the region's workforce that are poorly represented and who are at particularly high risk of occupational injury or death. These workers are occupied in certain kinds of informal employment, and in agriculture, construction or mining. Extending occupational safety standards to these large segments of the labor force in Latin America and the Caribbean is problematic because of the tension that may exist between the need to create and preserve jobs and the seemingly less immediate need of improving working conditions. This tension exists in all developing nations and may be expected to continue in the foreseeable future. Nevertheless, attention to the problem may allow us to find those areas in which simple and low-cost actions can improve worker safety without a negative effect on employment or wages.

Latin American and Caribbean countries also illustrate the disparity that often exists between legislation "on the books" and reality. Some countries in the region have a relatively complete set of laws regarding occupational health and safety, but enforcement is erratic. Legislation alone cannot improve workplace conditions, and consequently excessively hazardous conditions persist. Instead, public policy needs to look beyond constitutional guarantees and legal provisions toward a variety of measures that can alter this situation. Such policies need to support the generation and dissemination of information regarding the importance of occupational safety, its costs, and its remedies. They also need to identify safety practices that can benefit both workers and firms. Public policy must pay attention to finding the most effective ways to induce compliance with laws – whether through incentives, audits, litigation, or direct supervision. Finally, public policy can promote safer working conditions by encouraging and informing the continuing debates between workers, firms, occupational health professionals, and regulators.

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Appendix

Description of Social Security Systems for Work-Related Injuries in LAC

Country	Organization responsible, source and coverage
Argentina	Organization responsible: Superintendencia de accidentes de trabajo. Source of accident statistics: not available Type of program: Social insurance with private carrier Source of funds – Insured: none; Employer: whole cost, through a work-injury insurer or through self-insurance; Government: none Coverage: employed persons in private and public sector. Domestic workers, self-employed and others to be gradually integrated into system
Bahamas	Organization responsible: National Insurance Borad Source of accident statistics: not available Type of program: Social insurance system Source of funds – Insured: none, except self-employed; Employer: entire cost; Government: none Coverage: employed persons and certain categories of self employed Exclusions: family labor
Barbados	Organization responsible: Ministry of Labour, Labour Department Source of accident statistics: Notification of occupational injuries by employers to the Labour Department under the Accident and Occupational Disease (Notification) Act, Chapter 338 Type of program: Social insurance system Source of funds – Insured: none; Employer: 0.75% of payroll; Government: none Coverage: Employed Exclusions: self-employed and unpaid family labor
Belize	Organization responsible: Belize Social Security Board Source of accident statistics: Records of claims for compensation submitted to the Belize Social Security Scheme Type of program: Social insurance system Source of funds – Insured: small weekly contribution according to 4 wage classes; Employer: most of the cost, contribution according to 4 wage classes; Government: none Coverage: Insured persons Economic activities: All economic activities and sectors Exclusions: casual labor, family labor, employed person working less than 8hrs p.w., domestic working less than 24hrs p.w., and military personnel
Bolivia	Organization responsible: Caja Nacional de Salud, Departamento de Medicina Laboral Source of accident statistics: Occupational accident reports submitted to the Caja Nacional de Salud Type of program: Social insurance system Source of funds – Insured: none; Employer: 2% of payroll; Government: none Coverage: Workers covered by the Caja Nacional de Salud (approx. 20% of the working population)
Brazil	Organization responsible: Instituto Nacional do Seguro Social (INSS) of the Ministerio da Previdencia e Assistencia Social (MPAS) Source of accident statistics: Reports of occupational accidents filled in by the employer or by the enterprise's specialized safety and occupational health service Type of program: Social insurance system Source of funds – Insured: none; Employer: all cost through premium of 1%-3% of payroll; Govemment: none Coverage: Paid employees covered by social security. Domestic workers, own-account workers and workers without employment ties are excluded.

Chile	Organization responsible: Superintendencia de Seguros Sociales, administration of contribution Source of accident statistics: not available Type of program: Social insurance system Source of funds – Insured: none except self-employed; Employer: 0.95% of payroll, plus 0-6.8% according to degree of risk; Government: none Coverage: employed persons, government workers, students, and some self-employed persons
Colombia	Organization responsible: Instituto de Seguro Sociales, Subdirección de Servicios de Salud, División Nacional de Salud Ocupacional Source of accident statistics: Insurance records Type of program: Social insurance system Source of funds – Insured: none; Employer: 0.348%-8.7% of payroll according to degree of risk, in addition, 1% of employers' contribution goes to a work injury fund which promotes OSH; Govemment: none Coverage: Insured employees
Costa Rica	Organization responsible: Instituto Nacional de Seguros (INS) Source of accident statistics: Accident notifications submitted to the INS and statistical information programme on occupational risks and health Type of program: mixed compulsory and voluntary insurance with public carrier Source of funds – Insured: none; Employer: premium varying according to risk; Government: none Coverage: Workers covered by INS
Dominican Republic	Organization responsible: Instituto dominicano del Seguro Social. Source of accident statistics: not available Type of program: Social insurance system Source of funds – Insured: none; Employer: whole cost, with contribution varying with risk; Govemment: none Coverage: employers of firms with 3 or more workers, or 5 in agriculture; Exclusions: domestic servants and family labor
Ecuador	Organization responsible: Not available Source of accident statistics: Insurance records Type of program: Social insurance system Source of funds – Insured: none, 1.5% for self employed, voluntarily insured persons and artisan; Employer: 1.5% of payroll; Government: none Coverage: Persons insured
El Salvador	Organization responsible: Instituto Salvadoreño del Seguro Social Source of accident statistics: Insurance records Type of program: Social insurance system Source of funds – Insured: 3% of earning, self-employed 10.5% of earning; Employer: 7.5% of payroll; Government: annual subsidy Coverage: Insured persons; Exclusion: own-account agricultural workers, domestic workers, paid employees in public service and casual workers.
Guatemala	Organization responsible: Ministerio de Trabajo y Previsión Social, Instituto Guatemalteco de Seguridad Social Source of accident statistics: Medical records of patients Type of program: Social insurance system Source of funds – Insured: 1% of earning; Employer: 3% of payroll; Government: 1.5% of payroll Coverage: Paid employees covered by the Reginen de Seguridad Social; Exclusions: domestic workers, enterprises with less that 3 workers
Guyana	Organization responsible: National Insurance Scheme Source of accident statistics: Reports of occupational injuries submitted to the National Inscurance Scheme Type of program: Social insurance system Source of funds: not available Coverage: All persons employed; Exclusions: employers earning below G$7.5 per week, casual and

	subsidiary employers, and family labor
Haiti	Organization responsible: Office of Work Accident, Sickness and Maternity Insurance of the Haitian Social Insurance Institute. Source of accident statistics: not available Type of program: Social insurance system Source of funds – Insured: none; Employer: 2% of payroll (commerce), 3% (industry, construction and agriculture), 6% (mining); Government: none Coverage: employees of industrial, commercial and agriculture firms and public employees
Honduras	Organization responsible: Ministerio de Trabajo y Previsión Social and the Instituto Hondureño de Seguridad Social (IHSS) Source of accident statistics: Employers' reports on occupational accidents, and information collected by the Departamento de Medicina, Higiene y Seguridad Ocupacional del Ministerio de Trabajo Type of program: Social insurance system Source of funds – Insured: 2.5% of payroll; Employer: 5% of payroll; Government: none Coverage: All paid workers in enterprises; Exclusions: establishment with less than 10 workers; agricultural, domestic, family and temporary workers
Jamaica	Organization responsible: Ministry of Labour, Security and Sports Source of accident statistics: Labour inspectorate records Type of program: Social insurance system Source of funds – Insured: none; Employer: 2.5% of payroll; Government: none Coverage: Not available
Mexico	Organization responsible: Secretaría del Trabajo y Previsión Social (STPS), Instituto Mexicano del Seguro Social (IMSS), Instituto de Seguridad Social y Servicios Sociales de los Trabajadores del Estado (ISSSTE), Petróleos Mexicanos (PEMEX), Secretaría del Trabajo y Previsión Social (STPS) Source of accident statistics: IMSS occupational injuries insurance; ISSSTE information concerning awarded compensation; PEMEX follow-up of occupational injuries; STPS reports submitted by enterprises. Type of program: Social insurance system Source of funds – Insured: none; Employer: 0.025% to 15 of payroll, according to risk; Government: none Coverage: Employees covered by social insurance
Nicaragua	Organization responsible: Instituto Nicaragüense de Seguridad Social (INSS) and the Ministry of Labour Source of accident statistics: Gerencia General de Riesgos Laborales Type of program: Social insurance system Source of funds – Insured: none; Employer: 1.5% of payroll; Government: none Coverage: Workers participating in the compulsory social security scheme of Nicaragua. Statistics do not include self-employed workers or unpaid family workers
Panama	Organization responsible: Caja de Seguro Social and Departamento Nacional de Estadísticas. Source of accident statistics: Occupational Safety Department, National Statistics Department, Social Insurance Fund Type of program: Social insurance system Source of funds – Insured: none; Employer: all cost, through premium fixed according to risk category (average 1.7% of payroll); Government: none Coverage: All paid employees. Self-employed, domestic workers and workers in non-mechanized agriculture may participate in a voluntary insurance scheme
Paraguay	Organization responsible: Instituto de Seguridad Social, administration of contributions and benefits Source of accident statistics: Occupational Safety Department, National Statistics Department, Social Insurance Fund Type of program: Social insurance system Source of funds: not available Coverage: All employed persons
Peru	Organization responsible: Instituto Peruano de Seguridad Social

	Source of accident statistics: Insurance records Type of program: Social insurance system. Cash and medical system Source of funds – Insured: none; Employer: 1%-12.2% of payroll, according to risk; Government: none Coverage: Persons insured
Suriname	Organization responsible: Arbeidsinspectie, Ministerie van Arbeid Source of accident statistics: Reports of occupational injuries submitted to the Labour Inspectorate Coverage: Paid employees
Trinidad & Tobago	Organization responsible: Ministry of Labour and Co-operatives Source of accident statistics: Reports of accidents made by employers to the Labour Inspections Unit Type of program: Social insurance system. Cash and medical system Source of funds: not available Coverage: All persons employed
Uruguay	Organization responsible: Banco de Seguros del Estado Source of accident statistics: Reports of occupational accidents and occupational diseases submitted by employers to insurance institutions Source of accident statistics: Reports of accidents made by employers to the Labour Inspections Unit Type of program: Social insurance system. Cash and medical system Source of funds:– Insured: none; Employer: contribution varying according to risk; Government: none Coverage: Paid employees
Venezuela	Organization responsible: Instituto Venezolano de los Seguro Social (IVSS) and Ministerio del Trabajo Source of accident statistics: Dirección de Medicina del Trabajo Type of program: Social insurance system. Cash and medical system Source of funds: not available Coverage: Adult workers covered by the IVSS