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Costs of Work-Related Musculoskeletal Disorders (MSDs) in Developing Countries: Colombia Case

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The real burden of occupational diseases, specifically work-related musculoskeletal disorders (MSDs), and its impact on workers' productivity is not known. The situation is critical in developing countries where only cases that cause workers' disability are recorded. In this study, the incidence of MSDs in Colombia was estimated by using the age and gender specific double incidence rate of repetitive strain injuries diseases in Finland for 2002. The results showed that the estimated number of MSDs recorded in Colombia during 2005 was 23,477 cases at the rate of 11.6 cases per 10,000 workers. The estimated total cost of these MSD cases relative to workers' productivity was US \$171.7 million, representing around 0.2% of Colombia's Gross Domestic Product for 2005. The systematic appraisal of the incidence of MSDs and their associated cost on workers' productivity are necessary in developing countries to reduce the costly impact on productivity and to increase workers' well-being.

musculoskeletal disorders (MSDs) productivity cost developing countries

1. INTRODUCTION

In general, occupational diseases and specifically work-related musculoskeletal disorders (MSDs) impose a significant cost burden on health care systems. Traditionally, this cost is evaluated in two ways: human and social cost for the workers and their families, and financial cost for the employers and for the society as a whole. Although there has been a lot of research trying to find the real burden of these diseases and their impact on productivity, the exact cost of work-related MSDs is not known. The aim of this paper is to review the cost of work-related musculoskeletal disorders in some developed countries and use it to explore similar cost in developing countries. Colombia is focused on, since it is a developing country in which information on occupational diseases and specifically work-related MSDs is difficult to obtain. The term MSDs will be used throughout this paper to mean work-related musculoskeletal disorders.

1.1. Definition

The National Institute for Occupational Safety and Health (NIOSH) defines MSDs as “a group of conditions that involve the nerves, tendons, muscles, and supporting structures such as intervertebral discs. They represent a wide range of disorders, which can differ in severity from mild periodic symptoms to severe chronic and debilitating conditions. Examples include carpal tunnel syndrome, tension neck syndrome, and low back pain” (p. 1) [1]. Other authors consider musculoskeletal disorders as a collective term for several diseases subdivided into (a) clinically well-defined disorders (e.g., tendinitis, vibration induced white fingers); (b) less clinically well-defined conditions (e.g., tendon neck syndrome); and (c) non-specific disorders (e.g., cumulative trauma disorders or repetitive strain injuries [RSIs]) [2].

In studies on the origin of MSDs, it has been established in the scientific literature that there is a number of factors to be considered. According to the National Research Council and Institute of Medicine [3] these are (a) physical, organizational, and social aspects of work and the workplace; (b) physical and social aspects of life outside the workplace (sports, exercise programs, etc.), economical incentives and cultural values; and (c) the physical and psychological characteristics of the individual. Because of this multi-causality, MSDs are considered by the World Health Organization (WHO) to be work-related conditions because they can be caused by work exposures as well as non-work factors. Recently, the International Labour Organization (ILO) has proposed a new list of occupational diseases that includes occupational MSDs [4]. In this ILO recommendation, MSDs are included in the category of diseases classified by a target organ system, caused by specific work activities or work environment where particular risk factors are present. Examples of such activities or environment include (a) rapid or repetitive motion, (b) forceful exertion, (c) excessive mechanical force concentration, (d) awkward or non-neutral posture, and (e) vibration. With this new international list of occupational diseases, MSDs will be included in several national lists of occupational diseases, and more attention will be focused on the ergonomics factors that influence their occurrence.

1.2. Prevalence of the MSDs

In research on the global burden of diseases and injuries due to occupational factors, the annual incidence of MSDs represented 31% of all occupational diseases estimated in the world in 1994 [5]. This means that MSDs are the most frequent occupational disease affecting workers throughout the world. European workers commonly report MSDs as work-related health problems. The number of work-related diseases reported in Sweden in 2003 was 25,391 cases for employees and self-employed persons, with a rate of 61 cases per 10,000 workers. According to official Swedish statistics, ergonomics factors (monotonous or unusually strenuous movements

or work posture) were the cause of 58.5% of all work-related diseases with a rate of 35.7 cases per 10,000 workers [6]. Finland reported 4,807 occupational diseases in 2002 (20 cases per 10,000 workers). Twenty-eight percent of all cases were categorized as RSIs (MSD caused by non-physiological stress in work such as repetitive and monotonous work, unusual working posture) with a rate of 5.7 cases per 10,000 workers. The list of the diagnoses of specific RSIs in Finland included mononeuropathy of upper and lower extremity, hand and arm vibration syndrome, epicondylitis, tenosynovitis, peritendinitis, and bursitis, among others [7].

A total of 1,436,194 injuries and illnesses that required recuperation away from work were reported in private industrial workplaces during 2002 in the USA. During that year, over 487,900 MSDs (34%) were reported, accounting for more than one in three injuries and illnesses with days away from work. Although both total injuries and illnesses with days away from work caused by MSDs have decreased since 1992, these disorders continue to account for more than one in three of the total work-time cases [8].

1.3. Cost of MSDs

The extent of the losses associated with MSDs depends on the severity of the condition, the nature and quality of health care received, and on the characteristics of the patient, such as age and general health status. However, the non-health related factors, such as psychosocial factors, workplace characteristics, and availability of disability compensation, are also important determinants of the losses associated with MSDs [9]. Moreover, the differing socioeconomic factors of populations in different countries influence the results of the magnitude of several MSDs [10]. Traditionally the cost of occupational diseases has been based in the direct cost (health care and indemnity costs). The indirect costs are usually estimated as part of the direct cost. This is true in developed countries where systematic information is available. However, in the developing countries such information is hard to obtain and to estimate. Waehrer, Leigh, and Miller [11] have proposed three categories for

calculating the cost of occupational injuries and illnesses that could be used to calculate the cost of MSDs. These categories are

- Direct cost, which includes payments for hospital, physician, and allied health services, rehabilitation, nursing home care, home health care, medical equipment, burial cost, insurance administrative cost for medical claims, mental health treatment, police, fire emergency transport, coroner services, and property damage.
- Indirect cost, i.e., (a) victim productivity losses, which include wage losses and household production losses; (b) employer productivity losses, which include recruiting and training replacements for injuries workers; and (c) administrative cost, which includes administering a workers' compensation program. Unfortunately, productivity losses are very hard to calculate and include productivity losses due to absenteeism (interruption of the production process) and the temporary or permanent replacement of workers. Therefore, it is important to include the decline in attractiveness for customers and for new personnel. One important indirect cost that is usually forgotten is the "presenteeism" which is defined by Berry, Mirabito, and Berwick as "when the employees are present for work but are less productive because they are ill" (p. 56) [12]. In some multinational and big companies in the USA, presenteeism is the largest health-related economic cost, ahead of absenteeism, health insurance, and workers' compensation. Unfortunately it is hard to identify and calculate this cost at workplaces.
- Quality-of-life cost, i.e, value attributed to pain and suffering by victims and families. Usually the indirect cost of occupational diseases and injuries is estimated as part of the direct cost, and the quality-of-life cost (social cost) is excluded from the estimates and calculations.

Estimates of the MSDs costs vary depending on the methods used and the specific regulation and policies in each country. National Research Council and Institute of Medicine [3] has estimated that by including the indirect costs

associated to MSDs, the total cost associated with reported MSDs is as high as US \$45–54 billion, a figure that is around 0.8% of the USA's Gross Domestic Product (GDP). However, the true economic burden of work-related MSDs is likely to be even greater because many cases are not reported to the workers' compensation system [9]. For example, only 10.6% of workers suffering MSDs in Connecticut (USA) filled the workers' compensation claims in 1996 [13]. Although precise figures do not exist, estimates from Member States of the European Union indicate that the economic cost of all work-related ill health ranges from 2.6 to 3.8% of the GDP; 40–50% of the costs will be for MSDs. Available cost estimates of MSDs put the cost between 0.5% and 2% of GDP [14].

The European Forum of Insurance Against Accidents at Work and Occupational Diseases studied occupational diseases in Europe in 2001–2002 [15]. This study included information from 13 European countries. The results showed that disorders of the locomotor apparatus (MSDs and lumbago included) were the second most costly occupational diseases in European countries with 20.5% of the total cost, surpassed only by diseases caused by exposure to asbestos dust.

In the analysis of individual countries, Denmark showed the highest cost with 37.6%. In the individual cost analysis for some specific MSDs there are several interesting aspects to analyze. This is the case of low back pain (LBP), which is considered one of the most frequent and expensive MSDs in the workplace. Unfortunately LBP is common also outside the workplace, and the difference between LBP as a work-related or non-work-related MSD is often complicated. LBP causes the loss of 149 million workdays annually in the USA [16]. The cost of medical treatment for all work-related back pain was estimated as US \$13 billion in 1990 with an estimated growth rate of 7% per year [17]. In 1992, back cases represented 24% of U.S. workers' compensation claims and 31% of the costs. The estimated cost of back problems between 1988 and 1992 in some states of the USA was US \$8,244 per claim with 38% accounting for health-care cost, and 62% for indemnity costs [18]. LBP is also

a costly problem in other countries. For example, in the United Kingdom LBP was the single largest cause for leaves, responsible for 12.5% of all sickness absence days. In Sweden retirement and disability pensions caused by back pain rose by 6,000% from 1952 to 1987 and in Canada the total number of disability days for spine and back problems exceeded 21 million with an average of 21.4 days for sickness absence [10].

The cost of MSDs is different through occupations and industries. In their study of the health services sector, Waehrer, Leigh and Miller [11], found that more than 50% of the total cost of all occupational diseases were MSDs (carpal tunnel symptom [CTS] included). Another study by Punnett [19] on the cost of MSDs in the U.S. automobile manufacturing industry found that the average cost per case was US \$2,721 for back disorders, and 1,417 for shoulder problems.

There is limited information on the social cost of MSDs. In one population-based telephone survey conducted in Connecticut (USA), social factors related to work-related MSDs were studied. Some social variables were found to have affected workers suffering from MSDs. These variables included lost home, lost car, moving for financial reasons, lost health insurance, and divorce. This research studied the cost of out-of-pocket expenses that workers with MSDs had paid. This cost included medical expenses, transportation, equipment, child care, and housework. The total cost was estimated as US \$489 per case per year. Housework cost was the highest item with 33.1%. This was followed by medical expenses with 29.3%, child care with 26.9%, transportation with 6.3%, and equipment with 4.3% [13]. Usually the social cost is found to be missing in studies on the total cost of MSDs.

2. METHODS

Two analytical approaches were used in this study. These were (a) estimation of the incidence of MSDs, and (b) calculation of the productive cost of MSDs. For the collection of data used in the estimation of the incidence of MSDs in Colombia, a direct request was made to several occupational health and safety professionals

from different private and public Workers' Compensation Administrator Companies in Colombia, known in Spanish as Administradoras de Riesgos Profesionales (ARP). These companies are workers' compensation corporations whose main goals are accident prevention, and who attend to Colombian workers who are involved in accidents or suffer illnesses in the course of their work. However, only limited and partial information on the incidence and cost of MSDs was obtained. For this reason, the incidence of these diseases was estimated, and the direct and indirect costs were also calculated.

The number of MSDs per year in Colombia was estimated from the recorded double age and gender incidence of RSI rates in Finland for 2002. The Finland statistics on occupational diseases has been used for the estimation of occupational diseases throughout the world, because they are very well defined, and their distribution is similar to those in other Scandinavian countries. The double incidence was used previously for the estimation of occupational diseases in developing countries [5]. In the calculation of the cost of MSDs, the direct cost estimation from a study carried out in 1997 [26] on the only public Workers' Compensation Administrator Company in Colombia was used as the baseline for direct cost projection (i.e., the direct cost of one occupational disease, including health-care cost [17%] and indemnity cost [83%], was US \$1,135). The baseline used for indirect cost projection in relation to the direct cost [3] was as follows: indirect cost = $2.7 \times$ direct cost.

3. COLOMBIA CASE

3.1. Occupational Diseases and MSDs in Colombia

Since 1993, the whole health system in Colombia has been covered by a new general social security system (Law 100), known as Sistema de Seguridad Social Integral. This law divided the health system into several categories, such as pension fund, health insurance, professional risks insurance, and a number of related issues. The

occupational health and professional risks issues are managed by 16 Workers' Compensation Administrator Companies. Fifteen of these companies are private and one is public. Each of these companies has to negotiate the insurance coverage of employees according to the type of work the employees perform. The companies are, in turn, paid the total sum for such coverage by employers. The informal sector is not covered by this system.

Colombia has more than 46 million inhabitants. In April 2005, the number of workers affiliated to the General System of Professional Risk was 4,945,998 and the number of enterprises was 387,857 [20]. However, the number of people that formed the economically active population (the labour force) in 2005 was 20,199,376 [21]. This means that more than 15 million workers were not protected by the General System of Professional Risk. Some of these workers were from the informal sector. Others were self-employed, who were slowly entering the system. There were other workers who also had their own special protection systems. Data on occupational health, hazards, injuries, and occupational diseases from the Colombia Ministry of Social Protection include only information on workers affiliated to the system (i.e., 4,945,998). In 2005, employers who were affiliated to the General System of Professional Risk in Colombia paid around US \$312 million [20]. But if all workers (including the informal sector) were to have been affiliated to the system, the amount would have reached US \$1.2 billion.

Colombia has the same problem as other developing countries relative to information on occupational diseases. Partial registration of MSDs is mostly the norm. A Pan-American Health Organization (PAHO) estimate [22] shows that barely 1–5% of occupational diseases (MSDs included) are reported in Latin America and the Caribbean. In this regard, only cases resulting in disability and indemnification are recorded. During the past 11 years (1994–2004) there were around 930 cases of occupational diseases every year in Colombia, with a rate of 2.2 cases per 10,000 workers. In 2004, the number of occupational disease was 1,105 (2.3

cases per 10,000 workers). This means a rate nine times lower than the rate in Finland and 27 times lower than the rate in Sweden, two countries characterized by very high standards in occupational health and safety.

There have been few studies on MSDs in Colombia. Tafur [23], using information from the General Health System, found that 60% of all occupational diseases in Colombia in 2001 were MSDs. CTS and LBP were the first diagnoses of all occupational diseases, with 26 and 14% respectively. Eight diagnoses on MSDs were in the first 10 occupational diseases during that year. Fifty-six point six percent of the MSD cases were women. For CTS, the majority of those affected were females, constituting 80% of the total number of cases. On the basis of estimates, Idovro [24] found that in 2000 MSDs were the leading occupational disease in Colombia with more than 33,000 cases, representing 33.8% of all occupational diseases.

3.2. Prevalence and Cost of MSDs in Colombia

In this paper the number of MSDs in Colombia was estimated using age- and gender-specific incidence rates per year of occupational diseases in Finland for 2002 [7]. Finland has one of the best defined data on occupational illnesses and injuries in the world. The absolute number of cases was estimated by applying the age- and gender-specific rates to the appropriate age-gender population subgroups in the economically active population. The final estimation was carried out using the double incidence rate of Finland, which had been used previously in Latin-American and other developing countries [5]. The total estimate of MSDs in Colombia for 2005 was 23,477 cases, with men accounting for 64.4% and women for 35.6%. The total incidence rate was estimated as 11.6 MSDs cases per 10,000 workers. Table 1 shows the estimates of MSD incidence in Colombia for 2005.

A research study performed in 1997 [25] estimated that the direct cost of one occupational disease in Colombia was US \$1,135, including the health care cost (17%) and the indemnity cost (83%). This is the only reliable value reflecting

TABLE 1. Estimated Repetitive Strain Injury¹ by Age and Gender in Colombia (2005)²

Age	Men	Women	Total
15–19	239	330	569
20–24	1398	1019	2417
25–29	1855	1116	2970
30–34	3150	942	4092
35–39	3062	1697	4759
40–44	2960	1595	4554
45–49	2103	1461	3564
50–54	1345	1075	1419
55–59	434	337	771
60–64	69	54	123
>65	0	5	5
Rate per 10,000 workers	12.90	9.86	11.62
%	64.4	35.6	100
Total	15112	8965	23477

Notes. 1—A repetitive strain injury is a musculoskeletal disorder, caused by non-physiological stress at work (repetitive and monotonous work, unusual working postures). The group includes tenosynovitis, peridentinitis, epicondylitis, bursitis, and mononeuropathy [7]. 2—estimated values obtained from incident cases per year from age and gender specific incidence rate of occupational diseases in Finland for 2002 [7].

the cost of occupational diseases in Colombia. Using this value as a reference, the Colombia Ministry of Social Protection estimated the cost of all occupational diseases in Colombia for 2001 to be US \$127 million [26]. Assuming that these values are true, the present cost of one occupational disease in Colombia is US \$2,709. It is assumed that one MSD case has the same cost as one occupational disease. This means that the direct cost of MSDs in Colombia in 2005 was US \$63.6 million. Adding the indirect cost, which is considered to be 2.7 times higher than the direct cost [3], the total cost of MSDs in Colombia would have been US \$171.7 million. This value represents around 55% of the total income of the General System of Professional Risk. It also represents around 0.2% of Colombia's GDP for 2005. Finally, if it is assumed that one occupational disease in Colombia represents an average of 13.8 days away from work [24], the total number of days that were lost in 2005 as a result of MSDs was 324,000.

4. DISCUSSION

Usually developing countries have several limitations in providing reliable information on occupational diseases due to issues relative to case definition problems, lack of national statistics on occupational diseases, and lack of qualified occupational and safety professionals in the workplace, among others. The situation is even more complicated regarding MSDs, because these occupational diseases have multiple causes, and in some cases work-related factors are omitted. These factors make it difficult to know precisely the exact burden of these diseases. However, several researchers have used indirect methods to calculate their burden as well as their economic and social impact. The Finland statistics used to estimate the incidence of MSDs in Colombia can be criticized. This is due to the fact that a developed country (i.e., Finland) with one of the highest level in occupational health prevention was used as a reference point for assessing a developing country (i.e., Colombia), which has low levels of occupational health prevention. However, Finland's statistics have been used as a reference point by other researchers, too. They have been used to estimate occupational diseases and injuries in India, China, as well as in sub-Saharan Africa and Latin-American countries [5], all of which are developing countries with, generally, very low occupational health performances in comparison to Scandinavian countries.

On the basis of its estimate for 2002, and using the World Health Organization projections for occupational diseases, the Colombia Ministry of Social Protection projected the number of occupational diseases in Colombia to be 81,865 new cases yearly. By taking this projection into account, and considering the fact that MSDs have been identified by several studies as the leading occupational disease in Colombia [22, 23], the estimate of 23,477 new cases per year reported in this paper could be a representation of the current situation in Colombia. In relation to the estimated cost, it is assumed that one occupational disease has the same cost as one case of MSDs. However, several studies considered MSDs to be the most

expensive occupational disease in the workplace [9, 11, 15]. By taking this into consideration, it can be argued that the estimates made here are low. Yet, MSDs appear to have a considerable negative impact on Colombia's GDP (up to 0.2%) for 2005.

5. CONCLUSION

MSDs and their associated costs represent significant problems in developing countries with consequential impact on both productivity and workers' well-being. In the case of Colombia, the significance of these problems is highlighted by the impact MSDs have on productivity as reflected in their estimated consumption of 0.2% of the country's GDP in 2005. Colombia (as is the case with other developing countries) cannot allow its national productivity to be affected by such occupational diseases as MSDs, whose consequences can be reduced through the introduction of practical and non-expensive ergonomics measures in the workplace. It is important to recommend that Colombia (and other developing countries) ensure a systematic revision of the incidence and cost of MSDs. This will result in the documentation of reliable information that can be used to guide policy-making at different levels (i.e., government, third-party payers, employers, employees, unions, and occupational and safety professionals). This will help reduce the impact of occupational diseases on productivity and also increase workers' well-being. The systematic revision should entail the following: (a) defining the most frequent MSDs; (b) defining the principal category of the direct cost, including health-care and indemnity costs; (c) establishing some productivity indicators that define the real effect of MSDs on productivity; and (d) calculating the social cost of MSDs using simple indicators and variables. One way to produce this systematic revision will be to include such MSDs as sentinel diseases at several levels.

REFERENCES

1. National Institute for Occupational Safety and Health (NIOSH). Work-related musculoskeletal disorders (NIOSH Facts, document No. 705005). Washington, DC, USA; NIOSH; 1997.
2. Griefahn B. Cold—its interaction with others physical stressors. In: Holmér I, Kuklane K, editors. Problems with cold work. Proceeding from an international symposium held in Stockholm, Sweden, 1997. Solna, Sweden: National Institute for Working Life; 1998. p. 249–57.
3. National Research Council and Institute of Medicine. Musculoskeletal disorder and workplace: low back and upper extremities. Panel on musculoskeletal disorder and the workplace. Washington, DC, USA: National Academic Press; 2001.
4. International Labour Organization (ILO). Recommendation concerning the list of occupational diseases and the recording and notification of occupational accidents and diseases (Recommendation R194). Geneva, Switzerland: ILO; 2002.
5. Leigh J, Macaskill P, Kuosma E, Mandryk J. Global burden of diseases and injuries due to occupational factors. *Epidemiology*. 1999;10(5):626–31.
6. Sveriges officiella statistik. Arnetsmiljö Verket. Occupational accidents and work-related diseases (Statistik, rapport 2005:1. 2004). In Swedish with a summary in English. Retrieved October 9, 2006 from: http://www.xn--arbetsmiljverket-vwb.se/dokument/statistik/english/Occupational_2004.pdf
7. Riihimäki H, Kurppa K, Karjalainen A, Palo L, Jolanki R, Keskinen H, et al. Occupational diseases in Finland in 2002: new cases of occupational diseases reported to the Finnish Register of Occupational Diseases. Helsinki, Finland: Finnish Institute of Occupational Health; 2004.
8. Bureau of Labor Statistics. Lost-worktime injuries and illnesses: characteristics and resulting time away from work (2002). Washington, DC, USA: U.S. Department of Labor; 2004.
9. Baldwin M. Reducing the cost of work-related musculoskeletal disorders: targeting

- strategies to chronic disability cases. *J Electromyogr Kinesiol.* 2004;14:33–41.
10. Andersson GBJ. Epidemiology of low back pain. *Acta Orthop Scand.* 1998;69 Suppl 281:28–31.
 11. Weahrer G, Leigh P, Miller T. Costs of occupational injury and illness within the health service sector. *Int J Health Serv.* 2005;35(2):243–359.
 12. Berry L, Mirabito A, Berwick D. A health care agenda for business. *MIT Sloan Management Review.* 2004;45:56–64.
 13. Morse T, Dillon C, Warren N, Levestain C, Warren A. The economic and social consequences of work-related musculoskeletal disorders: the Connecticut upper-extremity surveillance project (CUSP). *Int J Occup Med Environ Health.* 1998;4:209–16.
 14. Blair S, Djupsjöbacka M, Johansson H, Ljubisavljevic M, Passatore M, Windhorst U, et al. Neuromuscular mechanisms behind chronic work-related myalgias: an overview. In: Johansson H, Windhorst U, Djupsjöbacka M, Passatore M, editors. *Chronic work-related myalgia. Neuromuscular mechanisms behind work-related chronic muscle syndromes.* Gävle, Sweden: Gävle University Press; 2003. p. 5–46.
 15. Eurogip. Cost and funding of occupational diseases in Europe (Eurogip-08/E). Paris, France: Eurogip, 2004.
 16. Guo HR, Takana S, Halperin WE, Cameron LL. Back pain prevalence in US industry and estimates of lost workdays. *Am J Public Health.* 1999;89(7):1029–35.
 17. Straus BN. Chronic pain of spinal origin: the cost of intervention. *Spine.* 2002;27(22):2614–9.
 18. Williams DA, Feuerstein M, Durbin D, Pezzullo J. Health care and indemnity costs across the natural history of disability in occupational low back pain. *Spine.* 1998;23(21):2329–36.
 19. Punnett L. The costs of work-related musculoskeletal disorders in automobile manufacturing. *New Solut.* 1999;9(4): 403–26.
 20. Ministerio de Protección Social de Colombia. Fondo de riesgos profesionales. Estadísticas 2005. Retrieved July 1, 2005, from: <http://www.fondorriesgosprofesionales.gov.co//Estadisticas/estadisticas2.asp?ANO=2005>
 21. Departamento Administrativo Nacional de Estadísticas. Encuesta continua de hogares. 2005. Población en edad de trabajar, tasa global de participación, de ocupación, desempleo (abierto y oculto) y subempleo. Retrieved May 1, 2005, from: http://www.dane.gov.co/files/investigaciones/empleo/ech_genero/C1_EG_IIItrim05.xls
 22. Pan-American Health Organization (PAHO). Regional plan on workers' health (1999). Washington, DC, USA: PAHO; 2001.
 23. Tafur F. Análisis de la información sobre diagnóstico de enfermedad profesional—régimen contributivo. Primer semestre de 2001. Grupo de fomento de salud de los trabajadores [internal document]. Bogotá, Colombia: Ministerio de Protección Social de Colombia; 2002.
 24. Idovro A. Estimación de la incidencia de enfermedades ocupacionales en Colombia, 1985–2000. *Rev Salud Pública.* 2003;5(3):263–71.
 25. Protección Laboral ISS. Análisis de costos directos e indirectos de accidentes de trabajo y enfermedad profesional. Revised edition. Santafé de Bogotá, Colombia: Instituto de Seguro Social, Administradoras de Riesgos Profesionales (ARP); 1997.
 26. Colombia Minister of Social Protection. Informe de la enfermedad profesional en Colombia 2001–2002. Bogotá, Colombia: Colombia Minister of Social Protection; 2004.