Latino Health in the US: A Growing Challenge

Edited by CARLOS W. MOLINA AND MARILYN AGUIRRE-MOLINA

Latino Health in the U.S.: A Growing Challenge, Occupational Health, Chapter 12

American Public Health Association
1015 Fifteenth Street, NW
Washington, DC 20005

Occupational Health

Chapter 12

George Friedman-Jiménez, MD, and Jesse S. Ortiz, DrPH

The occupational health of Latino workers in the United States is increasingly being recognized as an important area for study as well as for clinical and public health intervention. Occupational health can be defined as the recognition, diagnosis, treatment, and prevention of occupational (i.e., work-related) disease. This process includes surveillance, screening, medical care, hazard evaluation, education, and workplace intervention. An occupational disease can be defined as a disease that is caused by substances, physical conditions, or other hazardous exposures on the job. Occupational diseases cause substantial morbidity and mortality, yet they can be entirely prevented by eliminating or reducing the exposures that cause them. Although such diseases can affect members of all ethnic/racial groups and socioeconomic classes, available evidence suggests that Latino workers are at higher risk than other workers in the general population. This excess risk is probably owing to the overrepresentation of Latinos in the more hazardous occupations and industries.

Morbidity and Mortality from Occupational Diseases among Latino Workers

Available evidence suggests that occupational diseases are common in the US working population. However, because the great majority of cases are not diagnosed as occupational and never become known to the surveillance mechanisms that currently exist, no statistics on occupational disease prevalence and incidence in the United States have been compiled directly. Thus, the magnitude and severity of the problem can be determined only indirectly, and we must look for consistency in the patterns we encounter.

The best available estimates of morbidity and mortality from occupational disease in the general US population were published in 1989 by Landrigan and Markowitz.[1] Using five groups of occupational diseases—chronic respiratory diseases; cancers; and cardiovascular, renal, and neurological diseases—and excluding occupational injuries, they estimated that 350 000 new cases of occupational disease and 50 000 to 70 000 deaths from it occur annually. These estimates are similar to, albeit more conservative than, those published 15 years earlier of 390 000 new cases and 100 000 deaths each year.[2] Interestingly, the reported number of annual deaths in the United States from occupational *traumatic injuries* (rather than *diseases*) is around 7000.[3]

To estimate the annual morbidity and mortality from occupational disease among Latino workers, we can take the 1988 US Bureau of Labor Statistics estimate that 7% of the US work force is Latino,[4] and from that we can roughly figure that 25 000 new cases of occupational disease and 3600 to 5000 occupational disease deaths occur each year among Latinos in the United States. However, these estimates assume that the risk of occupational disease is the same among Latinos as it is among the general US population, and since evidence strongly suggests that Latinos are overrepresented in the more hazardous jobs and are at higher risk, the true numbers are probably higher.

Unfortunately, any attempt to judge the magnitude of the problem of occupational disease among Latino workers is hampered by underreporting. Landrigan and Markowitz estimated the degree of underreporting by comparing independently generated estimates of occupational disease mortality and incidence with the actual numbers of cases reported by the Workers' Compensation Board.[1] In New York State, only 11% to 38% of the estimated number of incident cases of occupational disease and only 3% to 5% of the estimated number of occupational disease deaths were reported by the Workers' Compensation Board as being of occupational etiology.

Many of these undiagnosed cases represent lost opportunities to properly treat and prevent occupational disease. If the correct diagnosis is not missed entirely, it may be recognized too late in the disease process for primary or secondary prevention to be possible. These missed and delayed diagnoses carry hidden costs in the form of time lost from work; decreased productivity; economic hardship and unemployment; increased burden on an already overloaded health care system; inappropriate diagnostic testing or treatment; prolonged duration of disease; progression of reversible disease to chronic irreversible disease; and, most important, avoidable suffering, disability, and death of workers. These hidden costs are borne mainly by workers and their families, as well as by employers (who often pass costs on to consumers); union benefit funds; city, state, and federal governments; and, in some cases, medical insurance companies (who pass the costs on to their other

Table 12.1—Reported Annual Incidence (All Races) of Occupational Disease (Excluding Injuries) in the United States, by Selected Industries

Industry	New Cases per 10 000 Workers,[a] 1984	Number of Workdays Lost per 1000 Workers,[b] 1979
Blue-collar industries		
Agriculture, forestry, and fishing	43.8	13
Manufacturing	38.5	28
Construction	16.3	10
Services	14.1	8
Mining	13.0	7
Transportation and public utilities	11.8	9
White-collar industries		
Wholesale and retail trade	6.5	5
Finance, insurance, and real estate	3.7	4

[a] *Source: Occupational Injuries and Illnesses in the US by Industry, 1984.* US Dept of Labor Statistics, Bulletin 2259, May 1986. As cited in Landrigan PJ, Markowitz S. Current magnitude of occupational disease in the United States: estimates from New York State. *Ann N Y Acad Sci.* 1989;572:27-45.
[b] *Source:* US Dept of Labor, *News* (Office of Information), USDL-80-726, Tables 2 and 4. As cited in Dicker L, Dicker M. Occupational health hazards faced by Hispanic workers: an exploratory discussion. *J Lat Community Health.* 1982;1:101-107.

clients). In addition, because the missed diagnoses are not reported as occupational diseases, they are invisible to the occupational health surveillance systems that do exist. This has delayed recognition and resolution of the public health problem of work-related disease.

A Population at Risk

Overrepresentation of Latino Workers in the More Hazardous Jobs

An examination of data on the rates of occupational disease in various industries and the distribution of jobs among Latinos in the United States suggests that Latino workers are overrepresented in the more hazardous job categories and underrepresented in the less hazardous ones. Rates of occupational disease are

Table 12.2—Latino Workers over Age 15 in Each Job Category, United States, 1988

Job Category	Number (in Thousands)	Percent
Higher risk (blue-collar) occupations	5108	10.2
Operators, fabricators, and laborers	1977	11.1
Service occupations	1564	10.2
Precision production, craft, and repair	1120	8.2
Farming, forestry, and fishing	447	13.0
Farm operators and managers	20	1.6
Other agricultural occupations	420	21.3
(Includes farmworkers)	(218)	(23.0)
Forestry and fishing	7	3.8
Lower risk (white-collar) occupations	3141	4.9
Technical, sales, and administrative support	2061	5.8
Managerial and professional	1080	3.7
Total Latino work force	8249	7.2

Note: Small arithmetic discrepancies are due to rounding.
Source: Statistical Abstracts. Washington, DC: US Dept of Labor, Bureau of Labor Statistics; 1990: Table 645.

available for selected industrial (rather than occupational) categories but not by racial or ethnic group. Because the industrial categories do not exactly match the occupational categories for which racial and ethnic breakdowns are available, there is only an approximate correspondence between them. Moreover, since not all industries are included, the rates, which are for reported cases of occupational disease, are thus underestimates. These factors make it difficult to rank the occupational categories more quantitatively than "higher risk" and "lower risk." It is apparent that the white-collar industries have the lowest rates of occupational diseases and the blue-collar industries have the higher rates in terms of incident cases as well as lost workdays (Table 12.1). The six categories of occupations, as classified by the Bureau of Labor Statistics,[4] can be roughly divided into four that are at

higher risk for occupational disease and two that are at lower risk, roughly along a blue-collar/white-collar division (Table 12.2). If we again take the Bureau of Labor Statistics' 1988 estimate that roughly 7% of the total US work force is Latino and assume that race and ethnicity are distributed randomly, independent of occupation, we would expect 7% of workers in each occupational category to be Latino, with very little sampling error since the numbers are large.

However, a clearly nonrandom pattern is evident. More than 7% of the workers were classified as Latino in each of the four higher risk occupational categories: farming, forestry, and fishing (13%); operators, fabricators, and laborers (11%); service occupations (10%); and precision production, craft, and repair (8%) (Table 12.2). Within farming occupations, if farm operators and managers are excluded, 23% of farmworkers were Latino. It should be noted that a large discrepancy exists between the reported number of Latino farmworkers in these data (218 000) and the 3.2 million estimated further on in this chapter. While this is only an estimate, it is certainly not a 15-fold overestimate, and it is likely that the Bureau of Labor Statistics' data severely undercount Latino farmworkers, both documented and undocumented. In the two lower risk occupational categories—managerial and professional; and technical, sales, and administrative support—Latinos were underrepresented (Table 12.2). Undercounting of Latino workers is much less likely in these lower risk occupations than in the higher risk occupations. The bureau's 1985 data show a nearly identical pattern.[5]

Analysis of a second, independent data set—the 1980 Census data from an urban center (New York City)[6]—reveals a similar pattern (Table 12.3). Compared with White workers, Latino workers are greatly overrepresented in the two most high-risk categories: operators, factory workers, and laborers (30% of Latino workers vs 11% of White workers) and service occupations (20% of Latino workers vs 10% of White workers). Additionally, they are underrepresented in both of the lower risk occupational categories: managerial and professional (11% of Latinos vs 30% of Whites), and technical, sales, and clerical (29% of Latinos vs 39% of Whites). The patterns of employment at both the national and New York City levels support the hypothesis that Latino workers tend to work in jobs with higher-than-average risk for occupational disease.

As previously noted, it is difficult to estimate the Latino population involved in agriculture, given such factors as workers' mobility, undocumented laborers, and rural location. Language barriers and the seasonal nature of the work pose further problems. According to the US Department of Agriculture, 2 million persons report that their sole or primary employment comes from agricultural work and 3.1 million report some farm income. In addition, 6 million family members and 2.7 million other persons are hired as seasonal farmworkers.[7] It has been reported that Latinos constitute 53% of the farmworkers in California, Nevada, and Ari-

Table 12.3—Distribution of Occupations (%) for White, African-American, and Latino Populations of New York City, 1980 US Census

	Whites (n=2160)	African Americans (n=826)	Latinos (n=616)
Higher risk occupations			
Operators, fabricators, and laborers	11.4	17.8	30.4
Service occupations	10.4	24.4	19.6
Crafts and foremen	8.5	6.7	9.7
Farming	0.4	0.5	0.5
Lower risk occupations			
Technical, sales, and clerical	39.0	36.1	29.0
Managerial and professional	30.2	14.5	10.8

Note: Total number (n) in each column is in thousands; percentages represent distributions of jobs within each ethnic/racial group.
Source: US Bureau of the Census. Public Use Microdata, 5% sample. Prepared for the Center for Puerto Rican Studies, Hunter College. New York, NY: 1980.

zona; 80% of the farmworkers in the East; about 90% of those in the Midwest; and almost 100% of those in the Southwest.[8] The migrant worker population has been estimated from 3 to 5 million; for the sake of convenience, let us assume 4 million. If 80% are Latino, this translates into 3.2 million Latino migrant farmworkers.

The American Friends Service Committee estimated in 1975 that about 800 000 agricultural workers were children under age 16.[9] Even these figures, however, are incomplete because they do not include undocumented workers. In 1988, Sonia Leon Reig et al. estimated that 80% of the child farmworkers are Latino.[10,11] If the 80% figure is once again applied, an estimated 640 000 migrant farmworkers are Latino children.

In 1991, the US Department of Labor conducted a survey of seasonal agricultural workers to determine their demographic characteristics.[12] Unfortunately, because the data are geared toward seasonal service, they do not include permanent workers. Further, the data are in percentages rather than in absolute numbers, making it difficult to estimate the whole agricultural population. Nonetheless, these data show that 71% of this seasonal labor force are Latinos and 62% are foreign born; of the foreign born, 92% are Mexicans. Moreover, 71% are men, 64% are married, and 65% are under age 35 while 4% are under age 18.

Increased Risk of Latino Workers for Occupational Diseases

Several bodies of evidence, independent from the above-mentioned job distribution data, suggest that disproportionate employment in high-risk jobs actually translates into increased risk of occupational diseases and injuries. A recent study in California concluded that Latino and African-American workers are at greater risk of occupational illnesses and injuries than White workers.[13] Latino men had 2.2 times and African-American men had 1.4 times the risk of White men; for Latino and African-American women, the risks were 1.5 and 1.3 times that of White women, respectively. Statistical adjustment for educational level and potential years of work experience reduced the excess risks but did not eliminate them, suggesting that only part of the excess risk can be explained by differences in these factors. However, the unadjusted excess risks represent actual elevations in risk from all contributing factors, including educational factors and potential years of work experience, and are more useful for public health inference and action than the adjusted excess risks.

Two studies of occupational injuries from the New Jersey Department of Health show patterns consistent with and more extreme than those in the California studies.[14,15] In the first, 200 fatal occupational injuries among construction workers were reported to the New Jersey fatal occupational injury surveillance registry from 1983 to 1989. Fatality rates were three times higher for construction workers than for all workers combined. For Latino (defined as those born in a Spanish-speaking country) and African-American construction workers, fatality rates per 100 000 employed person-years were 35 and 24, respectively, whereas the rate for American-born White construction workers was 11. Interestingly, only 6% of all the deaths had been reported to the Workers' Compensation Board. Fatality rates for US-born Latinos were not reported, and it is not stated explicitly whether they were included in the White or African-American categories.[14]

The second study was a telephone survey of individuals who had been hospitalized previously for finger amputations.[15] Of 637 persons invited to participate, 355 were contacted, 228 were interviewed, and of those interviewed, 134 (59%) said their injury occurred at work. Age-adjusted rates of hospitalized occupational finger amputations per 100 000 employees annually were 52.8 for Latino men, 28.9 for African-American men, and 9.5 for White men. The relative risks were 5.6 and 3.0 for Latino and African-American men compared with White men. Although the absolute rates for women were lower, a similar pattern was found. Age-adjusted rates for women were 7.4 for Latinos, 3.5 for African Americans, and 1.2 for Whites, yielding relative risks of 6.2 and 2.9 for Latino and African-American women compared with White women. Ethnic classification was by self-report for both numerators and denominators.[15] Two weaknesses of this study are the low response rate (36%) and the use of 1980 Census data to generate denominators for

the rates. The 1980 Census clearly undercounted the Latino population, producing a spuriously elevated rate when this undercount was used as a denominator. However, it is extremely unlikely that this alone could account for a sixfold elevation in rates of hospitalized occupational finger amputations. Despite its weaknesses, this study is consistent with the pattern of higher risks of occupational diseases among Latino workers seen in the other bodies of evidence.

In a study published in 1993 involving California adults with elevated blood lead levels, 46% of 149 adults who were reported directly by laboratories to the California adult blood lead registry with lead levels above 60 μg/dL were classified as Latino.[16] This is the level at which the 1986 Occupational Safety and Health Act legally mandates removal of a worker from the job, although toxic effects in adults have been documented at levels as low as 25 μg/dL and probably occur at even lower levels. The industries accounting for the largest numbers of reported cases were automobile radiator repair, lead battery manufacturing, brass/copper foundries, and gun-firing ranges.

In a companion study, 275 radiator service companies were enrolled in a lead-poisoning prevention project conducted by the California Department of Health.[17] As a result of this project, the percentage of companies that voluntarily performed blood lead screening on their employees increased from 9% to 95%. Sixty percent of the individuals participating in the screening program had Latino surnames; 22% of the study participants had blood lead levels above 40 μg/dL and 6% had levels above 60 μg/dL. This study demonstrates the potential for successful recruitment of employers in an occupational health screening program and the fact that Latino workers are overrepresented in this high-risk industry.

The phenomenon by which workers' homes become contaminated by work clothing and cause lead toxicity in the children has been well documented.[18,19] In the aforementioned study of California adults with elevated blood lead levels, one participant, a radiator repair worker, was reportedly responsible for household contamination with lead.[16] Toxic blood lead levels were found in both the father and his 11-month-old daughter, and lead concentrations in dust from carpet sweepings and the father's favorite chair were 5135 ppm and 7646 ppm, respectively. Of the participants in the study, 45% reported that they did not change work clothes and 60% said that they did not shower before leaving work for home.

Some parental occupations and toxic exposures have been associated with cancer in the children of exposed individuals.[20] Associations that have been reported most consistently include childhood brain cancer with paternal exposure to hydrocarbons, paints, and the chemical and petroleum industries, and childhood leukemias with paternal paint exposures. Maternal occupational exposures have been less well studied, but associations between leukemia and various chemicals have been reported.

The asbestos abatement industry is potentially a safe, low-risk industry, provided proper preventive methods and personal protective equipment are used. Although published data on this industry and the ethnicity of its workers have not been found, about one third of asbestos abatement workers in New Jersey take their certification exam in Spanish and many more are known to be Latino. In informal classroom discussions with Latino students enrolled in a training program for certification and recertification as asbestos handlers, Friedman-Jiménez has encountered many such students who already work as asbestos abatement workers and report flagrant noncompliance with protective regulations by their employers. The violations include forcing workers to reuse the same disposable clothing for 3 or more days, refusing to supply fresh filter cartridges for respirators, and failing to provide showers on the job. These practices, clear violations of the standards set by the Occupational Safety and Health Administration (OSHA), undoubtedly cause significant asbestos exposure and convert a potentially safe industry into a hazardous one.

The increased risk for occupational disease among Latino workers is further aggravated by several other factors. First, federal laws that are supposed to protect the worker are usually not enforced. The OSHA field sanitation standards for farmworkers exclude farms that employ 11 or fewer workers.[21] According to the Environmental Protection Agency (EPA), this leaves an estimated 89% of agricultural establishments and about 64% of all farmworkers uncovered by the act. A high percentage of farmworkers are similarly not covered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).[22] Second, standards set up to protect workers are often inappropriate for children and pregnant women. For example, threshold limit values for exposure to various pollutants set up by the National Institute for Occupational Safety and Health (NIOSH) are established for an 8-hour day for adult White men aged 18 to 65. While the standards may be safe for their target population, no one knows the health effects they may have on children and the unborn. To complicate the problem, many physicians do not recognize the symptoms of pesticide poisoning.[23]

Finally, there is the issue of notification and language. Federal right-to-know laws require clear labeling as well as availability to workers of material safety data sheets that describe all hazardous chemicals and their health effects. Although farm operators must notify workers of the dangers of pesticide and chemical exposure in terms of mixing, spraying, and reentry times, often the notification is given in English, which the worker may not understand. Moreover, labels on containers are hard to read unless one is a chemist, so even English-speaking workers usually cannot read them. And frequently, containers of toxic chemicals are not adequately labeled at all.

Why Are Latinos Overrepresented in Hazardous Jobs?

There are several reasons why Latinos are overrepresented in hazardous jobs. A variety of social and economic forces act to prevent workers from refusing known hazardous jobs, or from leaving those jobs once the hazards become obvious or they become ill from the work. These include deficiencies in general education, ethnic/racial discrimination, undocumented status, and language barriers. Another important reason is lack of specific knowledge about hazardous workplace conditions. Several factors responsible for this include nonenforcement of right-to-know laws and lack of culturally and linguistically appropriate worker education programs, effective labor-management health and safety committees, and unionization. Language barriers and educational deficiencies contribute to the problem as well.

The Chicago Lung Association administered a Spanish-language questionnaire to workers in an occupational health education project conducted in community-based schools that teach English as a second language.[24] Of the 92 workers studied, about one third were union members, all but one was Mexican, and almost all of them classified their English proficiency as beginning or intermediate level. Additionally, 90% of these workers were in manufacturing, of whom 54% reported exposure to hazardous materials and only 11% of those had received any Hazard Communication training. This is a very low compliance rate for an OSHA standard that has been given high priority for enforcement. Strikingly, only 7% of the entire group, whose mean length of time in the United States was 7.9 years, reported ever having heard of OSHA before the educational project began. The subjective impressions of the interviewers were that very few of the participants had any awareness that there were laws protecting workers' health and safety. Since enforcement of OSHA standards relies on either employers' or workers' requests for inspections, it is clear that, for many workplaces, the likelihood of an OSHA inspection is low.

Lack of general education is clearly associated with employment in hazardous jobs. In the example of the coated-fabric factory presented below, this played a definite role since a high school education was a job requirement for nonproduction (low-risk) work but not for the high-risk production jobs.[5] In the California study, adjusting for educational level reduced but did not eliminate the excess risk of occupational disease among Latino and African-American workers.[13] This statistical evidence is consistent with the hypothesis that education is one of several factors that influence the likelihood of employment in a hazardous job as well as the risk of acquiring an occupational disease.

Lack of education is a problem among urban US Latinos. In the 1980 Census data for New York City, 57% of Latinos over age 24 had not graduated from high school, compared with 32% of Whites and 40% of African Americans (see chap 1).[6]

In the same data, 13% of Latinos had some college education or were college graduates, compared with 20% of African Americans and 33% of Whites. Unfortunately, we see the quality and availability of education in urban Latino communities on the decline, and can predict that this trend will exacerbate the problem of occupational disease in Latino workers in the future.

Lack of English fluency and literacy is a common factor in selective employment of Latino workers in hazardous jobs. It can decrease a worker's ability to get a safe job as well as to be trained to recognize and avoid hazardous exposures on the job. Hazard communication in Spanish for monolingual Spanish-speaking workers is legally mandated but often not enforced. This puts non-English-speaking Latino workers at increased risk.

Supported by reviews of available evidence, several authors have hypothesized that racially discriminatory hiring practices have caused African-American workers to be selectively employed in the most hazardous jobs, that this is reflected in elevated risks of occupational disease and injury, and that these patterns of discriminatory hiring occur for other ethnic/racial minority workers as well.[25-27] The pattern of selective employment of Latino workers in hazardous jobs clearly has multiple social, economic, and cultural causes, and ethnic/racial discrimination is undoubtedly one of the contributing factors.

Undocumented status can play a role in worsening the problem of occupational disease among Latino workers in the United States. The number of undocumented Latino workers in the United States is thought to be quite large, and the problem of lack of documentation is severe in most cities as well as in rural areas. Complaining about or otherwise addressing hazardous working conditions is difficult or impossible for a worker who is working illegally. Thus, treatment and prevention of occupational diseases that require removal from or control of exposure is much harder for these workers to accomplish.

Moreover, high unemployment rates in Latino communities can force even properly documented workers and Latino US citizens to tolerate hazardous working conditions. The ratio of Latino to White unemployment has climbed steadily from 1.56 in 1975 to 1.74 in 1988. As a result, jobs are hard to find, and people cannot afford the luxury of refusing a job because it is dangerous. If a person develops an occupational disease once he or she is employed, the treatment is usually removal from or limitation of the exposure. This can lead to extremely difficult choices between leaving the job to prevent continuation or worsening of the occupational disease—"disemployment"[5]—or keeping the job and continuing to be ill. The threat of job loss or disemployment can actually cause exposures to be prolonged or more severe, resulting in more advanced disease or presentation at a later stage of disease than if the person had been more free to change jobs. For many workers, the threat of disemployment is more compelling than the threat of

an occupational disease, and they choose to remain on the job despite known risks. This is particularly true if the disease has a long latency period and minimal immediate symptoms, but, as seen in the example of the coated-fabric factory below, it can also occur even in the presence of obvious, symptomatic work-related disease.

Related to the issue of Latino overrepresentation in hazardous jobs is the way in which inadequacies in medical education and the medical care system help to perpetuate the problem. A worker's lack of access to high-quality occupational health and primary care services, as well as a primary care provider's insufficient knowledge of occupational medicine, can delay or prevent the correct diagnosis of an occupational disease, making effective treatment and prevention much less likely. Lack of access can be related to workers' lack of knowledge (of hazards or of how to use occupational health resources) or lack of medical insurance, as well as to various educational, cultural, and social factors. More commonly, however, it stems from the low likelihood that a primary health care provider will recognize a work-related disease and refer the patient to an appropriate occupational health specialist for follow-up.

In the case of the coated-fabric factory workers described below, many workers were symptomatic with nausea, vomiting, and abdominal pain.[28] Although some never went to see a physician, the diagnosis of work-related toxic liver disease was missed in all those who did go except for the one index case. If the physicians who were seen had taken even a brief occupational history and had had a rudimentary understanding of toxicology and occupational medicine, the epidemic would probably have been discovered much sooner. Instead, it took 10 or 15 years to find an ongoing epidemic that probably affected hundreds of workers.

The education of physicians in US medical schools generally includes a negligible amount of training in occupational medicine, averaging 4 hours in 4 years. A recent questionnaire survey of 11 community health centers in Connecticut found that 10 of 28 physicians participating reported no occupational health training.[29] Fewer than half of the respondents listed occupation as a question routinely asked. Ninety-four percent of the respondents believed work-related health problems escaped attention at the clinics, and "no or poor work histories taken" was the most common reason cited.

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Many of these factors are common in Latino communities across the country.

Often several of them combine to increase the risk of occupational disease in a synergistic manner. For example, the same jobs that require less formal education or English literacy also tend to have poorly regulated and hazardous working conditions, ineffective or nonexistent right-to-know educational programs to address work-related hazards, inadequate health benefits, and inadequate occupational health services; further, they offer little job security or protection to workers who complain about dangerous working conditions. These shops also tend not to be unionized and rarely participate actively in population-based occupational disease surveillance programs. It is the combined effect of multiple factors like these that causes the problem.

Occupational Diseases among Latinos in the Urban Setting

Although incidence, prevalence, and mortality data for specific occupational diseases have not been compiled, examples of some of the work-related diseases that occur in industries and occupations that employ many Latino workers have been identified (Table 12.4). The utility of identifying these conditions is to serve as a warning that epidemiological or industrial hygiene studies might be useful or that occupational medicine services or preventive intervention may be required in the workplace. Preventive intervention in the workplace begins with substituting toxic materials with nontoxic or less toxic materials if possible, lowering exposures using engineering controls such as ventilation, or briefly reducing exposures using personal protective equipment such as respirators.

The examples listed in Table 12.4 are presented to facilitate creation of surveillance programs and the provision of appropriate occupational health clinical, preventive, and educational services. Most of the occupational disease/exposure associations are drawn from NIOSH's recently updated list of occupational sentinel health events.[30,31] These are diseases or causes of disability or death (with ICD-9 codes) that satisfy defined criteria for literature-supported associations with specific toxic substances, work processes, industries, or occupations. Those associations that are supported by good evidence in the occupational health literature and are important among Latino workers but that do not meet the technical definition of an occupational sentinel health event are preceded by an asterisk. Since our knowledge of occupational diseases is constantly growing, the list is incomplete, and because many of the diagnoses are multicausal in nature, it can only be a general guide. In individual cases, once a work-related disease is suspected, a detailed occupational health workup (as discussed in several occupational medicine textbooks[32-35]) is indicated to clinically confirm or rule out work relatedness.

Table 12.4—Some Examples of Work-Related Diseases

Work-related asthma
Workers exposed to various airborne dusts or chemical fumes and vapors (Lists of several hundred asthma-causing agents can be found in Rom[35] and Bardana et al.[36])

Pulmonary tuberculosis
Health care workers, *shelter workers, *prison workers, *other workers exposed on the job to persons with active tuberculosis, workers with silicosis

Pulmonary asbestosis (pulmonary fibrosis with or without pleural scarring)
Asbestos workers with substantial asbestos exposure more than 15 years ago

Acute bronchitis, pneumonitis, pulmonary edema
Manufacturing workers exposed to airborne irritants including ammonia, chlorine, nitrogen oxides, sulfur dioxide, cadmium, and trimellitic anhydrid

Hypersensitivity pneumonitis
Workers (e.g., agricultural workers) exposed to organic dusts from molds, fungi, bacteria, and other sources

Silicosis
Sandblasters and other workers exposed to silica dust

Carpal tunnel syndrome
Meat packers and processors, *typists, *garment workers, *supermarket checkers, *factory workers, and others doing repetitive, forceful motions with their hands

Raynaud's phenomenon
Vibration or vinyl chloride-exposed workers

Occupational cancers
Lung cancer
Welders, smelter, foundry, rubber reclamation, and steel workers, as well as workers exposed to asbestos, polycyclic aromatic hydrocarbons, arsenic, chromate or nickel dust, ionizing radiation and radon, or bis(chloromethyl) ether
Malignant mesothelioma
Persons with asbestos exposure (even low dose, especially more than 30 years ago)
Leukemia or aplastic anemia
Workers exposed to benzene or ionizing radiation

Bladder cancer
Workers exposed to aromatic amine dyes

Laryngeal cancer
Asbestos-exposed workers

*Nasopharyngeal, *oropharyngeal, and *brain cancer in *formaldehyde-exposed workers

Nasal cancer in furniture makers and woodworkers

*Angina and *myocardial infarction
Workers exposed to *carbon disulfide, *carbon monoxide, or *methylene chloride

*Cardiac arrhythmias
Workers exposed to *halogenated hydrocarbon solvents or *anticholinesterase insecticides

Toxic neuropathy/encephalopathy
Workers exposed to lead, n-hexane, methyl-n-butyl ketone, carbon disulfide, acrylamide, ethylene oxide, arsenic

Toxic encephalitis
Workers exposed to lead, mercury

Parkinson's disease
Workers exposed to manganese, carbon monoxide, *carbon disulfide

Noise-induced hearing loss
Air hammer operators, musicians, factory workers, and others exposed to loud sound

Contact dermatitis
Workers who have skin contact with irritant or allergenic liquids or dusts

Cataracts
Workers exposed to infrared light, microwaves, ionizing radiation, trinitrotoluene, naphthalene, ethylene oxide

Hepatitis B; non-A, non-B hepatitis; and, rarely, HIV infection
Health care workers, from contaminated sharps injuries

Note: This list is meant to assist in the recognition of occupational diseases and is neither exhaustive nor definitively diagnostic. Actual diagnosis and management of occupational disease should be done in consultation with an occupational physician.

* Disease/exposure associations that are well documented in the clinical literature but do not meet the technical definition of an occupational sentinel health event.[31]

Table 12.5—Association between Production Work, Elevated Liver Function Tests (LFTs), and Latino Ethnicity

	Production Work and Elevated LFTs[a]			Production Work and Latino Ethnicity[b]		
	Elevated LFTs	No Elevated LFTs	Total	Latino	Non-Latino	Total
Production	35	11	46	43	3	46
Nonproduction	1	11	12	4	8	12

Note: 95% confidence intervals (CIs) were computed using CYTEL Software (*StatXact*, Version 1.0; 1989) and Robins, Greenland, Breslow variance.
[a] Prevalence OR = 35; 95% CI = 4, 303; $P = .0016$ (2-sided).
[b] Prevalence OR = 29; 95% CI = 5, 153; $P = .0002$ (2-sided).

An Epidemic of Occupational Disease in a Group of Latino Workers

The following example, adapted from Friedman-Jiménez,[5] illustrates the horrendous social and workplace conditions that can and do exist for some Latino workers and one type of solution that was effective in this case. Redlich describes an outbreak of toxic liver disease in a group of workers in a Connecticut factory that manufactures urethane-coated waterproof fabric.[28] A monolingual Spanish-speaking man from Puerto Rico presented to the emergency department of a major Connecticut hospital with abdominal pain, nausea, and vomiting. An astute physician's assistant took a brief occupational history, suspected occupational liver disease, and referred the man to the affiliated occupational medicine clinic. The clinic evaluated the man, confirmed the diagnosis, and organized a medical evaluation of the workers at the factory.

Of the 66 workers, 58 participated in the evaluation, of whom 36 (62%) had abnormal results on liver function tests, and most of these fit the diagnosis of toxic liver disease. The solvent dimethylformamide (DMF) was identified as the probable causative agent. Systemic absorption of DMF is thought to be primarily by skin contact, with some absorption by inhalation. There were 46 production workers among the group, including mixers, helpers, and machine operators; most or all of these had skin contact with DMF, sometimes dipping their unprotected arms into vats of the solvent. The 12 nonproduction workers included office staff, management personnel, inspectors, and supervisors who rarely, if ever, had skin contact with DMF. When evaluations were completed, 76% of the production workers had elevated liver function tests compared with 8% of the nonproduction

workers (Table 12.5). Production workers were thus at much higher risk for toxic liver disease than nonproduction workers (prevalence odds ratio [OR] = 35; 95% confidence interval [CI] = 4, 303). In terms of ethnicity, 93% of the production workers were Latino; most were from Puerto Rico and spoke only Spanish. However, only a third of the nonproduction workers were Latino (Table 12.5). Clearly, Latino workers were much more likely to be hired for high-risk jobs as production workers than for the relatively safer nonproduction jobs (prevalence OR = 29; 95% CI = 5, 153). It is highly unlikely that these associations occurred by chance alone.

Knowledge of some of the details of the situation is helpful in understanding employment patterns and the social etiology of the epidemic.*[37] English literacy and a high school education were required of nonproduction workers whereas neither was required of production workers. In the city where the outbreak occurred, only two employers—the factory and a bakery—regularly hired large numbers of monolingual Spanish-speaking workers. Employees who became ill at the factory would leave and work at the bakery for several weeks or months until their symptoms resolved, then return to work at the factory. Despite the physical discomfort involved, many workers chose to return to work at the factory because they were allowed to work as many overtime hours as they wanted, sometimes more than 75 hours a week. Unfortunately, in addition to their overtime pay, they also received overtime toxic exposures.

This case illustrates the failure of current occupational disease and hazard surveillance methods. It is noteworthy that the factory had used similar production processes for about 15 years. Since the latency period between exposure and disease is short (i.e., days to months), it is reasonable to infer that the epidemic had been ongoing for 10 to 15 years. Indeed, long-term employees reported having had intermittent symptoms for many years. The turnover of workers at the factory was 200% to 300% per year, in part because many of the workers became sick, left, and did not return. However, no previous case of occupational liver disease from the factory had been diagnosed at the nearby occupational medicine clinic, an excellent and well-known facility. Thus, it is likely that more than 100 unrecognized cases of toxic liver disease occurred during the past 15 years in this particular factory.

Since none of these cases was diagnosed and the factory had not been previously known to OSHA or NIOSH, the effectiveness of the current patchwork system of occupational disease surveillance by OSHA and NIOSH, as well as the usual practice of self-regulation of factories, must be seriously questioned. Without the

* Based on oral communications in 1988 with Daniel Perez, union organizer; Beth Lewis, clinic social worker; and Lora Fleming, clinic occupational physician; and in 1992 with Judy Sparer, clinic industrial hygienist.

commitment of both unions and management to create healthy and safe working conditions, community occupational health surveillance performed by government agencies and even top-notch academic institutions is sometimes haphazard and ineffective in detecting epidemics of occupational disease. This then compounds a situation already hampered by workers' lack of access to and knowledge about occupational health resources, by language barriers, and by fear of job loss.

The process by which the exposure was successfully controlled and the epidemic was ended is instructive. After the workers were diagnosed, the plant began to make some changes in the work process, as recommended by the occupational health clinic. However, new cases continued to present to the clinic. Workers were having difficulty getting workers' compensation for their illnesses; those who were removed from their jobs for health reasons had great difficulty finding other work. Although two unions had previously tried to organize the plant, they had failed because the organizers did not speak fluent Spanish. A Latino union organizer successfully organized the workers, who chose to strike against the plant. He also involved the local media, federal OSHA, the local mayor and health department, the state attorney general and Department of Environmental Protection, and an organization of neighbors who wanted the plant shut down.

An industrial hygiene investigation found that the factory had violated air quality standards and hazardous waste laws, failed to provide adequate protective equipment for workers, and failed to train workers sufficiently in safety procedures. After a 4-month strike, the union negotiated the workers' first contract with the company, including extensive and specific health and safety language. The company made changes in the production process, substituted another solvent for DMF, and began to use the clinic for health surveillance and medical consultation. In the following year, only one worker was found to have an elevated liver function test. Five years after the strike, the plant is still productive and profitable, and the occupational health improvements specified in the contract are still in effect. In addition to facilitating ongoing medical surveillance, the clinic provides preventive expertise to assist the plant in safely introducing hazardous substances into the production process.

Sweatshops in the Garment Industry

The patterns of working conditions illustrated above are also common in other industries, most notably sweatshops. In two documents published by the US General Accounting Office, sweatshops are formally defined as "businesses that regularly violate *both* safety or health *and* wage or child labor laws" and are also defined more loosely as "chronic labor law violators."[38,39] Construction firms, farms, and homework (e.g., piecework apparel or electronics manufacturing in the home) are excluded from the definition.

Sweatshops are hazardous workplaces. Those in the garment industry contain ergonomic hazards (e.g., repetitive motions, awkward working postures, vibrating tools such as fabric cutters, falls from ladders), airborne hazards (e.g., high concentrations of dusts, drycleaning solvents, and fumes from glues and fabric treatments like formaldehyde in poorly ventilated work areas), temperature extremes, and skin contact with irritant and allergenic substances. Occupational diseases and injuries prevalent among apparel sweatshop workers include back, neck, and shoulder injuries; cumulative trauma disorders like carpal tunnel syndrome[40,41]; contact dermatitis; work-related asthma and bronchitis; vibration-induced Raynaud's phenomenon; and acute and chronic neurotoxicity from solvents.

Sweatshops exist in significant numbers in 47 of the 50 states, most commonly in the apparel, restaurant, and meat processing industries.[38] Major concentrations are found in large cities, with New York having been the most intensively studied. An estimated 3000 to 4500 of the 7000 apparel factories and shops in New York City are sweatshops, employing more than 50 000 workers.[39] In New Orleans, an estimated 25% of the 100 apparel firms (employing 5000 workers) were multiple labor law violators. The only available estimate for restaurant workers comes from Chicago, where it is estimated that half of the 5000 restaurants (employing 25 000 workers) are chronic labor law violators.[38] Although no national estimates of numbers of sweatshop workers have been published, the majority of those in both the restaurant and apparel industries are thought to be Latinos, followed by Asians and African Americans.

Closely related to sweatshops are *maquiladoras*. These are factories along the Mexican side of the US-Mexican border that usually manufacture apparel; often subcontract from US-based corporations; hire mostly women; and offer inadequate, unpleasant, and hazardous working conditions.[42]

Sweatshops have proliferated because of prevailing social and economic conditions. The six factors most often cited in a poll of federal enforcement officials were an available immigrant work force, the labor-intensive nature of the industries, the low profit margin in these industries, weak or nonexistent unions, too few inspectors, and inadequate penalties for infractions.[38] It is not clear what is meant by low profit margins since these products often sell for a high price. Additionally, these industries require skills that many of the immigrant workers either already have or can learn on the job with little formal training. This is not to imply, however, that these are low-skilled jobs, and Fernandez Kelly graphically describes the high level of skill and productivity needed even to approach earning the minimum wage in a piecework payment system.[42] An additional factor is the lack of political and economic influence wielded by immigrant workers. If upper-middle-class US citizens were forced to work in sweatshop conditions, economic and political forces would be quickly mobilized and sweatshops would be eliminated.

These factors all contribute to the problem, and solutions will require efforts to address each one. Of the first six factors mentioned, those that are most amenable to reform are the last three, which could be addressed readily if they were made high priorities by the government and organized labor. So that the sweatshops are not merely driven out of one state and into another, action would need to be taken at the federal rather than local level.

The infrequency with which OSHA and the Department of Labor's Wage and Hour Division inspects apparel firms and restaurants is striking. In New York City, over a 5-year period, only 1% of the 17 000-plus apparel and restaurant businesses were inspected by OSHA, 6% were inspected by the Wage and Hour Division, and 0.01% were inspected by both, leaving 93% uninspected by either. It is no wonder that quantitative data on sweatshops are inadequate and that the state's Apparel Industry Task Force finds blatant violations in almost every firm it inspects. Clearly, providing adequate inspectors who have appropriate authority to enforce the laws would go far toward improving the health of Latino workers.

Child labor is common in sweatshops, and working children are at risk for occupational injury, illness, and toxic exposure. Equally important, their education and development is hindered by the often long hours they work, perpetuating a cycle of poverty and poor working conditions.[43] In New York State in 1986, workers' compensation awards were made to 1333 children under the age of 18 for work-related injury; 42% of these cases involved some degree of permanent disability. Ninety-nine awards were made to children aged 14 years or younger.[43]

Occupational Diseases among Latinos in the Agricultural Setting

As noted previously, it is estimated that 3.2 million Latinos are farmworkers. Unfortunately, health data on agricultural workers are sorely lacking. There are no data for Latinos on the health effects of exposure to toxic chemicals while working on the farms; very little data exist on injuries; and research on infectious diseases is limited mostly to parasitic and diarrheal infections. Although the National Association of Community Health Centers in Washington, DC, has conducted several surveys at individual clinics serving migrant workers, data collection on farmworkers at the national level is lacking. Whatever data exist are incomplete, fragmented, and inaccurate and generally do not include undocumented farmworkers or children. Given these limitations, we are forced to extrapolate from studies done on similar White populations under the assumption that such extrapolation is valid to Latino populations. But such an assumption is perhaps unfounded; in 1989 Robinson reported that, compared with White men, Latino men faced an

unadjusted relative risk of 2.2 and Latino women faced a relative risk of 1.5 for all occupational injuries and illnesses combined.[13]

Occupational health problems among farmworkers that have been discussed in the published literature include accidents, pesticide-related illnesses, heat-related illnesses, musculoskeletal problems, and communicable diseases. These conditions are not mutually exclusive because the presence of one may increase an individual's susceptibility to others.

Accidents

Statistics from the National Safety Council's annual survey of agricultural workers confirm those from the Bureau of Labor Statistics that show agriculture to be among the nation's most hazardous occupations.[44] Even though agricultural workers make up less than 3% of the total work force in all industries, accidental deaths in this group account for 15% of all occupational fatalities.[45] Among these accidental deaths are some 300 children killed each year while engaged in agriculture-related activities.

Fifty-five percent of these farm-related deaths are the result of traumatic machine-related accidents, with four deaths per 100 000 tractor accidents annually.[44] It is further estimated that nearly half of all survivors of serious farm trauma are permanently impaired, amounting to about 120 000 disabling farm injuries each year. Data from other epidemiological studies indicate that statistics from the National Safety Council and NIOSH underestimate farm injury rates and deaths by as much as 30%.[46-48]

The wide range of injuries involves tractors, augers, power-takeoff units, corn pickers, haybalers, and other farm vehicles. Most of the injuries result from careless driving and the use of unsafe vehicles. During a 10-year period in California, 112 documented farmworker deaths and 2575 documented injuries occurred while workers were being transported to the fields.[49] Agricultural machinery accounted for 18% of all injuries, of which 48% resulted in permanent disability. Animal handling also produces a significant number of injuries, as do accidents involving the many chemicals used on the farm. Because of the language barrier, Latinos are daily exposed to toxic chemicals in the workplace, especially the farms, because they may not understand the perils they face or are unable to read labels.[50-54] Thus, severe disabling dermatitis, respiratory disease, and allergies add to the complexity of health problems suffered by the farmworker.

Unfortunately, although deaths, injuries, and diseases occur at much higher rates in agriculture than in any other industry, agricultural health and safety problems are largely ignored by federal and state agencies. Of the $486.327 million spent by the federal government on occupational safety in 1986, only $0.97 million went for farm safety.[55]

Pesticides and Related Illnesses

Each year, some 45 000 pesticide products—1.2 billion pounds—are sold in the United States. Of these, nearly 1 billion pounds are used annually in agricultural production, applied to approximately 20% of the total crop acreage. Labor-intensive crops that receive heavy pesticide application include cotton, vegetables, fruits, nuts, tobacco, and sugar. Because these crops, for the most part, are not mechanized, workers are required to come into contact with them and hence with the pesticide.

The OSHA does not protect farmworkers or applicators from pesticide exposure; such employees must rely on the FIFRA and the EPA for legally mandated protection. However, registration of a pesticide by the EPA does not guarantee safety, and in many cases, laws that are supposed to protect the workers are not enforced.[56,57] Of the currently registered and used active ingredients in pesticides, up to 50% lack adequate reproductive studies, more than 60% lack teratogenic (birth defect) studies, 80% lack adequate cancer studies, and more than 90% lack genetic (mutagenic) studies.[53]

Pesticides are absorbed into the human body through the skin, via the lungs, and by the mouth. Dermal entry is the most prevalent mode of absorption among farmworkers, who are exposed to pesticides in various ways: by being directly sprayed in the fields through aerial or ground application; by drift, when pesticides sprayed in one field are carried by the wind to adjacent fields and areas where workers work and live; by reentering freshly sprayed fields while plants are still wet with pesticide; by contact with dry pesticide residue on plant leaves; by eating and smoking using pesticide-contaminated hands; by eating newly harvested fruits and vegetables that have not yet been washed to remove the pesticide residues; by using pesticide-laden vegetables (e.g., hollowed-out peppers, cucumbers) as drinking utensils; by drinking and bathing in pesticide-contaminated water; by using pesticide-contaminated leaves and twigs as substitutes for toilet paper; or by using drums that had contained pesticides to collect and store water for personal use.

> Symptoms of acute pesticide poisoning often mimic those of acute drunkenness: headache, weakness, nausea, vomiting, and mental disorientation. . . . In many instances, the physician's diagnosis is acute alcohol intoxication.

The acute and chronic health effects of intermittent exposure to pesticide residues for farmworkers is a major con-

cern for many health professionals. Such exposure may result in acute systemic poisoning, in skin problems such as rashes and inflammation, or in eye problems such as corneal ulcerations. Chronic health effects may include chronic dermatitis, fatigue, headaches, anorexia, anxiety, mental disturbances, cancer, birth defects, sterility, increased blood enzyme levels, and abnormalities in tests for liver and kidney function.

Poisoning. One of the most troubling problems of pesticide poisoning is that physicians do not readily recognize the symptoms and thus often misdiagnose the problem.[23] Symptoms of acute pesticide poisoning often mimic those of acute drunkenness: headache, dizziness, weakness, nausea, vomiting, and mental disorientation. Other symptoms include muscle twitching, tremors, abdominal cramps, diarrhea, sweating, salivation, blurred vision, convulsions, and very sour personalities. In many instances, the physician's diagnosis is acute alcohol intoxication.

Although the acute health effects of pesticide poisoning are fairly well known, at least to health workers who have direct experience with farmworkers, the long-term effects of intermittent low-level exposure over a number of years are less clearly understood. Data on the chronic health effects are almost nonexistent owing to various factors common to the farm population: (1) farmworkers' mobility, which precludes effective follow-up; (2) inaccessibility of farmworkers (e.g., isolated labor camps, language barriers, mistrust of the health researcher); and (3) difficulty in determining the extent of exposure because of lack of knowledge about which pesticides are used and when, the effect of various mixtures of pesticide used, the wide range of pesticides used on various crops any one worker may pick in a given season, and the seasonal nature of farm work. Nonetheless, the existing literature links pesticides to a range of chronic effects including cancer; birth defects; genetic damage; neurological, psychological, and behavioral effects; blood disorders; sterility; menstrual dysfunction; and abnormalities in liver and kidney function.

The only currently used biological method to test for exposure to pesticides is acetylcholinesterase inhibition. Organophosphates, a widely used class of pesticides, inhibit the enzyme acetylcholinesterase, causing the various symptoms listed above.[58] Studies comparing the cholinesterase levels of farmworkers with those of nonagricultural workers have documented the health effects of pesticide exposure for farmworkers.[23,52,59] Studies of farmworkers in New Jersey,[60] Ontario,[61] and North Carolina[62] have confirmed these effects.

Surveys have also demonstrated extensive pesticide exposure among farmworkers. A survey of 469 farmworkers in southern Florida found that nearly half of the respondents reported having been sprayed directly with agricultural chemicals at least once while they were working, more than half experienced one or more of the symptoms attributed to acute pesticide poisoning, and just over one quarter became ill enough to seek medical help; in 29 of these cases, acute pesticide poi-

soning was clinically confirmed.[63] In a survey of 3000 Mexican men working on the tomato crop in Indiana, Ohio, and Michigan in 1983, the farmworkers reported having been sprayed or otherwise exposed to pesticides on the average of seven times per year; 21% reported 10 or more exposures.[64]

Farmworker reentry poisoning has been a major problem in California. The California Department of Public Health surveyed 1100 farmworker households in 1974, along with nonagricultural control households of the same ethnic group (Mexican) and socioeconomic status.[65] The farmworkers had a 15-fold increase in potentially pesticide-related symptoms compared with the control subjects. These symptoms were severe enough to cause the farmworkers to seek medical help. The California statistics for 1981 showed a total of 1093 cases of pesticide-related illness, of which 613 involved agricultural workers; 235 of those cases occurred in farmworkers exposed to pesticide residue in the fields.[65]

Dermatitis. One condition related to pesticide exposure is dermatitis. In some cases, pesticide-related dermatitis is severe enough for the farmworker to seek medical help; in many cases, the condition can be disabling. For those who continue to work, the pain and discomfort is a burden for years to come. Of the 2204 skin conditions reported for agriculture by *Occupational Diseases in California, 1988*, 28% were due to poison oak; 26% were due to agricultural chemicals; and 12% were due to shrubs, trees, and plants.[66] Of the total skin conditions due to agricultural chemicals, 84% occurred in farmworkers, compared with only 2% in the manufacturing sector for the same chemicals. The rates for chemical-related skin conditions in agricultural workers was 129 per 100 000 workers compared with 0.87 for all other occupations. Other data have confirmed that agricultural workers have higher rates of skin conditions than all other workers.[51,52,59]

Cancer. Many widely used pesticides are known or suspected to be animal carcinogens. Further, many pesticides that by themselves are not carcinogenic may contain contaminants that are carcinogenic—for example, the dioxins (2,3,7,8-TCDD) that are a contaminant of the herbicide known as Agent Orange (2,4,5-T). And the fertilizers used in farming contain nitrate, which has the potential to combine with chlorides to form trihalomethanes, which themselves are carcinogenic.

Despite the low mortality for most types of cancer among farmers, epidemiological surveys of farmworkers have uncovered consistent excesses of hematologic cancers including leukemia, Hodgkin's disease, non-Hodgkin's lymphoma, and multiple myeloma, as well as cancers of the lip, skin, prostate, and brain.[67-70] Farmworkers are exposed to a plethora of pesticides, herbicides, fertilizers, and other chemicals in their daily activities. Some of this contamination is then brought home in their clothes. Many researchers have hypothesized that the increase seen in leukemias and non-Hodgkin's disease lymphomas in farmworkers is the result

of pesticide and nitrate exposure. Recent epidemiological studies have suggested that the excess risk of leukemia and brain cancer seen in the children of farmworkers is due to pesticide exposure at home.[71] Some studies have implicated nitrates in the drinking water as the possible cause of non-Hodgkin's lymphomas, while other studies focus on the pesticides, especially the phenoxyacetic acid herbicides, as the main cause of this type of cancer.[72,73]

A 1957 report documented a high rate of liver cancer on vineyard workers exposed to arsenical pesticides in the Moselle Valley.[74] Work done more than 20 years later in New Jersey showed that farmworkers, especially those in the wine industry, were at almost twice the risk of developing liver cancer as the nonfarm control population, a risk level that did not occur among farm owners and managers.[70] Because Latinos work in the California vineyard valleys and are exposed to similar pesticides, it is assumed that they too may be at risk for liver cancer. Another study on liver cancer, which does not specify occupations, shows that Mexicans in Texas have a prevalence of disease that is two to three times higher than that of Whites.[75]

Hazards to children and pregnant women. Again, several studies have linked pesticide exposure with brain cancer and non-Hodgkin's lymphoma in children. Another effect of chemical exposure and especially pesticides is mutagenic and teratogenic effects on the fetus.[63,76,77]

Exposure to agricultural chemicals adversely affects the female reproductive system. For example, dichlorodiphenyltrichloroethane (DDT) exposure has often been associated with the onset of menorrhagia and dysmenorrhea. It has also been associated with disruption of childbearing by spontaneous miscarriages, pregnancy toxemia, and bursting of the amniotic sac in exposed women as compared with control subjects.[78] Additionally, exposure to chemicals has also been linked to uterine bleeding during pregnancy.

A study of female Latino farmworkers under age 50 by Slesinger and Okada revealed that they had a higher number of both pregnancies and fetal loss than the general US female population.[77] Another study in North Carolina, which examined medical records of migrant and seasonal female farmworkers, showed that the average number of pregnancies was 3.1 while the average number of live births was 2.0[79]; the differences were due to a fairly high rate of fetal loss (80 per 1000 pregnancies). Infant and child death rates in this group were also very high (75 per 1000 live births). Another problem is low birthweight; in the North Carolina study, 8% of the live births for all ethnic/racial farmworkers weighed 2500 g or less compared with 6% of those for nonagricultural Whites.

During pregnancy, many of the chemicals used in agriculture can cross the placenta-blood barrier, thus affecting the fetus. The end result of this type of exposure, other than miscarriage and stillbirth, may be congenital birth defects. In the

Table 12.6—Incidence of Workers' Compensation Claims for Heat Disorders by Occupational Classification, Reported by 26 States, 1979

Occupation	Incidence per 100 000	All Heat Cases, %
Farm laborers	57	7.5
Firemen	52	6.8
Miscellaneous laborers	43	5.6
Construction laborers	40	5.2
Miscellaneous operatives	36	4.7
Truck drivers	33	4.3
Laborers (unspecified)	29	3.8
Gardeners and groundskeepers	26	3.4
Miscellaneous machinists	23	3.0
Miscellaneous mechanics	18	2.4
Carpenters	17	2.2
All others (each < 2%)	388	51.0

Source: Jensen RC. Workers' compensation claims relating to heat and cold exposure. *Professional Safety.* September 1983:19-24.

North Carolina study, five infants had congenital defects.[80] A study of hospital birth records in Imperial County, California, shows that the rate of limb defects among infants whose parents were both farmworkers was four times higher than that for offspring of other parents.[81] Congenital malformations are visually presented in a videotape done by the United Farm Workers of America called *The Wrath of Grapes*, in which five pesticides used in the grape industry are blamed for cancer, miscarriages, and birth defects.[54]

Finally, if exposure to pesticides does not result in one or more of the health problems presented above, the newborn child is still at risk from drinking his or her mother's milk, since chemicals such as organochlorine or chlorinated hydrocarbon pesticides have been shown to be excreted in human milk.[82,83]

Heat-Related Illnesses

To understand heat-related illness, it is necessary to understand the physiology of body temperature regulation, a detailed explanation of which is beyond the scope of this chapter. Briefly, body temperature is controlled by the thermo-

regulatory center in the hypothalamus, which responds to the increase in temperature by initiating sweating and cardiovascular reactions to reach an equilibrium.[84] Problems occur when dehydration, electrolyte depletion, or exposure to an unmanageable workload break down the steady state that has been maintaining the individual. Other operative factors here include obesity, fatigue, diarrhea, chronic diseases, alcoholism, and use of tranquilizers.[85] The most important factor in preventing heat injury, however, is acclimatization.

People are capable of working in a relatively broad range of both hot and cold environments without apparent ill effects. They do this by making protective adjustments to help reduce any risk of harm. When working in hot environments, people dress lightly and drink large quantities of cool fluids to replace water lost through sweating. Unfortunately, farmworkers are unable to make these adjustments: they cannot change clothes readily or have access to cool water or other fluids to help compensate for body fluid loss.

It is axiomatic that a person who works in the open field, exposed to the hot summer sun, is much more at risk for developing a heat-related illness than someone working indoors. The Bureau of Labor Statistics Supplementary Data System[86] lists farm labor as the No. 1 occupation in which workers sought compensation for heat disorders in 1979 (Table 12.6).[87] The highest incidence occurred among those aged 20 to 25. Data collected by OSHA during the field sanitation hearings in 1984 show that three Latino farmworkers who died from heat stroke—an event that is rare in the general population—were between the ages of 18 and 32.[88,89] Further, when comparing heat illness compensation case rates by major industry, agriculture was highest with 9.2 cases per 100 000 employees (Table 12.7).[87] Data from the California Department of Industrial Relations in 1986 indicate that the rate of heat-related illness in agricultural workers is much higher than that in any other workers.[90] Further data from California show that the farmworker is at 3.2 times the risk for a heat-related illness than all other occupational populations.[66]

Musculoskeletal-Related Problems

The exhausting physical labor of 14- to 16-hour days associated with farmwork leads to degenerative musculoskeletal syndromes that eventually become chronic and often crippling. Of all conditions reported among farmers and farm managers between 1969 and 1977, 17% were musculoskeletal and connective tissue diseases. By contrast, these conditions, which were reported more often by farmers than by farm managers, were reported by only 12% of those in all occupations. Arthritis was the most common complaint, reported by 68% of men and 74% of women.[66,90] Unfortunately, musculoskeletal disease is one of the least researched topics in the study of farmworker health problems.

Table 12.7—Comparison of Heat Illness Compensation Case Rates by Major Industry Group, Based on Reports from 26 States, 1979

Industry	Cases Reported	Employment (in Thousands)	Reported Cases per 100 000 Employees
Agriculture	62	677.0	9.16
Construction	125	1964.2	6.36
Mining	16	319.5	5.01
Manufacturing	226	8871.4	2.55
Transportation	55	2166.7	2.54
State and local government	97	5859.9	1.66
Service	115	7371.5	1.59
Trade	57	8956.3	0.64
Finance	8	2063.6	0.39

Source: Jensen RC. Workers' compensation claims relating to heat and cold exposure. *Professional Safety.* September 1983:22.

Factors leading to these problems arise from many sources, such as chronic vibration from tractors and farm machinery, constant bending while harvesting vegetables, use of *el cortito* (the short hoe), kneeling, heavy lifting and carrying, work in a cold and damp climate, work at an excessively fast pace, and the general trauma associated with daily farmwork.[91]

Research has shown a strong association between actions involving repetitive motion or excessive effort (or both) and musculoskeletal problems, such as sciatica, herniated lumbar intervertebral discs, and nerve compression (carpal tunnel syndrome) of hands, wrist, and forearm. The most common complaints include low back pain (lumbago); hip arthritis and degenerative osteoarthritis of the knee; and upper extremity, neck, and shoulder problems. The use of *el cortito* or *la mano del diablo* (the devil's hand) has been banned in many states, but there is no national ban on it and it is still used in farming. As its use requires prolonged labor in a doubled-over position, it has been linked to back pain; arthritis; hernias; breathing impairment; and stomach, heart, and bladder ailments because of the unnatural pressure it puts on its user. In addition, hearing impairment is extremely common in workers who work with noisy machinery.[80]

Communicable Diseases

For the sake of clarity, infectious diseases are grouped according to the nature of the causative agent—that is, bacterial, parasitic, and viral. Further, it should be stressed that what we consider food- or waterborne diseases in the general population are considered occupational diseases among farmworkers. For instance, salmonellosis is transmitted by the fecal-oral route through food or water to the general population as a result of improperly cooked food or unsanitary practices, whereas farmworkers may get it by handling contaminated animals or drinking water contaminated with animal feces, or through the lack of sanitary facilities in the fields. The high incidence of intestinal diseases in the migrant worker population has been well documented.[92]

Bacterial diseases. One disease, salmonellosis, is an acute infection caused by various strains of *Salmonella*. In farmworkers, salmonellosis is considered an occupational disease since they contract it mostly by direct exposure to infected animals on the farm, by drinking water contaminated with animal feces, or by picking vegetables in the field where wild animals have left their droppings. Since sanitary facilities are mostly lacking in the fields, the workers inoculate themselves with *Salmonella* when they eat or smoke with contaminated hands. Typhoid fever, a much more severe form of salmonellosis, is a blood (sepsis) infection that requires prompt medical attention—specifically, treatment with antibiotics and fluid replacement in cases of dehydration.

Once again, although it is difficult to get an accurate determination of the incidence of *Salmonella* in farmworkers, the poor sanitary and environmental conditions under which they work make it very easy to extrapolate data that apply to farmworkers. Among Latinos in Texas, Watts and Lindsay report a diarrheal rate of 4% for families with inside plumbing and generally good sanitary facilities, compared with 9% for families with low income and outside plumbing.[93] Similarly, work done in Kentucky with a population under 2 years of age shows a death rate from diarrheal disease that was six times higher in slum areas than in well-sanitized areas.[94] In 1974, Feldman et al. reported the presence of *Salmonella typhi* in a migrant labor camp, in which at least 82% of the cases resulted in hospitalization.[95] Epidemiological investigation suggested a common source and implicated the camp's water supply as the mode of transmission.

Another bacterial disease is shigellosis. This is caused by the genus *Shigella* which, unlike *Salmonella*, is restricted to human infections. The infection is transmitted by the fecal-oral route, primarily hand to mouth, but also by food handling and vectors, especially flies. The lack of sanitary facilities in many farms forces farmworkers to defecate in nearby bushes, where the fly population flourishes. The prevalence of outdoor latrines and the density of the fly population are directly correlated with the incidence of shigellosis; person-to-person contact is also very

important in the epidemiology of the disease. The availability of water for the frequent washing of hands is significant in controlling outbreaks. It is therefore no wonder that the prevalence of *Shigella* in farmworkers is high since they usually do not have access to clean water for drinking, much less for washing hands.

The incidence of shigellosis is especially high among farmworker children. Schliesman found a 2.6 times higher rate of diarrheal illness in rural children than in urban ones.[96] Watts and Lindsay, studying Latinos in Texas, show that the incidence of diarrheal disease in children could be reduced by reducing the fly population.[93] Similarly, McCabe and Haines show that the incidence of shigellosis was reduced by 52% when privy techniques were rehabilitated.[94] Finally, studies by Coke and Prosow,[97] Watts et al.,[98] and Hollister et al.[99] conclude that the etiology of diarrhea among several populations in Fresno County and the San Joaquin Valley in California was *Shigella*, that shigellosis constitutes an important problem in agricultural labor camps, and that the most important mode of transmission is person-to-person contact. Further, the studies conclude that the availability of water for personal hygiene can reduce the prevalence of shigellosis.

Parasitic diseases. Parasitosis is a great problem in the farmworker population. Several published and unpublished reports have shown that farmworkers have a much higher prevalence of parasitic disease than counterparts who work and live in urban settings. Two of the most common and quite devastating diseases in terms of the diarrhea and discomfort they cause are amebiasis and giardiasis. Yet again, both infections can easily be prevented by making water available to the farmworker for sanitary facilities and drinking purposes.

Amebiasis is caused by the parasitic protozoa *Entamoeba histolytica*, which colonizes in the intestinal tract of humans; giardiasis is caused by the flagellate protozoa *Giardia lamblia*. *E histolytica* exists in two distinct forms: in its infectious stage, it is a cyst that infects the host; in its clinical form, it causes the symptoms in the host. The infection is very common in warm climates; in Mexico, it is estimated to occur in one in five persons. About 90% of the cases are asymptomatic. In the general population, the organism is transmitted either by fecal contamination of food and water or by direct person-to-person contact.

The incidence of amebiasis and giardiasis among farmworkers has been well documented. In studies among migrant farmworkers in North Carolina[100] and on the East Coast[101] and of Puerto Rican children of farmworkers in Massachusetts,[102] one third or more of the subjects were found to be harboring parasites, especially *Giardia*. However, studies among farmworkers in the West—namely, Arizona[103] and California[104]—report infection rates of 45% or better, with a much greater prevalence of amebiasis than of anything else. Ortiz concludes that 1 out of 10 farmworkers harbors *Entamoeba* compared with 1 out of 34 482 in the general population.[102] Similarly, 1 out of 9 farmworkers was infected with *Giardia* as compared

with 1 out of 19 000 in the general population. In terms of all the intestinal diseases, farmworkers apparently bear a risk for gastroenteritis and parasitic infection that is 11 and 20 times greater, respectively, than that of the general population.

In addition to amebiasis and giardiasis, farmworkers seem to be the host for a wide range of other parasitic infections. For instance, studies done in Rochelle, Ill, indicate that farmworkers' children living in labor camps had a 31% prevalence of parasitosis compared with a 16% prevalence among children of former migrants (urban setting).[105] The most common parasite found in this study was *Giardia*, followed by *Hymenolepsis nana* and *Ascaris lumbricoides*. Ortiz found a 36% prevalence of parasitosis among migrant Puerto Rican children under age 15, with the rate being higher for males than for females (42% vs 31%).[102] Among the parasites found, *Trichuris trichiura*, hookworm, and *Giardia* were the most common. The study also reported two cases of hookworm infection in children born in the northeastern United States who had never traveled outside the area. In comparing the study with one done among a similar population in Chicago, Winsberg et al. showed that although *Trichuris*, hookworm, and *Giardia* were the most common parasites found, the prevalence rate in the urban Latino population was half that reported by Ortiz for farmworker children.[106]

Illness caused by many of these parasites includes diarrhea; anemia, especially hookworm anemia, which leads to iron deficiency; intestinal blockage; and possible perforation of the intestine by the ascaris worm.

The health implications of this high rate of parasitosis are magnified by the fact that much of this population may be already suffering from malnutrition. Because many parasitological studies have shown an association between nutritional status and the presence of parasitic infections, such studies must be done in conjunction with nutritional studies.

Viral diseases. Infectious hepatitis is a contagious disease that is transmitted through fecally contaminated water or food, or from person to person through poor personal hygiene. Its incidence among farmworkers is very high and has been attributed to the lack of sanitary facilities in the field. Although published data on this subject are lacking, physicians who worked directly with the farmworkers presented sufficient testimony during OSHA's 1984 field sanitation hearings to substantiate a high incidence of hepatitis in this population.[21] Ortiz found an incidence rate of 993 cases per 10 000 persons as compared with 1 case per 10 000 in the general population.[88] A best estimate was that farmworkers are 333 times more likely to be infected with hepatitis than the general population. However, this does not seem to be the case with hepatitis B virus. A study using hepatitis B markers showed that the rate of hepatitis B in pregnant Latino women was no different from that in the general population.[107]

Barriers to Prevention of Occupational Diseases

In principle, all occupational diseases are preventable. Prevention depends on identifying the causal exposure(s) quickly and eliminating or reducing them until no more workers get sick. This usually involves—in decreasing order of importance—substitution with less toxic materials, engineering controls (e.g., installation of an effective ventilation system), or use of personal protective equipment. It makes more sense to try to prevent the disease from occurring at all than to allow it to occur and then try to medically treat and rehabilitate the person and provide monetary compensation for damage already done.

Unfortunately, several types of barriers currently exist to prevent implementation of this seemingly simple plan. One is a lack of scientific understanding of the causal agents and their mechanisms. Research and surveillance must be ongoing to identify hazardous agents and work situations. For example, only about 10 000 of the 60 000 commercially used chemicals have been tested for toxicity in animals,[32] and very few of these have been studied epidemiologically in humans. Understanding the cellular and molecular mechanisms of toxicity is clearly important to developing new approaches to treatment and prevention of occupational disease. Yet results of epidemiological studies can often be used effectively to prevent occupational disease even without detailed knowledge of the mechanism. For example, using simple epidemiological techniques, researchers identified a probable causative agent (DMF) in the coated-fabric factory epidemic.. Then, by modifying the production process to eliminate exposure to DMF, the factory was able to eliminate the epidemic, providing even stronger evidence that DMF was, in fact, the causative agent. Other situations may not be so clear-cut, however, and may require more sophisticated epidemiological techniques or understanding of the basic toxicology to identify the most likely causative agent.

Notwithstanding the importance of incomplete biomedical and epidemiological understanding of the etiologic agents responsible for specific occupational diseases, the main barriers to prevention have been economic, political, legislative, and social. Often workers cannot afford to turn down jobs for which they are qualified simply because those jobs are hazardous. Similarly, workers often are unable to leave jobs they know are hazardous because they do not have the financial resources to stop working for the time required to find another job or apply for and receive workers' compensation payments. Workers' compensation payments for occupational diseases in New York and many other states generally take more than 6 months and often more than a year to begin, even in the most clearly documented cases. In addition, the threat of prolonged unemployment weighs heavily on members of communities where jobs are scarce. The need to support a family often puts an irresistible pressure on workers to endure the very concrete physical discom-

forts or the more abstract elevated risks of occupational diseases. As a result, such workers may present with advanced or late-stage occupational diseases and may resist quitting their jobs even when strongly counseled to do so by their physician. This economic and bureaucratic trap is a major barrier to the successful prevention of occupational illness in Latino workers.

Employers who are ethical, well informed about occupational health, and sensitive to the particular needs of their work forces can play a key role in providing safe and healthy workplaces. Labor/management health and safety committees can help by raising issues and resolving them before serious health effects occur. Employers sometimes believe that improvement of working conditions will be prohibitively expensive, so they are unwilling to make the investment, even if their workers are getting sick from exposures on the job. Yet sometimes the cost of directly eliminating the hazard is less than the combined long-term costs of decreased productivity due to time lost from work and low morale, increased workers' compensation premiums, and fines from enforcing agencies. Often a "win-win" solution can be found that improves the working conditions without incurring unmanageable costs and may even increase productivity. In the coated-fabric factory, substitution of DMF with a less toxic solvent and other improvements in the production process represented a one-time capital investment that allowed the workers to be healthier and more productive while helping the employer comply with OSHA and EPA regulations. The medical surveillance program has helped to identify cases of other, unrelated occupational diseases in the plant.

Prevention of occupational disease among workers in a particular workplace provides economic benefits to society as well as to the employer. If workers remain healthy and continue working, they do not collect unemployment, welfare, social security disability, Medicaid, or other government funds. They usually escape the enormous social costs of homelessness, incarceration, and other indirect results of unemployment and disability. These costs, which may be considerable, are not explicitly considered in standard cost-benefit analyses. The employer is expected to pay for the entire cost of prevention, but much of the economic benefit is reaped by society at large, through savings in tax-funded expenditures. The cost barrier would be much less prohibitive for employers if the government, which benefits economically from prevention of occupational diseases, subsidized the prevention process in some way.

Obsolete, inadequate, or nonexistent standards regulating workplace exposure to toxins, and nonenforcement of existing standards, are great impediments to the protection of workers' health on the job. Yet they reflect the low priority that occupational health has received in the past decade. Even substances such as lead, whose toxic effects are well known and for which a reasonable standard exists, continue to cause substantial illness. Although the same standards should apply

to all workers, enforcement of these standards is often weakest for small, nonunion shops, which tend to employ disproportionate numbers of Latino workers. Ineffective or nonexistent right-to-know training is one factor that leads to this selective nonenforcement of standards.

Lack of access to comprehensive clinical occupational health services is another barrier to effective recognition and prevention of occupational diseases. Access is difficult for most workers, but particularly so for Latinos. For example, the New York State Department of Health administers a statewide network of occupational health clinics. Each clinic reports data on all cases of occupational disease to the state. Clinics in areas with significant Latino working populations have made sincere, if underfunded, efforts to reach out to Latino workers. In the 5 years since the inception of the clinic network, 10 141 cases of occupational disease have been reported, with information on ethnicity and race. Of these cases, only 4% were classified as Latino (M. London, personal communication, 1992). In the 1990 Census, 12% of the population of New York State was classified as Latino. Since independent evidence strongly suggests that Latino workers are at higher risk of occupational disease than the general population, the most plausible explanations for their underrepresentation in the reported cases are that Latino workers have especially poor access to clinical occupational health services and that occupational diseases are being underdiagnosed in Latino workers to a greater extent than in White workers. In New York City, where the municipal hospital system provides medical care to 43% of the Latino population of the city,[108] the number of cases of occupational disease reported to the Workers' Compensation Board by municipal hospital physicians has been negligible. The increased risk of occupational disease combined with poor access to clinical, preventive, and educational occupational health services suggests that the public health impact of interventions to correct this situation would be particularly great.

Overcoming the socioeconomic and political barriers to prevention may prove to be an even greater challenge for Latino workers than for White workers, and it will not occur until the problem is recognized and adequate additional resources are committed to a rational solution.

A Comprehensive Approach to the Problem of Occupational Disease in Latino Workers

The evidence strongly suggests that preventable occupational diseases cause substantial mortality and morbidity among US Latinos, and that this problem is not being recognized or addressed adequately. Admittedly, the evidence is fragmented and of variable quality, but it is more than enough to merit attention now.

We cannot afford to wait until the evidence is scientifically incontrovertible, especially since it is clear that OSHA has not been effective in identifying hazardous exposure situations and that existing case-finding and surveillance systems fail to detect the great majority of cases and epidemics, even those that are severe and obvious.

To begin to address the problem directly, we need to break the vicious cycle of no services→no data→no services. This can be done by making comprehensive occupational health services more accessible to Latino workers and simultaneously documenting the occupational disease morbidity and mortality with careful clinical, epidemiological, and surveillance studies of working populations that include significant numbers of Latinos. Unless we greatly improve both access to clinical occupational health services and the sensitivity of our surveillance mechanisms, we can never be adequately reassured that working conditions are safe, nor can we plan effective strategies to identify, treat, and prevent occupational disease.

The following recommendations are offered as a comprehensive approach to addressing this problem. These recommendations fall into five categories: clinical services, educational approaches, research and surveillance, unionization and organization of workers, and legislation and regulation of hazardous workplace exposures, all of which need to be addressed. Although occupational diseases may disproportionately affect Latino workers, the aim of preventive programs should be to reduce hazards for *all* workers, not simply to redistribute the hazards more equitably. These recommendations are intended to supplement broader, ongoing efforts to improve health and safety in the workplace.

Clinical Occupational Health Services

Access to comprehensive clinical occupational health services is probably the major determinant of the success of medical treatment for occupational diseases, as well as of surveillance and secondary prevention programs. Access is determined mainly by the existence and commitment of local occupational health clinics, of primary care providers knowledgeable in occupational medicine, and of other referral sources such as concerned unions, businesses, and attorneys. In New York City and other urban areas in the United States, most working-class Latinos have negligible access to these services. Their access must be improved through mechanisms such as sliding fee schedules, community- and union-based outreach programs, and appropriate bilingual capability of occupational health clinic staff.

Comprehensive occupational health services should include the following:

- Diagnosis and symptomatic treatment of the medical condition
- An assessment of whether the medical condition is work-related and the most specific identification possible of the causative exposure(s)

- Evaluation of workplace conditions, including inspection of the workplace if necessary and feasible
- Capability to mount a group medical screening of coworkers from the same workplace with similar exposures, if indicated
- Education of the worker/patient as well as the employer and union regarding occupational hazards
- Recruitment of the cooperation of the employer and, if the work force is organized, the union in addressing health and safety issues on the job
- Removal or control of the hazardous exposure by materials substitution, engineering controls, personal protective equipment, or, if all this proves impossible, removal of the worker from the workplace
- The filing of workers' compensation applications when appropriate
- A report of all cases to the appropriate surveillance program, if one exists (e.g., the Occupational Health Clinic Network of the New York State Department of Health, or the NIOSH SENSOR program[109])
- If necessary, *and with the workers' informed consent*, a report of hazardous workplaces to OSHA, NIOSH, EPA, or the appropriate regulatory or research agency
- Facilitation of vocational rehabilitation and job retraining for workers disabled by occupational diseases
- Education of primary care providers about the occupational health aspects of the individual patients they refer

The first item is usually addressed by most medical providers, but the rest generally require the commitment and specialized training of an occupational health clinician. Some large corporations have occupational health departments that can provide many of these services. However, published data on the accessibility of these services to Latino workers, and on the effectiveness of corporate occupational medicine services in treating and preventing work-related disease in industries that employ many Latino workers, were not found in a computerized literature search. Since a large number of Latino workers work in small shops without these resources, it is clear that the development of provider-based occupational health services that are accessible to Latino workers will be extremely important.

Medical practitioners trained in occupational and environmental health are in extremely short supply in the United States, relative to the need for services. Clearly, more specialists in this field need to be trained. Since this is a verbally intensive field that requires long histories to be taken from the patient and talks to be given to groups of workers, there is a particular need for bilingual occupational physicians who can speak directly to patients and workers.

The Institute of Medicine has recommended that "at a minimum, all primary care physicians should be able to identify possible occupationally or environmentally induced conditions and make the appropriate referrals for follow-up."[110] This assumes, of course, that an appropriate referral center exists that is accessible to both patients and physicians.

Clinical services for most Latinos begin with primary care providers in the Latino communities, including community-based practitioners and health centers as well as providers in hospital outpatient departments and emergency rooms. A recent probability sample survey of residents of Washington Heights, a predominantly Latino neighborhood in New York City, found that 59% of those surveyed received their "usual care" from doctors or group practices unaffiliated with the major medical center in the community rather than from the medical center or its primary care clinic network (R. Garfield, personal communication, 1991). Unfortunately, most primary care providers have never been trained to recognize an occupational disease and do not know how or where to refer a patient who may have one. Thus, since they are often the first or only accessible source of health care and advice, education of these community-based practitioners is crucial.

These providers should be trained to take a very brief occupational history whenever an illness's etiology is not obvious and to consider the possibility of an occupational etiology when appropriate; potential cases of occupational disease should then be referred to the appropriate referral facilities. If the first-contact providers do not recognize the occupational etiology of the illness, it is unlikely that the correct diagnosis will be made at all. They should have a basic knowledge of those diagnoses they might encounter that are likely to be work related—that is, the occupational sentinel health events discussed earlier.

Education of the primary care providers could take the form of miniresidencies and regular clinical case conferences or continuing education courses given by academic occupational medicine centers for providers already practicing in Latino communities. Simply having an occupational health consultant known and accessible to community practitioners will go far in providing them with relevant, patient-oriented education. Formal education of physicians, nurses, and physician assistants in training could easily include more occupational health training since the current amount of training is minimal. Training of Latino occupational health professionals will also be very helpful, as will their greater presence on faculties of medical, public health, and other related institutions. Finally, appropriate referral channels must be made accessible to them to pursue possible work-related diagnoses. As previously mentioned, the New York State Department of Health administers a statewide network of occupational health clinics, and the Association of Occupational and Environmental Clinics, based in Washington, DC, is a

growing network of occupational/environmental health clinics across the country with more than 50 clinics currently available for referrals.

In addition to seeing patients on an individual basis, the referral facilities should be capable of organizing and conducting group screenings of coworkers of individuals found to have occupational diseases, or they should be prepared to call in NIOSH to do a health hazard evaluation. These screenings are often the only way to determine definitively whether an individual's disease is indeed work related. In occupational medicine, the treatment for an illness is usually not a medication or an operation but rather the limitation or elimination of the adverse exposure. Often, when the employer is cooperative, industrial hygiene evaluation of the worksite together with the occupational physician and the rest of the occupational health team (including the worker/patient) can lead to control of the exposure and elimination of the epidemic. One caveat here is that all clinical or epidemiological investigations involving the employer must be done with the permission and cooperation of the individual worker, whose job is at risk if his or her involvement in the investigation becomes known.

If the worker is a member of a union, the union can help in interactions with employers. If the worker, union, or provider cannot satisfactorily negotiate a reduction or elimination of the hazardous exposure directly with the employer, a clinic staff member should be designated with both the time and the skills to pursue other strategies. These could include contacting local committees for occupational safety and health and other concerned parties. Although such interventions are not the traditional role of medical clinics, they are as important to the prevention of occupational disease as effective smoking cessation programs are to the prevention of lung cancer and heart disease. And they are especially important in the case of Latino workers, who are often in work situations that cannot be improved by direct negotiation with the employer.

In occupational medicine, the treatment for an illness is usually not a medication or an operation but rather the limitation or elimination of the adverse exposure.

Case finding and surveillance based on medical practitioners are necessary and a good place to start, but it can only reach those workers who are already symptomatic or sick; it cannot reach the much larger group of workers who are exposed to toxic substances or hazardous situations and have not yet become ill. This is an important group since primary prevention of occupational disease must take place before the disease occurs. Thus, the effort

to prevent occupational disease must include outreach programs that make unions, churches, community agencies, and other community-based organizations aware of clinical occupational health services and thus make these services more accessible.

Educational Approaches for Latino Workers and Their Employers

Comprehensive, widespread occupational health education programs that are culturally and linguistically appropriate should be targeted at and accessible to workers in specific industries and occupations. These programs should be offered in Spanish and English and should include right-to-know education, other health and safety training, and Spanish translations of relevant material safety data sheets. Kimball's *Workers' Sourcebook* is an excellent resource that lists and reviews 289 Spanish-language occupational health and safety materials for workers and is a useful aid in planning and conducting worker education programs for Spanish-speaking Latino workers.[111]

Employers are often not well versed in health and safety issues, even those related to hazardous substances or conditions in their own facilities. Educational programs to make them aware of appropriate health and safety practices and to sensitize them to workers' concerns and perspectives can facilitate improvements in health and safety conditions.

Recent literature on empowerment approaches to worker health and safety education emphasizes active involvement of workers in creating solutions to health problems in their own workplaces.[112,113] Improvement of both the quality of education and the numbers of Latino high school and college graduates would not only help strengthen this sense of empowerment but also help to lower the risk of occupational disease in Latino workers by opening up opportunities for less hazardous jobs.

Research and Surveillance

Sufficient evidence already exists to justify beginning to address the problem of occupational disease in Latino workers immediately. However, for the issue to compete successfully with other high-priority issues for funding as well as for research and clinical talent, and for the most pressing occupational health issues to be identified, further research is needed to document the extent and severity of the problem. A good first step would be to develop a scientifically valid and socially acceptable system of ethnic classification of Latinos,[114] which could be standardized for use in all government, union, and industrial statistical data gathering; all epidemiological studies of groups that include Latinos; and all state and federal occupational disease surveillance programs. More detailed studies are needed of where Latinos work, such as the analysis of US Census data by the Center for Puerto Rican Studies at Hunter College in New York City.[6]

Additionally, high-risk industries that employ large numbers of Latino workers should be studied. Since it is population based, the Hispanic Health and Nutrition Examination Survey could be an ideal tool for gathering detailed occupational data linked with data on specific sentinel health events likely to be work related (e.g., new onset asthma in adults). Clinical occupational health services accessible to Latino workers are critically important to the improvement of research and surveillance and would greatly help efforts to document the prevalences and incidences of currently undiagnosed occupational diseases in Latinos.

In 1984, data collection on occupational disease in the United States was considered to be fragmented, unreliable, and lagging behind surveillance of communicable disease.[115] With recent advances in communicable disease surveillance and a backsliding of occupational disease surveillance over the past 9 years, such data collection has fallen even further behind. Part of the reason why OSHA's and NIOSH's surveillance systems have been unable to detect obvious, severe, and long-standing epidemics like that in the coated-fabric factory probably lies with the aggressive defunding and partial dismantling of these federal agencies during the 1980s. To begin to have some confidence that our public health infrastructure can protect us against even the most extreme occupational hazards, we need to restore the authority, effectiveness, and autonomy of these agencies or replace them with much more effective surveillance mechanisms.

Principles of effective occupational health surveillance have recently been well summarized by Markowitz, who writes that it "entails systematic monitoring of health events and exposures in working populations in order to prevent and control occupational hazards and associated diseases and injuries."[116(p19)] He goes on to list four essential components of occupational health surveillance:

- To gather information on cases of occupational diseases and injuries and on workplace exposures
- To distill and to analyze the data
- To disseminate organized data to necessary parties, including workers, unions, employers, government agencies, and the public
- To intervene on the basis of data to alter the factors that produced these health events and hazards

Consensus among authorities on occupational health surveillance is that intervention must be an integral part of any surveillance program. Clearly, then, accessible clinical and educational services for occupational health are a prerequisite to the establishment of an effective program of occupational health surveillance.

Because funding for clinical occupational health services is extremely scarce, some state legislatures (e.g., those in New York and California) have responded

by establishing occupational health clinic networks. These networks provide occupational health services, are usually state funded, and are accessible—in principle—to all residents of the state. Although these projects are very recent and the clinics are not yet able to provide the volume of services necessary, they are at least generating data to estimate the magnitude of the problem. It will be critical in the near future to discover and document a larger proportion of the epidemics of occupational disease in Latino workers, and to make substantial commitments to resolving this public health problem.

Worker Organization and Unionization

Ideally, employers provide healthy and safe working conditions without intervention from outside. Some companies have identified worker health and safety as a priority and have occupational medicine departments in-house or have hired consultants to provide occupational health services. However, it is fairly common that the employer does not voluntarily provide healthy and safe working conditions. In these situations, a union can facilitate the process of securing improved workplace conditions for employees.

Health and safety regulatory laws do not effectively prevent an employer from firing an individual worker for becoming sick from the job, filing for workers' compensation, requesting appropriate protective equipment, or simply complaining about dangerous working conditions. The protections under the law that do exist are often circumvented when the employer asserts that the worker was terminated for economic or other non-health-related reasons, and the burden of proof rests on the worker to demonstrate otherwise. Organized workers are better able to avoid or reduce toxic and dangerous exposures in the workplace and are less vulnerable to being fired by an unscrupulous employer.

Like other workers in the United States, only about 1 in 6 Latinos is a member of a union. But as the coated-fabric factory example shows, organizing Latino workers can be a crucial step in improving employer compliance with OSHA guidelines and bringing about safe and healthy working conditions. A strong union health and safety committee can often be especially effective in facilitating this process, especially when management cooperates with formation of a labor/management health and safety committee. This worker empowerment approach is not always easy, and it usually requires bilingual and bicultural union organizers. However, it is often extremely successful since workers are taking responsibility for their own health and safety.

Unfortunately, in the past, Latino workers have been excluded from some labor unions, as have African-American workers. This barrier must be actively addressed and overcome before progress can be made in some industries. Despite the difficulties of union organizing, it is clear that attempts to improve working conditions

are most effectively carried out by an organized group rather than by an individual worker.

Legislation and Regulation of Hazardous Workplace Exposures

Like many other workers, Latinos often work in situations where toxic exposures abound and existing OSHA standards are not being enforced. Even when this is not compounded by problems with legal work documentation, it is often quite difficult to get the employer to comply with the OSHA standards. Improved enforcement of existing standards and development of rational new standards are necessary steps that can only take place with increased legislative support, such as the current bill to reform OSHA.

A Brief Approach to Prevention of Agricultural Hazards

Finally, the data presented here paint a dismal picture of the health of the Latino agricultural population, whether they are migrant or permanent workers. Accidents lead not only to deaths but also to permanent disabling injuries, exposure to toxic chemicals in the fields mean an uncertain health future for those exposed, and the lack of sanitary facilities and drinking water for the workers promotes the spread of communicable diseases that often result in hospitalization. But like all occupational hazards, these hazards could be greatly minimized if not prevented altogether if the following steps were taken:

- OSHA should administer educational programs in both Spanish and English on the proper and safe use of farm equipment, including motor vehicles such as tractors as well as knives and machetes used in the harvesting of crops.
- The federal government and the EPA must enforce the existing regulations dealing with the spraying of toxic chemicals and the guidelines on reentry into the fields. Further, farm operators must provide information to workers in both English and Spanish on the safe use of agricultural chemicals and the dangers of exposure to them.
- OSHA regulations on sanitary facilities should be extended to all workers, not just to farms that hire more than 11 workers.

Conclusions

Clearly, local epidemics of specific occupational diseases among Latino workers in specific industries have occurred and undoubtedly continue to occur. These epidemics are often unrecognized, are sometimes severe, and could probably be

recognized and addressed if more resources were committed to occupational health surveillance and to clinical occupational medicine services. The available evidence is inadequate to quantify the prevalence and incidence of occupational diseases and injuries among Latino workers at national or state levels, but it does suggest that the overall risk for such diseases and injuries among Latinos is greater than it should be, and it is certainly sufficient to justify a greatly accelerated investigation of the problem, especially one that includes Latino workers and the high-risk industries that employ them.

In addition to much-needed biomedical, toxicological, and epidemiological research, there must also be a rapid and substantial increase in the clinical, preventive, and educational occupational health services accessible to Latino workers. Since most occupational diseases remain undiagnosed and unreported by the current medical care system, improving their recognition and diagnosis by primary care, subspecialist, and occupational health providers not only is critical but is also a prerequisite to the adequate reporting of such diseases. Obviously, improving access to clinical occupational health services is vital to this process.

Although this chapter has focused on Latino workers, any solution to these problems obviously must consider high-risk workers of all races and ethnicities while ensuring the meaningful inclusion of Latinos in the process. Addressing local epidemics haphazardly, when and if they happen to be discovered, will never be an adequate solution. A more humane, scientifically valid, and ultimately cost-effective strategy would be an integrated program of occupational health surveillance, accessible clinical occupational health services, careful epidemiological research, bilingual worker education and training, health care provider education, collaboration with cooperative employers, unionization of Latino workers, legislative reform, and improved enforcement of regulatory standards.

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