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Achieving Environmental Justice: The Role of Occupational Health

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ACHIEVING ENVIRONMENTAL JUSTICE: THE ROLE OF OCCUPATIONAL HEALTH

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I. Introduction

The current rapidly growing interest in environmental justice is both timely and important. Occupational health is an integral part of assuring environmental justice. Concrete examples of environmental inequity leading directly to unequal health status can be found in occupational health literature and among the patients of occupational health clinics which serve populations that include low wage workers and workers of color. The toxic properties and health effects of many environmental contaminants were originally discovered in workplace settings where workers were repeatedly exposed to high doses of such contaminants. In the future, clinical occupational medicine, occupational epidemiology, occupational toxicology, and occupational health education will undoubtedly play key roles in addressing many environmental justice issues both inside and outside the workplace.

The threat of environmental exposures to human health is very real, but its nature and magnitude are poorly understood. The most important preventable causes of occupational and environmental diseases are exposures to toxins in the workplace and non-workplace environments. Over the past decade, uneven distribution of community exposure to environmental toxins has been well documented. There is incontrovertible evidence that toxic waste sites are preferentially located closer to communities of color and low income communities.[1] Exposures to urban air pollution, lead, and other environmental toxins tend to be more common in these communities as well.[2]

There are fewer studies and reports of uneven distribution of workplace exposures to toxic substances and hazardous conditions.

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1. *See generally* UNITED CHURCH OF CHRIST, COMMISSION FOR RACIAL JUSTICE, TOXIC WASTES AND RACE IN THE UNITED STATES (1987).

2. *See* Barry L. Johnson et al., Proceedings of the National Minority Health Conference: Focus on Environmental Contamination ix (1992); *see also* CONFRONTING ENVIRONMENTAL RACISM: VOICES FROM THE GRASSROOTS (Robert D. Bullard, ed. 1993).

However, published evidence suggests that African-American, Latino and probably Asian, Pacific Islander, Caribbean, and Native American workers in the United States, especially those in low-paying agricultural, manufacturing, service, and manual labor jobs, tend to be at higher risk for occupational diseases, injuries, and disability than the general population. The evidence supporting these claims has been reviewed elsewhere and therefore will be highlighted only briefly in this paper.[3]

Occupational diseases are caused by exposure to toxic substances or hazardous conditions in the workplace and are, by definition, preventable. They are often disabling, and probably quite common. The best available estimate indicates that 350,000 workers develop new onset occupational diseases and 50,000 - 70,000 active, disabled, or retired workers die of occupational diseases each year in the United States.[4] Other authors independently estimate that 2% - 15% of asthma is of occupational etiology.[5] This translates into 400,000 - 3,000,000 active, disabled, or retired workers with occupational asthma in the U.S.[6]

Occupational diseases are greatly underrecognized and underreported. Combining the above estimates with workers' compensation data has led to estimates that only three to five percent of occupational disease deaths and eleven to thirty-eight percent of new cases of occupational disease are actually reported as occupational.[7] The situation is even worse for some specific occupational

3. MORRIS E. DAVIS & ANDREW S. ROWLAND, OCCUPATIONAL DISEASE AMONG BLACK WORKERS: AN ANNOTATED BIBLIOGRAPHY (1980); Beverly H. Wright & Robert D. Bullard, *Hazards in the Workplace and Black Health*, 4 NAT'L J. SOC. 1, 45-62 (1990). *See generally* George Friedman-Jiménez, *Occupational Disease in Latino Workers in Urban Areas of the United States*, *in* LATINO HEALTH: AMERICA'S GROWING CHALLENGE, (Carlos Molina & Marilyn Aguirre-Molina, eds.) (forthcoming 1994) (on file with author); George Friedman-Jiménez, *Addressing the Problem of Occupational Disease in African American, Latino and Other Workers of Color in the United States: Strategies for Action in*, NATIONAL PROCEEDINGS OF THE HEALTH WATCH SYMPOSIUM ON THE ENVIRONMENT, *in* THE WORKPLACE AND NATIONAL HEALTH OF AFRICAN AMERICANS, Apr. 28, 1993 (forthcoming 1994) (on file with author) [hereinafter Friedman-Jiménez, *Addressing the Problem of Occupational Disease*]; David Michaels, *Occupational Cancer In The Black Population: The Health Effects of Job Discrimination*, 75 J. NAT'L MED. ASS'N 1014 (1990).

4. Philip Landrigan & Steven Markowitz, *Current Magnitude of Occupational Disease in the United States: Estimates from New York State*, 572 ANNALS N.Y. ACAD. SCI. 27, 27 (1989).

5. *See* Stuart M. Brooks, *Occupational and Environmental Asthma*, ENVTL. & OCCUPATIONAL MED. 393, 394 (William N. Rom ed., 2d ed. 1992) (discussing five studies of the occurrence of occupational asthma in various countries).

6. *Id.* at 393.

7. *See* Landrigan & Markowitz, *supra* note 4, at 27, 28-33, 40.

diseases. For example, three percent of the U.S. workforce works in New York City, so the national projection for occupational asthma yields an estimated 12,000 - 90,000 cases in New York City alone. Of this estimated number of cases, only twenty-four cases (0.2% or less) were reported to the New York State Occupational Lung Disease Registry in 1992.[8] Of the more than 3,000 estimated yearly cases of occupational cancer in New York State, only an average of three are reported annually by the Workers' Compensation Board as occupational in etiology.[9] This extreme underreporting has impeded recognition of occupational disease as an important and *avoidable* public health problem. As a result, many opportunities to prevent chronic disease, disability, and untimely death due to work-related exposures are lost.

Using this background as a springboard for discussion, this paper will focus on the need for strategies to guarantee environmental justice in the workplace. This paper will also explore the potential for the scientific and medical occupational health fields to contribute to solving environmental health problems outside the workplace.

II. Occupational Health as a Primary Environmental Justice Issue

Workers of color and low wage workers are more likely than the rest of the population to work in hazardous jobs.[10] Such inequities in employment probably result in increased risk of occupational disease and injury for these workers. Several other authors have reached similar conclusions supporting these claims.[11]

Occupational diseases and injuries are almost completely preventable and create avoidable costs not adequately reflected in published data, budgets, or cost-effectiveness analyses. Such costs include suffering, disability, and death of workers, as well as time lost from work, economic hardship, job loss and long term unem-

8. Telephone interview with Matthew London, Occupational Health Clinic Network, N.Y.S. Dep't of Health (Oct. 1993).

9. Philip Landrigan & Steven Markowitz, *The Magnitude of the Occupational Disease Problem: An Investigation in New York State*, 5 TOXICOLOGY & INDUS. HEALTH 4 (1989).

10. *See infra* notes 12-14 and accompanying text.

11. *See generally* DAVIS & ROWLAND, *supra* note 3; Beverly Hendrix Wright, *The Effects of Occupational Injury, Illness and Disease on the Health Status of Black Americans: A Review*, *in* RACE AND THE INCIDENCE OF ENVIRONMENTAL HAZARDS 114 (1992); Michaels, *supra* note 3, at 1014-18; David Kotelchuck, *Occupational Injuries and Illness Among Black Workers*, HEALTH/PAC BULL. 81-82 (1979).

ployment due to work-related disability. Low wage workers and workers of color may be less able than the general population to leave or refuse dangerous or obviously health-damaging jobs. If the occupational cause of the illness remains unrecognized and is not eliminated early, a worker who is reluctant to request improved working conditions or leave the job can suffer severe and prolonged disease. The costs of unrecognized and uncontrolled occupational illness may have even greater impact on low income communities and communities with high unemployment rates than on more affluent communities. Thus, it appears that occupational exposures and diseases contribute substantially to the problem of environmental inequity. The process of achieving environmental justice must therefore include ensuring environmental justice in the workplace.

A. Who Works in Which Jobs?

African-American workers comprise 10.1% and Latino workers 7.2% of the U.S. workforce.[12] Analysis of six occupational categories by race/ethnicity indicates that Latino workers are overrepresented and comprise over 7.2% of the workers in three categories: 11.1% of operators, fabricators and laborers; 10.2% of service workers; and 21.3% of "other agricultural occupations" (includes farm workers, but excludes farm managers and operators).[13] African-American workers are overrepresented (i.e., comprise over 10.1% of the workers) in two categories: 15% of operators, fabricators and laborers; and 17.6% of service workers. Both African-American and Latino workers are substantially underrepresented in the professional/managerial and technical, sales, and administrative support categories.[14] These data exclude the many undocumented workers currently living and working in the United States.

B. The Most Hazardous Jobs and Industries

Risk of occupational disease is higher in some jobs than in others. Unfortunately, published data providing this information are extremely limited, due in part to the underreporting of occupa-

12. BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, STATISTICAL ABSTRACTS Table 645 (1990) (analyzing data of total number of workers over 15 years of age in 1988).

13. *Id.*; *see also* Friedman-Jiménez, *Addressing the Problem of Occupational Disease*, *supra* note 3.

14. BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, *supra* note 12.

tional diseases. Also, data on risk of occupational disease are published according to industry, not race/ethnicity. Further, published occupational distributions by race/ethnicity do not include information on risk. Since industrial categories do not correlate perfectly with occupational categories, this approach is qualitative, and cannot provide quantitative measures of risk.

For purposes of this Article, broad industrial categories are classified as higher risk and lower risk. The six higher risk industrial categories include: agriculture, forestry, and fishing; manufacturing; construction; services; mining; and transportation and public utilities. The two lower risk industrial categories include: wholesale and retail trade; and finance, insurance, and real estate. The occupational categories operators, fabricators, laborers; service workers; and farm workers predominate in the higher risk industries.[15] Professional and managerial positions and technical, sales, and administrative support occupations predominate in the lower risk industries, with some ambiguity for technical workers that cannot be addressed using these data. Rates of work-related disease and lost workdays are 1.8 to ten times higher for the higher risk industries than the lower risk industries.[16]

A recent report indicates functional disability due to musculoskeletal disorders is related to some occupational groups more than others.[17] Twelve broad occupational groups were ranked by disability index from highest to lowest.[18] For women, the eight occupational categories with the highest disability indices were, in decreasing order: farming, forestry, and fishing; no occupation, unemployed, and homemaker; handler, cleaner, helper, and laborer; service occupations; technicians; operatives; crafts workers; and transportation operators.[19] The four lower disability occupational categories were, in decreasing order: professionals; sales workers;

15. *See* BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, *Occupational Injuries and Illnesses in the U.S. by Industry*, BULL. 2259 (1986), *reprinted in*, Landrigan & Markowitz, *supra* note 3, at 32 (Table 5); OFFICE OF INFO., U.S. DEP'T OF LABOR, *News* Tables 2 & 4, *reprinted in* Lois Dicker & Marvin Dicker, *Occupational Health Hazards Faced by Hispanic Workers: An Explanatory Discussion*, 1 J. LATIN COMM. HEALTH 1, 101-07 (1982); Friedman-Jiménez, *Addressing the Problem of Occupational Disease*, *supra* note 3.

16. *See* BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, *supra* note 15; OFFICE OF INFO., U.S. DEP'T OF LABOR, *supra* note 15.

17. J. Paul Leigh & James F. Fries, 82 *Disability in Occupations in a National Sample* 82 AM. J. PUB. HEALTH, 1517, 1519 (1992) (data from the Epidemiological Follow-up Study of the National Health and Nutrition Examination Survey I).

18. *Id.*

19. *Id.*

administrative support workers; and managers.[20] Findings were similar for men, with the same eight higher disability categories, in slightly different order, and the same four lower disability categories, in different order.[21] The higher risk occupational categories again reflect occupations in which Latino and African-American workers are overrepresented and the lower risk categories reflect occupations in which they are underrepresented.[22]

These data suggest that African-American and Latino workers are in jobs that place them at higher risk for occupational diseases and musculoskeletal disability. Although very crude, these analyses of broad categories are consistent with each other, with anecdotal experience, and with the few published occupational disease and injury studies which include racial/ethnic categories.

C. Increased Risk of Occupational Disease and Injury for Low Wage Workers and Workers of Color

Few studies have provided data comparing risk of occupational disease or injury by race, ethnicity, or income. Several authors have found, however, that African-American workers may be at higher risk for occupational disease and injury because of disproportionate employment in hazardous jobs.[23] This conclusion is likely to be true for Latino workers as well.[24]

A study of steel mill workers found that long-term, full-time, topside coke oven work, one of the least pleasant and most hazardous plant jobs, had a ten-fold increase in risk of lung cancer.[25] Of these workers, 88% were "Nonwhite", while only 21% of non-coke oven workers in the entire plant were "Nonwhite."

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20. *Id.*

21. *Id.*

22. *Id.*

23. *See* MORRIS E. DAVIS & ANDREW S. ROWLAND, OCCUPATIONAL DISEASE AMONG BLACK WORKERS: AN ANNOTATED BIBLIOGRAPHY (1980); Davis & Rowland, *Problems Faced by Minority Workers*, *in* OCCUPATIONAL HEALTH: RECOGNIZING AND PREVENTING WORK-RELATED DISEASE 417-30 (1983); Michaels, *supra* note 2; Friedman-Jiménez, *Addressing the Problem of Occupational Disease*, *supra* note 2.

24. George Friedman-Jiménez, *Occupational Disease in Latino Workers in Urban Areas of the United States: An Unrecognized Epidemic?*, *in* LATINO HEALTH: AMERICA'S GROWING CHALLENGE 14-19 (Carlos Molina & Marilyn Aguirre-Molina eds., forthcoming 1994).

25. Carol K. Redmond et al., *Long-Term Mortality Study Of Steelworkers*, 14 J. OCCUPATIONAL MED. 621, 621 (1972).

A recent California study reported that Hispanic men had 2.21 times the risk of occupational disease and injury of White men.[26] Black men had 1.41 times the risk of White men, Hispanic women had 1.49 times the risk of White women, and Black women had 1.31 times the risk of White women.[27] This effect was only partially explained by differences in educational level and length of employment.[28]

A California lead registry study found that 46% of adults with blood lead levels above 60 micrograms per deciliter (a toxic level requiring immediate removal from work) were Hispanic.[29] The most frequent industries involved were automobile radiator repair, lead battery manufacturing, brass/copper foundries, and gun firing ranges.[30] Home contamination and resulting lead poisoning in a worker's child were documented.[31] Lack of showers at work and wearing work clothes home were suggested causes of this problem of lead as a "take home toxin".[32]

A toxic liver disease epidemic in a coated fabric factory in Connecticut was found to have been caused by skin contact with dimethylformamide (DMF), a solvent used in the production process.[33] Seventy-six percent of the production workers, some of whom had to dip their arms into vats of DMF, were found to have abnormal liver function tests. Only eight percent of non-production workers had abnormal liver function tests.[34] Latinos comprised over ninety percent of the production workers, but only thirty-three percent of non-production workers.[35] This epidemic apparently existed for over ten years before being discovered and represents a failure of both the medical care system and the occupational health surveillance system to identify a severe and long standing occupational disease epidemic.

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26. James C. Robinson, *Exposure to Occupational Hazards Among Hispanics, Blacks and Non-Hispanic Whites in California*, 79 AM J. PUB. HEALTH 629, 630 (1989).

27. *Id.* at 629.

28. *Id.* at 630.

29. Neil Maizlish & Linda Rudolph, *California Adults With Elevated Blood Lead Levels, 1987 through 1990*, 83 AM. J. PUB. HEALTH 402, 402-03 (1993).

30. *Id.* at 404.

31. *Id.*

32. *Id.*

33. Carrie A. Redlich et al., *Liver Disease Associated With Occupational Exposure to the Solvent Dimethylformamide*, 108 ANNALS INTERNAL MED. 680 (1988); Friedman-Jiménez, *supra* note 28, at 15-19.

34. Redlich et al., *supra* note 37, at 682.

35. *Id.*

One study found the proportion of lung cancer attributable to work in one of twenty-two high risk occupations was higher in "Nonwhite" than in White workers in all four states included in the analysis.[36] This finding, if true in general, implies that the proportion of lung cancer cases preventable by controlling workplace exposure to lung carcinogens is higher for "Nonwhite" workers in these occupations than for White workers.

A systematic review of the occupational cancer literature concluded that few studies have published data on racial distribution of the study cohort.[37] The reviewers found a tendency for higher all-cancer mortality ratios for "Nonwhites" compared to Whites, and suggested that much more research is needed to examine the complex relationships between cancer, occupation, race, and potential confounding factors such as smoking.[38]

Two recent New Jersey studies report that African-American and Latino workers are at a higher risk for occupational injuries. In the first study, age adjusted rates of fatal occupational injuries in construction workers were 34.8/100,000 per year for Hispanic workers, 24/100,000 per year for Black workers, and 10.6/100,000 per year for American-born White workers.[39] In the second study, age-adjusted rates of hospitalized occupational finger amputations were 52.8/100,000 per year for Hispanic men, 28.9/100,000 per year for Black men, and 9.5/100,000 per year for White men. Women's rates were lower, but with a similar pattern: 7.4/100,000 per year for Hispanic women, 3.5/100,000 per year for Black women, and 1.2/100,000 per year for White women. Although only twenty percent of New Jersey workers are in manufacturing, fifty-three percent of the amputations occurred in manufacturing workers.[40]

D. Sweatshop Workers

Sweatshops are businesses that regularly violate both health or safety laws, as well as wage or child labor laws.[41] These workplaces

36. Paolo Vineis et al., *Proportion Of Lung Cancers In Males, Due To Occupation, In Different Areas Of The USA*, 42 INT'L J. CANCER, 851, 851-56 (1988).

37. Howard M. Kipen et al., *Are Non-Whites At Greater Risk For Occupational Cancer?* 19 AM. J. INDUS. MED. 67, 67-74 (1991).

38. *Id.* at 71-72.

39. Gary S. Sorock, Ph.D. et al., *Fatal Occupational Injuries In The New Jersey Construction Industry, 1983 to 1989*, 35 J. OCCUPATIONAL MED., 916, 916-21 (1993).

40. Gary S. Sorock, Ph.D et al., *Hospitalized Occupational Finger Amputations, New Jersey, 1985 and 1986*, 23 AM. J. INDUS. MED. 439, 439-47 (1993).

41. U.S. GEN. ACCOUNTING OFFICE, GAO/HRD-88-130BR, BRIEFING REPORT TO THE HONORABLE CHARLES E. SCHUMER, HOUSE OF REPRESENTATIVES: "SWEATSHOPS" IN THE U.S.: OPINIONS ON THEIR EXTENT AND POSSIBLE ENFORCEMENT OP-

are often hazardous and employ many low wage workers and workers of color. Sweatshops are found in the apparel, restaurant, meat packing, and other labor intensive industries. Health complaints in sweatshops include back, neck, and shoulder injuries and cumulative trauma disorders such as carpal tunnel syndrome, contact dermatitis, neurotoxicity from solvents, and respiratory problems.

Two U.S. General Accounting Office studies of sweatshops[42] reported that most sweatshop workers are Latino, Asian, and African-American, and estimate that in New York City, 50,000 people work in some 3,000-4,500 apparel factories classified as sweatshops. In addition, only one percent of the 17,000-plus apparel and restaurant sweatshops in New York City had been inspected by the Occupational Safety and Health Administration over a five year period.[43]

E. Reasons for Increased Risk of Occupational Disease and Injury

Greater exposure to hazards on the job is the single most likely reason for increased risk of occupational disease and injury among low wage workers and workers of color. Although much more research is needed, the few relevant published studies and anecdotal experiences from an urban occupational and environmental health clinic suggest that exposures to toxic substances and hazardous conditions in the workplace environment tend to be higher for these groups of workers. Individual susceptibility to environmental toxicants can vary significantly.[44] However, technology for accurately predicting which workers will be unaffected and which will get sick at a given level of exposure has not yet been developed for most occupational diseases. Thus, intensity, duration, and frequency of exposure to hazards in the workplace remain the main modifiable risk factors for occupational disease.

Exposure to workplace hazards is determined by a variety of powerful social and economic factors, some of which preferentially affect low wage workers, newly immigrated workers, and workers

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TIONS (Aug. 1988); U.S. GEN. ACCOUNTING OFFICE, 2 GAO/HRD-89-1-1BR, BRIEFING REPORT TO THE HONORABLE CHARLES E. SCHUMER, HOUSE OF REPRESENTATIVES: "SWEATSHOPS" IN NEW YORK CITY: A LOCAL EXAMPLE OF A NATIONWIDE PROBLEM (June 1989).

42. *See* sources cited *supra*, note 45.

43. *See* sources cited *supra* note 45.

44. Richard Rios et al., *Susceptibility to Environmental Pollutants Among Minorities*, 9 TOXICOLOGY & INDUS. HEALTH 797, 797-820 (1993).

of color. Lack of health and safety training, lack of English fluency, and newness on the job (the "last hired, first fired" phenomenon) can greatly increase risk of exposure. Real and perceived threats of job loss and reluctance to request improvements in health and safety conditions can keep workers trapped in hazardous jobs. This is a common situation for workers seen in our clinic. Often, workers are unwilling to take steps to improve working conditions which they feel may label them as "troublemakers" and possibly jeopardize their jobs. Frequently, workers with clearcut, disabling, and worsening occupational diseases, like carpal tunnel syndrome and occupational asthma, will refuse to leave their jobs in spite of strong medical advice to do so. This is an especially difficult situation for workers that are single parents or sole breadwinners, have little financial buffer, have little formal education, do not speak fluent English, are disabled, or those from communities with high rates of unemployment. Similarly, many of these workers are unable to refuse new jobs which they know or suspect may be hazardous to their health.

Another factor is the employer's degree of commitment to providing healthy and safe working conditions. Many employers conscientiously comply with regulatory standards and succeed in providing healthy and safe workplaces. Sometimes employers are unable or unwilling to expend the effort and money to make the workplace safe, however, even if these changes would be cost effective in the long run. Businesses that pay low wages and hire recent immigrants tend not to invest in workplace safety. OSHA only regulates businesses with more than ten employees and does not cover employees of smaller businesses or farm workers.

Union health and safety departments can help improve workplace health and safety while protecting workers to some extent from vulnerability. However, in the municipal hospital setting, most of our patients use public hospitals for medical care because they have no health insurance or benefits. This often means they are not union members. Treatment and prevention of occupational diseases is often more difficult, although not impossible, for unorganized workers.

F. Asbestos and Lead Abatement Industries

Asbestos abatement is a relatively new industry with potential for asbestos exposure. Asbestos can cause serious or fatal long

term health effects, including lung cancer, mesothelioma,[45] and asbestosis, which occur only after a latency period of fifteen to fifty years. Extremely effective methods are available to reduce exposure to asbestos dust and thereby lower the risk of these health effects. The Occupational Safety and Health Act standards,[46] when enforced, should completely eliminate risk of asbestosis, and reduce the risk of lung cancer and mesothelioma to unmeasureably low levels. OSHA requires all asbestos abatement workers to complete a thorough training course, pass a certification exam before beginning work, and complete a periodic update course for recertification.[47] Since symptoms do not occur immediately, workers without this training might not be motivated to use the necessary protective methods and equipment.

I had the opportunity to teach the health effects of asbestos as part of the certification and recertification courses in Spanish for asbestos handlers. A large number of Latinos have entered this industry and over a period of six years, I have lectured to over 2,000 Latino asbestos abatement workers in New York and New Jersey. I have been unable to obtain exact data on ethnicity of asbestos abatement workers, but the subjective impression of one of the major training organizations for asbestos abatement workers is that approximately one-third of the trainees speak English, one-third speak Spanish, and one-third speak Polish.[48] In discussions with Latino students working in the industry, it became apparent that the protective methods and equipment were frequently unavailable. Workers described having to resue the same dusty disposable coveralls for many days, lack of showers on site, difficulty obtaining replacement filter cartridges for their respirators, being issued a respirator without a proper fitting, and lack of enforcement of other OSHA-mandated preventive practices. Many workers reported finding white dust inside their respirators, a sign of leakage and probable exposure to asbestos dust.

Several workers who had complained about these violations lost their jobs, and others feared that if they complained the same would happen to them. Several unemployed workers were always waiting to take each of these jobs as soon as it became available,

45. Mesothelioma is a form of cancer affecting the pleura or peritoneum, linings of the chest cavity, and abdominal cavity respectively. It is nearly always rapidly fatal and most cases are caused by asbestos exposure, sometimes in relatively low doses.

46. 29 U.S.C. § 655 (1988).

47. *See* Pub. L. No. 99-499, § 126(a)-(f), 1986 U.S.C.C.A.N. 1690.

48. Interview with Myles O'Malley, Director, White Lung Ass'n of N.J., in Newark, N.J. (June 1989).

which added to workers' feelings of vulnerability. In addition, some employers assist workers in obtaining legal residency status. This practice contributes to workers' reluctance to complain about unsafe working conditions. Asbestos abatement could be a safe industry since effective protective methods are available and required by OSHA. This example illustrates how a potentially safe industry can become hazardous when mandated preventive methods are not enforced.

Lead abatement is a new and rapidly growing industry. Workers from affected communities will be trained and employed in this work. This will help solve the childhood lead poisoning problem while providing jobs in precisely those communities that need them most. One caveat is that this potentially hazardous work would be concentrated in low income communities and communities of color. This concern should not prevent implementation of the plan, but underscores the importance of effective mechanisms to assure enforcement of regulations and prevention of occupational lead poisoning. When workers have the protection of a collective bargaining organization, labor/managmenet health and safety committees can be very effective in this role. Experience has shown that control of exposure to toxic substances and hazardous working conditions is much harder to ensure when workers are not organized.

G. Failure to Recognize Occupational Disease in Low Wage Workers and Workers of Color

If occupational disease is a major public health problem for low wage workers and workers of color, why has this problem gone unrecognized? The most important explanation is the widespread underdiagnosis and underreporting of occupational disease in the general population. Primary care and subspecialist physicians typically have little or no training in occupational medicine, and only rarely diagnose patients with occupational diseases.

Medical students receive an average of four hours of training in occupational medicine while in medical school. This training is infrequently reinforced during their residency, and does not adequately equip them to recognize and treat or refer patients with possible occupational diseases. Most cases of occupational disease are diagnosed by the small number of physicians specializing in occupational medicine. Currently, only around 800 practicing physicians in the entire U.S. are board certified in occupational

medicine.[49] Many of them work for large corporations and are not accessible to the general public. As illustrated by the toxic liver disease epidemic in the coated fabric factory, the current public health surveillance systems are inadequate and can fail to detect even blatant occupational disease epidemics.

More widespread access to clinical occupational health services is necessary for accurate diagnosis and reporting of occupational diseases. Low wage workers and workers of color may have even less access to clinical and preventive occupational health services than the general population. In the New York State Occupational Health Clinic Network's first five years of data, this appears to be the case for African-American and Latino workers.[50] Seven New York State occupational health clinics reported over ten thousand patients in a five year period: 8.8% were Black, 4.8% were Hispanic and 1.1% were Asian/Pacific Islanders.[51] In New York State, 15.9% of the population is Black and 12.3% is Hispanic.[52] The most likely explanation for this disparity is that access to clinical occupational health services is less for these groups than for the general population. A less plausible alternative explanation is that they have lower rates of occupational exposure and disease. However, the evidence reviewed above indicates that these populations are probably at higher, not lower, risk of occupational disease.

H. Consequences of Failing to Recognize Occupational Disease

Failure to recognize occupational disease can produce catastrophic public health and economic consequences. Asbestos is an illustrative example. Adverse health effects of asbestos have been clearly documented by many epidemiologic and clinical studies.[53] Asbestosis was recognized as an important lung disease in the 1920s. Asbestos was first linked with lung cancer in the 1930s, although evidence was very weak by current medical standards. Scientific research to elucidate this link and publication in U.S.

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49. *See* JOSEPH LADOU, OCCUPATIONAL MED. 1 (1990)

50. Matthew London et al., New York State's Occupational Health Clinic Network: First 10,000 Patients (1993) (unpublished report on file with author).

51. *Id.*

52. U.S. BUREAU OF THE CENSUS, 1990 CENSUS OF POPULATION AND HOUSING, RACE AND HISPANIC ORIGIN 45 (1991).

53. *See, e.g.*, Brooke T. Mossman, Ph.D. & J. Bernard Gee, M.D., *Medical Progress: Asbestos-Related Diseases*, 320 NEW ENG. J. MED., 1721, 1721-30 (1989); William N. Rom et al., *Cellular and Molecular Basis of the Asbestos-Related Diseases*, 143 AM. REV. RESPIRATORY DISEASE 408-422 (1991); Irving J. Selikoff et al., *Mortality Experience of Insulation Workers in the United States and Canada, 1943-1976*, 330 ANNALS NY ACAD. SCI. 91, 91-116 (1979).

journals of research results were actively discouraged by the asbestos industry at that time. As a result, use of asbestos in the U.S. was widespread from the 1940s through the 1960s.

By the time conclusive evidence of excess mortality of asbestos workers from asbestosis, lung cancer, and mesothelioma was published in the 1960s, asbestos insulation had already been installed in millions of homes, schools, and commercial buildings. It was ubiquitous in our environment and safe removal of all in-place asbestos was no longer possible. Now, we are faced with the difficult decision of either leaving most of the asbestos in place and accepting an ongoing, very small, but nonzero, excess mortality from exposure of large numbers of people to low levels of asbestos, or spending billions of dollars to remove the asbestos. Cost issues aside, widespread asbestos abatement is not without its own risk of contamination and resulting disease.

Another option is currently being explored which might help reduce the public health consequences of the asbestos situation. The molecular mechanisms of asbestosis, mesothelioma, and lung cancer caused by asbestos are being studied in hope of developing drugs which will block the disease process and lower the risk of disease in people already exposed to asbestos.

The public health, legal, and economic nightmares of asbestos could have been largely avoided by encouragement of open medical and scientific dialogue and research on health effects of asbestos in the 1930s, followed by more prompt regulation and avoidance of such widespread use of asbestos. The critical delay in regulation was caused more by political obstacles than by technological difficulty. We should learn from this example and develop a more public health oriented approach to the large number of commercial substances of unknown toxicity.

III. The Roles of Clinical Occupational Medicine, Occupational Epidemiology, and Occupational Toxicology in Achieving Environmental Justice

People are exposed to a myriad of substances in their homes and work environments. Medical and scientific evidence of actual health effects (or lack of health effects) of these exposures is critical to sound environmental decisionmaking. Occupational and environmental diseases are very real and very important, and most are not being addressed in an effective or equitable manner. However, many adverse health outcomes which appear to be associated with environmental exposures are not causally related at all. It is

impossible to control or eliminate exposure to all environmental substances. Distinguishing health effects of environmental exposures from health effects due to other causes is often difficult, but in many cases can be accomplished with well designed studies. Environmental justice requires a broad, deep, and expanding knowledge base in environmental science, as well as clinical public health, political, and legislative action in order to translate this scientific understanding into control and elimination of environmentally and occupationally induced disease. The scientific, medical, and public health aspects will be discussed in the hope of inspiring ideas for political and legislative action.

We have an inadequate level of scientific understanding of the health effects of most environmental and occupational exposures. Less than 10,000 of the more than 60,000 chemicals in common commercial use have been evaluated for toxicity in animals or humans.[54] These 60,000 chemicals range in toxicity from completely nontoxic to highly toxic. Most probably have some degree of toxicity above certain doses or under certain exposure conditions. For carcinogens, dose determines probability of disease, rather than severity of disease, and even exposure to low doses can cause cancer in a tiny fraction of people. In many cases, even the most rudimentary data on human health effects are lacking. Regulation of all potentially toxic chemicals is not technologically possible. Allowing widespread use of chemicals before adequate research has been done on human toxicity, however, can lead to public health, economic, legal and personal disasters, as we have learned from the history of asbestos. The medical and scientific disciplines of occupational medicine, occupational epidemiology, and occupational toxicology can contribute a great deal to the process of sorting out toxic from nontoxic exposures. This process is fundamental to achieving environmental justice both inside and outside the workplace. In addition, clinical and epidemiologic documentation of occupational disease in populations other than White males will help us to prioritize preventive public health interventions.

Clinical occupational medicine is an interdisciplinary field which includes recognition, diagnosis, treatment and prevention of occupational diseases. Occupational diseases are often easier to diagnose unambiguously than other environmental diseases, but

54. *See* LADOU, *supra* note 49, at 1.

occupational medicine clinics see patients with both types of problems. Comprehensive occupational medicine services include

1) Diagnosing or ruling out occupational etiology in individuals with medical complaints, and following up with appropriate treatment, including initiation of preventive interventions in the workplace to reduce or eliminate the causal exposure. When appropriate, providing medical documentation for Workers' Compensation claims.
2) Educating patients, employers, unions, community groups, and primary care medical providers about occupational exposures and illnesses.
3) Following up on public health implications of individual "index cases" by organizing group medical screenings to identify occupationally related health problems in similarly exposed coworkers.
4) Providing the technical assistance necessary to help management and labor when an occupational exposure situation raises scientifically justifiable public health concerns for groups of workers. This process can include:
   A) Evaluating workplace exposures, symptoms, and medical conditions of concern.
   B) Evaluating, clinically and/or epidemiologically, whether association between exposure and medical condition is likely to be causal.
   C) Identifying potential exposure—disease associations for which more research is critical to guarantee rational public health, clinical, economic, and regulatory decisionmaking.
   D) Assisting labor and management in designing, implementing, and evaluating effective interventions in the workplace which will lower or eliminate the risk of occupational disease.
   E) Providing technical information to allay fears which are clearly inconsistent with current scientific understanding.
   F) Applying clinical knowledge and experience to assist management and labor in planning a rational approach to defining, prioritizing, and resolving key questions when the relation between health effects and occupational exposure is unclear.

The most direct and obvious contribution of occupational medicine to the environmental justice movement is the provision of clinical services to workers who need them. This will require

greatly increased access to clinical occupational medicine services. Since low wage workers and workers of color have particularly poor access to these services, targeting services to these groups should be a top priority.

One major obstacle in clinical occupational medicine is that adequate clinical and preventive services can be provided only for the subset of occupational diseases for which there is sufficient scientific understanding to reduce or eliminate the cause through intervention. For some of the most common and disabling work-related complaints, a lack of scientific and medical understanding frequently makes it difficult or impossible to identify a specific preventable etiologic exposure or to confidently state that the medical complaint is not occupational in origin. Some examples include work-related asthma, cumulative trauma disorders including carpal tunnel syndrome,[55] back pain, "Sick Building Syndrome",[56] and "Multiple Chemical Sensitivities."[57] Additional epidemiologic, clinical, and toxicologic research is needed for each of these entities in order to develop accurate and reliable methods of diagnosis and determination of work-relatedness, treatment, and prevention. These common complaints cause a great deal of suffering, disability, and economic loss. More and better scientific research is desperately needed to separate the wheat from the chaff.

An important but less obvious contribution is the potential for Occupational Medicine clinics to aid in the general understanding

55. Carpal Tunnel Syndrome is a nerve disorder of the median nerve, which provides sensory and motor function to much of the hand. It is sometimes work-related and is common in meat packers, garment workers, other factory workers, supermarket checkers, typists, and others who perform forceful, repetitive, and awkward hand motions.

56. "Sick Building Syndrome" is a term used to describe a variety of subjective symptoms including headache, lethargy, lightheadedness, chest tightness, itching, and others, which frequently occur in large proportions of workers in centrally ventilated, air conditioned buildings. The precise causes are poorly understood. For a more thorough discussion of Sick Building Syndrome, see Richard Menzies et al., *The Effect of Varying Levels of Outdoor Air Supply on the Symptoms of Sick Building Syndrome*, 328 NEW ENG. J. MED. 821 (Mar. 1993), and the accompanying editorial by Kathleen Kreiss, 328 NEW ENG. J. MED. 877-78 (Mar. 1993).

57. "Multiple Chemical Sensitivities" refers to a large variety of symptoms affecting multiple organ systems that are predictably triggered by low levels of exposure to specific chemicals or odors. The mechanisms of disease are not understood at all and even the validity of the diagnosis is controversial. *See, e.g.*, Gregory E. Simon, M.D., M.P.H. et al., *Immunologic Psychological and Neuropsychological Factors in Multiple Chemical Sensitivity: A Controlled Study*, 119 ANNALS INTERNAL MED. 97, 97-98 (1993); *Letters to Editor*, 120 ANNALS INTERNAL MED. 249, 249-51 (1994) (responding to Simon); *see also* NICHOLAS A. ASHFORD & CLAUDIA S. MILLER, CHEMICAL EXPOSURES: LOW LEVELS AND HIGH STAKES (1991).

of occupational as well as other environmental diseases. Analysis and publication of occupational health clinics' experiences can contribute much to the understanding of causal relationships between environmental exposures and human disease. For example, an individual, a union, or an employer may become concerned that a health problem is related to exposure to some substance in the workplace. By evaluating several of the sickest workers and the workplace exposure situation, the clinic can often provide an opinion about the relationship between the exposure and the medical problem, within the limitations of existing medical and scientific knowledge. Based on this evaluation, the clinician may be able to formulate a testable scientific hypothesis amenable to study by clinical, epidemiologic, toxicologic, or molecular biology methods. Often, extrapolation of findings of toxic effects or lack of toxic effects from workers with higher exposures to community members with lower exposures is more justifiable and interpretable than extrapolation from animal toxicology studies. In this way, clinical occupational medicine can generate new knowledge about the health effects of occupational and other environmental exposures.

Few occupational medicine clinics in the United States have significant experience with populations that include many low wage workers and workers of color. In addition, few primary care providers have been trained to recognize, diagnose, and treat or refer patients with possible occupationally or environmentally related diseases. This handicaps our ability to address environmental justice issues. In the past, very few occupational medicine clinics were publicly accessible for referrals from primary care providers. However, referral access to occupational and environmental medicine services has recently been improved through clinic networks and other organizations. Individual workers, unions, community organizations, medical providers, attorneys, employers, and others seeking accessible clinical occupational medicine services can call these networks and organizations to request a referral to the nearest clinic or practitioner.[58]

"Centers of Excellence" for clinical occupational medicine have been suggested as part of the health care reform currently being

58. One example is the Association of Occupational and Environmental Clinics, a Washington-based national network of over fifty independently funded clinics (contact number 202-347-4976). Another example is the New York State Occupational Health Clinic Network, an Albany-based network of eight clinics around the state, largely funded by the New York State Department of Health (contact number: 518-458-6228). A third organization is the Chicago-based American College of Occupational and Environmental Medicine (contact number: 708-228-6850).

discussed in Congress.[59] These would be clinical centers offering individual workers comprehensive, accessible occupational medicine services on a referral basis, as well as through Health Maintenance Organizations, other healthcare provider organizations, and concerned employers. Centers of Excellence would also provide educational, surveillance, data management, and research functions related to occupational disease. The key is to assure that clinical services are accessible to workers and that clinicians remain objective in their assessments of occupational disease and disability.

Clinical and preventive services, research, occupational health education, and effective regulation of occupational hazards are inseparable. They must be done together to successfully address the problem of work-related disease. Successful clinical treatment and prevention of occupational diseases usually depends on control or elimination of workplace exposures. Identification and confirmation of the actual causal exposures usually requires epidemiologic studies, often combined with industrial hygiene, toxicologic, and increasingly, molecular biologic methods. Once causal exposures are identified, adequate control of these exposures requires occupational health education of workers and employers, industrial hygiene interventions in the workplace, and effective ongoing regulation of workplace exposures. Enforcement of OSHA and other legal standards for protection of workers is a key component of the regulatory process. Development of rational regulatory standards requires adequate scientific understanding of the disease process. OSHA reform is clearly needed to improve the effectiveness of the regulatory process. Greater involvement of grassroots environmental groups, local Committees for Occupational Safety and Health (COSH groups) environmental attorneys, and environmentally conscious politicians in improving and enforcing occupational health standards will have a substantial positive effect on improvement of environmental health.

Understanding health effects caused by workplace exposures is a cornerstone of the environmental health field. Clinical occupational medicine and occupational epidemiology have probably provided the greatest body of evidence of actual human health effects of environmental exposures. In addition, the techniques which can

59. Healthcare Reform Working Group, American Pub. Health Ass'n Occupational Health Section, National Healthcare Reform, Workers Compensation, and the Diagnosis, Treatment and Prevention of Occupational Illness and Injury 9 (Jan. 1994) (unpublished report on file with author).

most convincingly demonstrate *lack* of human health effects of environmental exposures are probably well-done, properly interpreted epidemiologic studies of long term, high level workplace exposures.

Occupational toxicology and molecular biology are also making increasing contributions to the environmental health knowledge base. Understanding the molecular mechanisms of environmental and occupational disease is now deemed critical to the development of occupational medicine and occupational epidemiology. The use of biological markers of exposure, susceptibility, and disease promises to greatly increase the ability of epidemiology and clinical medicine to detect real health effects of environmental and occupational exposures. It is hoped that research in the molecular biology of environmental and occupational diseases will contribute substantially to their control and elimination in the future. However, reduction of exposure is and will remain a necessary and dominant component of the overall strategy.

Epidemiology studies can improve our understanding of human health effects caused by specific environmental exposures by providing objective, interpretable evidence of these effects. Community environmental epidemiology studies have often been unsuccessful in providing this sort of evidence due to several important difficulties. Exposures are usually low and there are many potentially confounding exposures[60] which may explain the health effect being studied. In addition, exposure and confounder information rarely exist at the individual level and are often estimated with much error. Defining and following a study cohort are difficult. These factors often make clear interpretation and conclusions difficult. Epidemiology studies of more concentrated, long term exposures in a well-defined and closely followed occupational group with fewer confounding exposures can often yield more interpretable information. If no health effect is found in a properly designed study of highly exposed workers, this can be more reas-

60. Confounding exposures are extraneous exposures which are independent risk factors for the disease and are associated with the exposure being studied. It is often difficult or impossible to disentangle the effect of the exposure being studied from the effect of the confounding exposure. An illustrative example is a study of diesel exhaust and lung cancer. Potential confounding exposures might include cigarette smoking and asbestos exposure, if they are associated with diesel exhaust exposure. If cigarette smoking and asbestos exposure are accurately measured in addition to diesel exhaust exposure, adjustments can be made for effects of the confounding exposures. If information on exposures to each of these potential confounders for each individual in the study is not available, it is difficult or impossible to adjust for the confounding effects of each exposure.

suring than a similar result from a larger community study of much lower exposure levels. If a health effect is found, this can provide guidance on which populations, health effects, and exposure measures should be targeted in a larger study of lower community exposure.

Lawyers and legislators can also play an important role in ensuring environmental justice. Control or elimination of exposure is a critical step in treatment and prevention of occupational and environmental disease. Experience shows that this rarely occurs without effective regulation and enforcement. Such regulation and enforcement require rational standards which reflect current scientific understanding (or lack of it) and public health principles. Equitable prevention of occupational and environmental disease requires careful consideration of environmental justice issues in the regulatory and policymaking processes, with equitable representation of all parties involved, including low income communities and communities of color. Occupational and environmental disease has health, social, quality of life, and economic costs which are not adequately reflected in cost/benefit analyses. Further, many of these costs are not borne by those that reap the benefits. This underscores the need for a more democratic environmental decision making process.

Strong scientific and medical research is necessary, but not sufficient, to ensure an actual public health impact. Recognition of this crucial fact has led some to call for creation of a "New Paradigm" for partnership between grassroots community and environmental groups, health providers knowledgeable in occupational and environmental medicine, academic environmental science researchers, and government environmental agencies. The hope is that these partnerships will help ensure that research and clinical services actually lead to reductions in occupational and environmental disease and to greater environmental justice and equity.

A. Example of a Successful Partnership Between Researchers, Workers, Management and a Governmental Agency in an Occupational Epidemiology Study

Occupational health can provide models for the "New Paradigm." Numerous epidemiology studies addressing concerns of environmental hazards in the workplace have been conducted with

labor and management support. A study of cancer in firefighters in which I participated is one example.[61]

Firefighters are exposed to toxic and carcinogenic combustion products in fire smoke. After a large study of Boston firefighters reported no increased mortality from all cancers combined nor from a group of specific cancers,[62] the firefighters' union approached an occupational physician at Massachusetts General Hospital with their perception that too many of their members were dying of cancer. They had collected over five hundred death certificates from their union death benefit fund, and requested assistance in analyzing them for excess cancer. As a medical student, I worked with a preceptor from Massachusetts General Hospital and four members of the firefighters' union to gather missing death certificates from the Massachusetts Department of Health. The Department of Health also supplied mortality data cross-matched with the list of deceased firefighters from the union. The firefighters participated in discussions of strengths and limitations of the study design. In addition, we met with management at fire headquarters, and they agreed to support the study and assist us in following up on the results.

The firefighters contributed a great deal to the scientific process. Initially, they suggested a hypothesis, based on their collective observed experience. In addition, several firefighters made substantive contributions to the design and interpretation of the study. The head of the union benefits fund helped us evaluate completeness of follow up of the firefighter cohort, and helped us identify several out-of-state deaths. The head of health and safety answered questions about possible sources of exposure to toxic fumes and smoke and other issues important to the reasonable interpretation of the results. A third union member helped gather and organize the death certificates, and asked important and difficult questions of the researchers. He was instrumental in communicating the information to the union membership at large.

The study found no excess of cancer overall, but did find excess mortality due to malignant melanoma, based on small numbers. The results were presented at a national symposium on health effects of firefighting sponsored by the International Association of Firefighters, and at a meeting of the American Public Health Asso-

61. George Friedman-Jiménez et al., *A Proportionate Mortality Study of Boston Firefighters*, Abstract, 117th Annual Meeting of Am. Pub. Health Ass'n (1989).

62. William Musk et al., MORTALITY OF FIREFIGHTERS IN BOSTON, 35 BRIT. J. INDUS. MED. 104 (1978).

ciation. Partly in response to this finding, the Massachusetts Department of Health did a follow up study of melanoma incidence in a different sample of firefighters, and reported a nearly identical excess. The study focused concern on melanoma and a small number of other possible health effects of firefighting. The process allowed the firefighters to base their health concerns on objective data and on their understanding of the occupational health literature on firefighting. They gained a deeper understanding of the limitations of the science as well.

The research results led to several appropriate public health interventions. When the Department of Health reported similar findings in their own study, they suggested a melanoma screening program for firefighters. Fire department headquarters worked with the firefighters more closely in addressing specific health concerns and in upgrading protective equipment. Firefighters' concern for health and safety and their regular use of protective equipment were enhanced.

This example illustrates the feasibility of a partnership which includes the workers' active participation throughout the study, as well as participation by management, health department and an academic institution. This partnership contributed substantially to the scientific validity of the study. It also enhanced the researchers' credibility with both labor and management, who accepted the results and limitations of the study with greater understanding and trust than might otherwise have occurred. Occupational epidemiology studies similar to this one may provide useful models for studies of community environmental exposures, with a community-based organization playing the role of the union.

B. A "Vicious Cycle" Limits Ability of Occupational Health to Effectively Contribute to the Environmental Justice Movement

The occupational health field has been chronically underfunded, most significantly since 1981. This has complicated the implementation of a rational public health approach. The problem is a "Vicious Cycle" which, unless stopped, will continue to severely limit the ability of occupational health to make the important public health contributions outlined above.

The vicious cycle (see Figure 1) operates as follows: Lack of funding and inadequate reimbursement for clinical and preventive occupational medicine services, education, and research in occupational medicine have caused an extreme shortage of occupational

medicine physicians and accessible clinical services. Lack of clinical services, education, and research lead to underdiagnosis and underreporting of occupational diseases. Underreporting leads to a lack of data on incidence, prevalence, and public health impact of occupational diseases, which leads to a lack of funding for clinical and preventive services, research and education. This vicious cycle disproportionately affects the occupational health of low wage workers and workers of color.

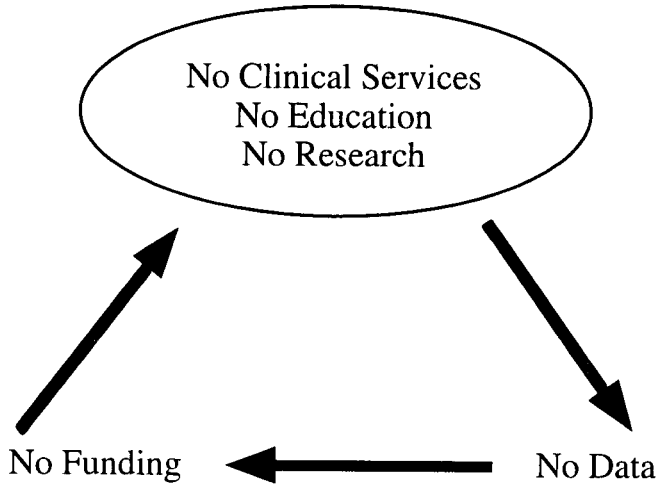

Figure 1.
The Vicious Cycle in occupational health.

IV. Conclusion

Occupational disease among low wage workers and workers of color in the United States is a concrete example of unequal environmental exposures leading directly to unequal health status. Accessible clinical services as well as scientific research resulting in public health action are necessary to address these inequities. It is clear that clinical occupational medicine, occupational epidemiology, and occupational toxicology, including molecular biology, can contribute a great deal to ensuring environmental justice. These disciplines can provide much of the scientific data which are sorely needed to distinguish true environmental toxins from nontoxic environmental exposures, and to set public health priorities for action. Partnerships between clinicians, scientists, and educators in these and related fields, grassroots community environmental groups, and government research and regulatory agencies are nec-

essary in order to advance in this direction. Low wage workers and workers of color must have better access to clinical occupational medicine services and must be more effectively included in epidemiology studies of their workplaces.

The vicious cycle discussed in section III.B. must be broken by providing funding to simultaneously increase access to clinical occupational medicine services for workers at high risk, and to document occupational disease patterns in these populations. Primary care providers serving low income communities and communities of color must be trained to suspect, recognize, and treat patients with possible occupational diseases, or to refer them to an occupational medicine specialist. Educated employers and labor unions can help reduce the risks of occupational disease, especially through labor/management health and safety committees. Improved enforcement of existing regulations and development of standards that better reflect scientific and public health knowledge are critical. The Comprehensive Occupational Health and Safety Reform Act[63] currently being discussed in Congress addresses these needs to a large extent.

Occupational diseases and injuries may disproportionately affect low wage workers and workers of color. Efforts to achieve environmental justice should focus on *reducing risks to all workers*, with specific provisions to include these high risk workers. Redistributing the risks more "equitably" without an overall reduction could hardly be called justice.

63. H.R. 1280 and S. 575, 103d Cong., 1st Sess. (1993).

Appendix[64]
Some Illustrative Examples of Potentially Work-related Diseases

WORK-RELATED ASTHMA

Workers Exposed to a wide variety of airborne dusts or chemical fumes and vapors.

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

Parenchymal pulmonary fibrosis with or without pleural scarring in workers with substantial asbestos exposure more than 15 years ago.

ACUTE BRONCHITIS, PNEUMONITIS, PULMONARY EDEMA

Workers exposed to airborne irritants including ammonia, chlorine, nitrogen oxides, sulfur dioxide, cadmium, trimellitic anhydride.

HYPERSENSITIVITY PNEUMONITIS

Workers (e.g., agricultural workers, office 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, garment workers, supermarket checkers, typists, factory workers.

RAYNAUD'S PHENOMENON

Vibration or vinyl chloride exposed workers.

OCCUPATIONAL CANCERS

Lung cancer

Workers exposed to asbestos, tobacco smoke, polycyclic aromatic hydrocarbons, arsenic, chromate or nickel dust, ionizing radiation and radon, bis(chloromethyl) ether, as well as smelter, foundry, rubber reclamation, and steel workers.

Malignant mesothelioma

64. *See* Friedman-Jiménez, *Addressing the Problem of Occupational Disease, supra* note 3.

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 & brain cancer
In formaldehyde exposed workers.

Nasal cancer
In furniture makers and woodworkers.

Angina and myocardial infarction
Workers with underlying coronary artery disease who are exposed to carbon disulfide, carbon monoxide or methylene chloride.

CARDIAC ARRHYTHMIAS
Workers exposed to halogenated hydrocarbon solvents or anticholinesterase insecticides.

TOXIC NEUROPATHY
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 & C AND, RARELY, HIV INFECTION
Health care workers, from contaminated sharps injuries.