

THE EPIDEMIOLOGY OF OCCUPATIONAL INJURIES AND ILLNESSES OF HEALTH CARE WORKERS

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Health care workers are exposed to a wide range of occupational hazards that often depend on the nature of their work. The term *health care worker* may include workers directly involved in the delivery of patient care, such as physicians, dentists, podiatrists, chiropractors, nurses, nursing assistants, physicians assistants, and therapists. The term may also include workers in health care facilities who do not provide patient care but provide services integral to the function of the facility. These include laboratory workers, maintenance and custodial staff, security personnel, and administrative staff working in a variety of settings including hospitals, outpatient clinics, private practitioner's offices, long-term care facilities, and home health care. Table 1 lists some of the hazards in health care and the work with which they are associated.

This article provides an overview of data from existing surveillance systems of health care worker illness and injury, including systems operated by the Centers for Disease Control and Prevention (CDC) (e.g., human immunodeficiency virus [HIV], hepatitis, tuberculosis surveillance) and US Department of Labor, Bureau of Labor Statistics (Survey of Occupational Injuries and Illnesses, and the Census of Fatal Occupational Injuries). Although health care workers confront a variety of occupational hazards, surveillance of the resultant illnesses and injuries often is limited or

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CLINICS IN OCCUPATIONAL AND ENVIRONMENTAL MEDICINE

Table 1. OCCUPATIONAL HAZARDS IN HEALTH CARE AND JOB TASKS THEY ARE ASSOCIATED WITH

Hazard Type	Associated Job Tasks
Infectious diseases	
Transmitted by contact	Patient care, laboratory, housekeeping
Airborne transmission	All personnel exposed to infectious aerosol
Bloodborne pathogens	Patient care, laboratory, housekeeping
Musculoskeletal injuries	Patient care, especially nurses, aides (back injuries), and dental personnel (upper extremity)
Chemical hazards	
Sterilants	Central supply, others who sterilize equipment
Inhalational anesthetics	Anesthesiologists, anesthesiologists, other operating room personnel, dental personnel
Aerosolized pharmaceuticals	Nurses, respiratory therapists
Other pharmaceuticals (including antineoplastic drugs)	Pharmacy staff, nurses
Ionizing radiation	Radiologists, radiology technicians
Latex allergy	Physicians, dentists, nurses, technicians
Workplace violence	All health care workers

incomplete. Whenever possible, this article presents descriptive epidemiology data regarding particular hazards. Other articles in this issue explore in greater detail the epidemiology of specific illnesses and injuries and the risk factors associated with them.

OVERALL FREQUENCIES AND RATES OF INJURY, ILLNESS, AND DEATH

The Bureau of Labor Statistics (BLS) uses data from the Current Population Survey of the Bureau of the Census to gather information on the labor force.¹² According to the Current Population Survey, in 1999 there were approximately 5,117,000 workers employed in hospitals and 6,529,000 employed in health services other than hospitals. The total number of 11,646,000 workers represented 8.7% of employed persons in the United States aged 16 and over.¹¹

The BLS also collects reports of fatal and nonfatal injuries among US workers. The Survey of Occupational Injuries and Illnesses is a federal/state program in which employer reports are collected from about 169,000 private industry establishments and processed by state agencies cooperating with the Bureau of Labor Statistics.¹⁹ These data allow comparisons between rates of reported injury and illness in different industries. Table 2 shows the categories of workplaces included under Standard Industrial Classification 80, Health Services.²⁰ Examples of the illnesses listed in the table according to the BLS include the following:

Occupational skin diseases or disorders: contact dermatitis, eczema, or rash caused by primary irritants and sensitizers or poisonous plants, oil acne, chrome ulcers, chemical burns or inflammations

Table 2. INCIDENCE RATES (PER 10,000 FULL-TIME WORKERS) OF NONFATAL ILLNESSES IN HEALTH SERVICES, ALL PRIVATE INDUSTRY, AND ALL SERVICES, 1998

Industry	SIC Code	Total Cases	Skin Disease or Disorders	Dust Diseases of the Lungs	Respiratory Conditions Caused by Toxic Agents	Poisoning	Disorders Caused by Physical Agents	Disorders Associated with Repeated Trauma	All Other Occupational Illnesses
All health services	80	51.3	14.5	.3	3.6	.4	1.3	15.2	15.9
Offices and clinics of medical doctors	801	37.5	1.6	.3	4.4	.5	.5	19.9	10.3
Offices and clinics of dentists	802	12.4	5.6	*	*	*	0.1	6.7	*
Offices of osteopathic physicians	803	59.0	55.8	*	*	*	1.6	1.6	*
Offices of other health practitioners	804	7.7	.6	.3	.2	0	0	6.3	.3
Nursing and personal care facilities	805	38.2	14.8	0	1.7	.2	.9	6.5	14.1
Hospitals	806	79.0	24.7	.6	5.5	.5	2.3	20.6	24.9
Medical and dental laboratories	807	48.6	4.4	.4	2.0	*	4.3	33.0	4.4
Home health care services	808	42.6	12.5	.3	3.5	.8	.7	5.6	19.2
Health and allied services, not elsewhere classified	809	25.8	9.0	*	.9	1.5	.1	6.2	8.1
All private industry		44.2	6.0	0.2	2.0	0.5	1.9	28.5	5.1
All services		27.2	6.7	0.2	1.9	0.3	1.0	10.2	6.8

* Incidence rate less than 0.05.

Adapted from Bureau of Labor Statistics: Nonfatal occupational illness incidence rates by industry and category of illness, 1998. Washington, DC, Department of Labor, Bureau of Labor Statistics, January 2000. Available at: <http://www.bls.gov/special.requests/ocwc/oshwc/osh/os/ostb0766.pdf>. Accessed May 1, 2000.

SIC = Standard Industrial Classification.

Dust diseases of the lungs (pneumoconioses): silicosis, asbestosis and other asbestos-related diseases, coal workers' pneumoconiosis, byssinosis, siderosis, and other pneumoconioses

Respiratory conditions caused by toxic agents: pneumonitis, pharyngitis, rhinitis or acute congestion caused by chemicals, dusts, gases, or fumes, farmer's lung

Poisoning (systemic effects of toxic materials): poisoning by lead, mercury, cadmium, arsenic, or other metals; carbon monoxide, hydrogen sulfide, or other gases; benzol, carbon tetrachloride, or other organic solvents; insecticide sprays such as parathion and lead arsenate; other chemicals such as formaldehyde, plastics, and resins

Disorders caused by physical agents (other than toxic materials): heatstroke, sunstroke, heat exhaustion, and other effects of environmental heat; freezing, frostbite, and effects of ionizing radiation (isotopes, radiographs, radium); effects of nonionizing radiation (welding flash, ultraviolet rays, microwaves, sunburn)

Disorders associated with repeated trauma: conditions caused by repeated motion, vibration, or pressure such as carpal tunnel syndrome, noise-induced hearing loss; synovitis, tenosynovitis, and bursitis, Raynaud's phenomena

Health care is considered a "clean" industry, but when compared with other workers, health care workers are at a surprisingly high risk of injury and illness. An estimated 606,000 cases of worker injury or illness were incurred by health services employees in 1998 with an incidence rate of 7.7 injuries or illnesses per 100 full-time workers. This finding is higher than the overall rate of 5.2 injuries or illnesses per 100 full-time workers in all service industries (including health care) and is higher than the rate for private industry in general (6.7 per 100 full-time workers). It approaches the rate of 7.9 injuries or illnesses per 100 workers seen in agriculture, forestry, and fishing.^{15, 22}

Of the 606,000 cases, 279,700 involved days away from work, days of restricted work activity, or both. The rate of such cases, 3.6 cases per 100 full-time workers, exceeded that for all service industries (2.4 cases per 100 full-time workers) and private industry (3.1 cases per 100 full-time workers).^{15, 22}

The great majority (566,200, or 93%) of the 606,000 were cases of injury defined as "any injury such as a cut, fracture, sprain, amputation, etc., which results from a work-related event or from a single instantaneous exposure in the work environment."^{14, 22} This resulted in an injury rate of 7.2 injury cases per 100 full-time workers, again higher than rates for all service industries or for all private industry.¹⁵

The BLS definition of illness includes infectious diseases, skin disorders, pneumoconioses, poisoning, disorders caused by physical agents (heat, cold, radiation), and diseases resulting from repeated trauma.¹⁴ In 1998, survey data indicated that health care workers in these settings incurred 51.3 non-fatal illnesses per 10,000 full-time workers. Table 2 provides further breakdown of types of illnesses stratified by specific type of

health care workplace.²⁰ Incidence rates represent the number of illnesses per 10,000 full-time workers and were calculated as:

$$(N/EH) \times 20,000,000$$

In the equation, *N* represents the number of illnesses, *EH* equals the total hours worked by all employees during the calendar year, and 20,000,000 is the base for 10,000 equivalent full-time workers working 40 hours per week and 50 weeks per year. These figures should be viewed with caution, as BLS data in general may severely underestimate the incidence of occupational illnesses.⁴⁴ Although absolute numbers may be low, the comparisons between industries are valid unless there are systematic reporting differences among industries.

Occupational fatalities are the least frequent injuries among health care workers. They are tabulated by the BLS in the Census of Fatal Occupational Injuries, which uses diverse state and federal data sources to identify, verify, and profile fatal work injuries.¹⁴ Table 3 shows the reported numbers of occupational fatalities among health care workers in 1998.¹⁸

INFECTIOUS DISEASES

Occupational infections are the most-studied occupational hazards of health care workers. Concerns have focused on occupational infections with bloodborne pathogens, notably HIV, hepatitis B and C, and airborne infection with tuberculosis.

HIV

Through June 1999, the CDC was aware of 56 cases in the United States of documented occupationally acquired HIV infection or AIDS among health care workers, defined as persons, including students and trainees, who have worked in a health care, clinical, or HIV laboratory setting at any time since 1978. Health care workers were considered to have documented infection if their HIV seroconversion occurred after an occupational exposure or if they had other laboratory evidence of occupational infection. Of these 56 workers, 49 had percutaneous exposure, five had mucocutaneous exposure, two had both percutaneous and mucocutaneous exposures, and one had an unknown route of exposure. Forty-nine exposures were to blood from an HIV-infected person, one to visibly bloody fluid, one to an unspecified fluid, and three to concentrated virus in a laboratory. Twenty-five of these infected health care workers were known to have developed AIDS.²⁴

The CDC also was aware of 138 additional cases of possible occupationally acquired HIV infection or AIDS. These health care workers have been investigated and are without identifiable behavioral or transfusion risks. Each reported percutaneous or mucocutaneous occupational exposures to blood or body fluids or laboratory solutions containing HIV, but HIV seroconversion specifically resulting from an occupational exposure was not documented.²⁴

Table 3. NUMBER AND PERCENTAGE OF FATAL OCCUPATIONAL INJURIES IN HEALTH SERVICES BY EVENT OR EXPOSURE IN HEALTH SERVICES, ALL PRIVATE INDUSTRY, AND ALL SERVICES BY EVENT OR EXPOSURE, 1998*

Industry	SIC Code	Total Fatalities (#)	Event or Exposure (%)					
			Transportation Incidents [†]	Assaults and Violent Acts [‡]	Contact with Objects and Equipment	Falls	Exposure to Harmful Substances or Environments	Fires and Explosions
Health services	80	64	43.8	31.2	—	10.9	9.4	—
Offices and clinics of medical doctors	801	13	38.5	38.5	—	—	—	—
Hospitals	806	23	30.4	34.8	—	13.0	17.4	—
General medical and surgical hospitals	8062	21	28.6	38.1	—	14.3	14.3	—
Home health care services	808	16	75.0	18.8	—	—	—	—
Health and allied services not elsewhere classified	809	3	100.0	—	—	—	—	—
All private industry		5428	42.1	15.2	16.8	12.5	9.9	3.3
All services		757	41.9	25.6	9.6	9.2	9.5	3.4

* Dashes indicate no data reported or data that do not meet BLS publication criteria.

[†] Includes highway, nonhighway, air, water, and rail fatalities.

[‡] Includes violence by persons, self-inflicted injury, and assaults by animals.

Adapted from Bureau of Labor Statistics: National Census of Fatal Occupational Injuries, 1998. Washington, DC, Department of Labor, Bureau of Labor Statistics, August 4, 1999. Available at: <http://www.bls.gov/special.requests/ocwc/oshwc/cfoi/cfnr0005.pdf>. Accessed May 1, 2000.

SIC = Standard Industrial Classification.

Surveillance of occupational HIV transmission is passive and probably does not reflect all cases of transmission. Cases can be difficult to document, especially if exposures are not reported at the time of occurrence, and under-reporting of percutaneous injuries is common.⁶ To detect previously unreported or unsuspected HIV infection in health care workers, investigators have conducted cross-sectional seroprevalence surveys among orthopedic surgeons, other physicians, health care worker blood donors, and dentists. These studies have not found a high rate of previously undetected or unsuspected HIV infection.²⁷

Two publications have summarized the published international incidence of occupationally acquired HIV infection among health care workers.^{31,34} They report, respectively, 94 and 95 cases of documented infection and 170 and 191 possible cases. Notably absent are reports from areas of increasing HIV prevalence such as Southeast Asia and the Indian subcontinent, implying that these totals probably reflect varying degrees of under-reporting from different parts of the world.

Hepatitis B

In 1989, the CDC estimated that approximately 12,000 health care workers whose jobs entailed exposure to blood were newly infected with the hepatitis B virus (HBV) every year. The CDC further estimated that 500 to 600 of those infected workers were hospitalized as a result of that infection, and 700 to 1200 of those infected became HBV carriers. Of the infected workers, an approximate estimate of 250 would die (12–15 from fulminant hepatitis, 170–200 from cirrhosis, and 40–50 from liver cancer). Studies indicated that 10% to 30% of health care or dental workers showed serologic evidence of past or present HBV infection.²³

In 1991, the Occupational Safety and Health Administration (OSHA) issued its Bloodborne Pathogens Standard. The standard compelled employers to offer hepatitis B vaccine at no charge to employees with occupational exposure to blood.⁴¹ It resulted in increased acceptance of hepatitis B vaccine among at-risk employees and an increase in the number of employers offering it.¹ Unfortunately, national rates of completed vaccination among health care workers are still suboptimal and are estimated at 71% among nurses and 72% among physicians in 1994 and 1995 surveys.³⁸

Despite the incomplete coverage, since the availability of the vaccine there has been a steady decline in the estimated annual number of health care worker infections with hepatitis B to an estimated 400 cases in 1995. The decline is especially striking when the incidence of new infections in health care workers is compared with that of the US general population. In 1983, the estimated incidence among health care workers was 386 per 100,000, which was more than triple the rate in the general population (122 per 100,000). By 1995 that ratio had more than reversed, and the incidence in health care workers was 9.1 per 100,000 compared with 50 per 100,000 in the general population.³⁸ This change is a dramatic improvement and is probably a result of the use of universal precautions (now

standard precautions) and immunization; however, the incomplete rates of immunization show that there is still work to be done.

Hepatitis C

Hepatitis C infection is the most common bloodborne infection in the United States and is an important cause of acute and chronic viral hepatitis.²⁵ Most (more than 85%) of those patients who become infected develop persistent infection. Chronic hepatitis C develops in 60% to 70% of infected persons, and 10% to 20% of patients with chronic disease may develop cirrhosis and are at increased risk of hepatocellular carcinoma. The prevalence of antibody to hepatitis C virus (HCV) was 1.8% in the Third National Health and Nutrition Examination Survey, a representative sample of noninstitutionalized US civilians conducted from 1988 to 1994. This finding corresponds to an estimated 3.9 million Americans infected with HCV, and the CDC estimated that 8000 to 10,000 deaths each year result from HCV-related liver disease.³

Seroprevalence surveys suggest the prevalence of HCV infection among health care workers, including orthopedic, general, and oral surgeons, is no greater than the general population, averaging 1% to 2%. Published case reports, however, describe health care workers who have become infected with HCV after an occupational exposure. One study of risk factors for HCV infection found that a history of occupational needle-stick injury was associated with HCV infection, although transmission from a blood splash to the conjunctiva also has been reported.^{3,43} A follow-up study of 110 health care workers with needle-stick exposures from patients seropositive for HCV antibody found seroconversion in three (2.7%) of the exposed workers.³⁵ Of the total acute cases of hepatitis C that were reported to the CDC from 1991 to 1995, 4% were among workers with occupational exposure to blood.²

Tuberculosis

Health care workers have long been at risk of tuberculosis, a trend that continued with the resurgence of the disease in the United States with the AIDS epidemic in the 1980s and the subsequent increase in drug-resistant cases. In 1998, there were 18,361 cases of tuberculosis reported to the CDC of which 16,980 (92.5%) had information on the patient's occupation. Of those, 3% of the reported tuberculosis cases occurred among health care workers. The percentage varied by states with some states reporting that none of their cases occurred in health care workers and others reporting up to 6.6%.²⁶ National tuberculosis surveillance data collected by the CDC indicate that the incidence of the disease among health care workers in 1998 was 4.6 per 100,000 compared with a US national rate of 6.8 per 100,000 (A. Curtis, Surveillance and Epidemiology Branch, Division of TB Elimination, National Center for HIV, STD, and TB Prevention (NCHSTP), CDC, 1999, personal communication).²⁶

A CDC-funded tuberculin skin testing (TST) demonstration project from 1995 to 1998 followed 25,659 health care workers at risk of tuberculosis exposure in Colorado, Florida, Massachusetts, Mississippi, New Jersey, Oregon, and the cities of New York, San Diego, and San Francisco. Of the workers followed, 13,597 (53%) were TST-negative at baseline and had at least two follow-up TSTs. TST conversions were identified in 112 of the 13,597 workers for a crude conversion rate of 0.8%.²⁸ These findings may reflect community-acquired and work-related infections. Rates can be considerably higher among certain health occupations, however. A study on tuberculosis infection in a hospital reported that the purified protein derivative tuberculin (PPD) positive rate in medical staff was 10.2% compared with 3.5% in administrative staff.³⁶ Rates of skin test conversion can be particularly high in health care settings with frequent exposure to infectious patients and poor engineering controls with rates ranging from 4% to 77%.¹⁰ Studies of occupational conversion rates, however, must be interpreted with caution. Such studies ideally include two-step skin testing to rule out boosting and comparison with otherwise similar unexposed workers to control for community exposures.

Other Infectious Diseases

Health care workers can be exposed to a variety of other infectious diseases including herpetic whitlow, measles, and meningococcal disease. Exposure and infection with some of these illnesses can be prevented by immunization, and others are prevented through appropriate infection control procedures.⁹ At present there are no national surveillance systems that systematically report the incidence of these diseases among health care workers.

MUSCULOSKELETAL INJURIES

The Bureau of Labor Statistics' reports divide musculoskeletal injuries into disorders associated with repeated trauma and disorders associated with an acute event. Disorders associated with repeated trauma include: conditions caused by repeated motion, vibration, or pressure such as carpal tunnel syndrome; noise-induced hearing loss; synovitis, tenosynovitis, and bursitis; and Raynaud's phenomena.¹⁴ Aside from the inclusion of pressure-related disease and noise-induced hearing loss, most of the disorders occur in the upper extremity and are associated with repeated motion or vibration. As shown in Table 2, the overall incidence of these ailments in health services was 15.2 cases per 10,000 workers, which was lower than the rate of 28.5 cases per 10,000 workers in all surveyed private industry. The highest rates, seen in medical and dental laboratories (33.0 cases per 10,000 workers), hospitals (20.6 cases per 10,000 workers), and offices and clinics of medical doctors (19.9 cases per 10,000 workers) are comparable with the overall industry rate.²⁰

The BLS also reports the 25 industries with the highest nonfatal illness incidence rates of disorders related to repeated trauma and the highest

number of cases of repeated trauma disorders. Hospitals ranked fourth and offices and clinics of medical doctors ranked eleventh in the number of cases reported among private industries surveyed.¹⁶ Because of the large numbers of employees in this sector, however, none of the health services workplace categories ranked among the highest in injury rates.¹⁷

BLS data also give some insight into the nature of the musculoskeletal injury. In 1998, workers in health services incurred 8.2 cases of back pain involving days away from work per 10,000 full time workers, which well exceeds the rate of 4.8 cases per 10,000 full-time workers in all private industry (M. Wald, Bureau of Labor Statistics, Atlanta Regional Office, US Department of Labor, personal communication, June 2000). Other incidence rates appear in Table 4. In general, health services workers show higher rates of various types of sprain and strain injuries and soreness but lower rates of fractures and lacerations compared with the average rates for all private industry workers.

CHEMICAL HAZARDS

Health care workers can be exposed to a variety of chemical hazards depending on their particular job tasks. Examples of exposures include sterilants and disinfectants such as glutaraldehyde, inhaled anesthetics including nitrous oxide, aerosolized pharmaceuticals, and antineoplastic pharmaceuticals. The BLS Survey of Occupational Injuries and Illnesses includes health effects from chemical exposures in several categories depending on the organ systems affected: occupational skin diseases or disorders; respiratory conditions caused by toxic agents; and poisoning (systemic effects of toxic materials). The incidence of reported injuries and illnesses in these categories appear among those listed in Table 2.²⁰ The BLS also provides the number of cases reported, and in these three categories combined there were 14,500 nonfatal cases reported in 1998.²¹

Table 4. INCIDENCE RATES OF SELECTED NONFATAL OCCUPATIONAL INJURIES BY SELECTED WORKER AND CASE CHARACTERISTICS AND INDUSTRY, ALL UNITED STATES, COMPARING ALL PRIVATE INDUSTRY WITH HEALTH SERVICES, 1998*

Injury Type	Private Industry [†]	Health Services [†]
Sprains, strains	85.6	131.3
Fractures	13.0	8.2
Cuts, lacerations, punctures	18.1	6.0
Bruises, contusions	17.3	17.6
Amputations	1.2	—
Carpal tunnel syndrome	3.0	2.9
Tendonitis	1.9	1.8
Soreness, pain	11.5	17.7
Back pain	4.8	8.2

* Dashes indicate no data reported or data that do not meet BLS publication criteria.

[†] Incidence rate in cases involving days away from work per 10,000 full time workers.

Data from M. Wald, Bureau of Labor Statistics, Atlanta Regional Office, US Department of Labor, personal communication, June 2000.

Some surveillance data are available for specific chemical hazards. The National Institute of Occupational Safety and Health (NIOSH) conducts the Sentinel Event Notification System for Occupational Risks (SENSOR), a NIOSH program coordinated with states to develop condition-specific strategies for surveillance of occupational diseases and injuries.⁵ During 1993 to 1995, surveillance for occupational asthma in four participating states found glutaraldehyde to be the most frequently reported cause of work-related asthma for which putative causes were reported, accounting for 19 of 462 (1.7%) of the cases. All 19 cases reportedly were new-onset asthma rather than work-aggravated asthma.³⁰

Other data confirm the association of asthma with health care work. Using cause of death data collected by the National Center for Health Statistics, industries and usual occupations were ranked by the associated asthma proportionate mortality ratio (PMR) of workers who died from 1987 to 1996. The asthma PMR for workers in nursing and personal care facilities was 1.43 times the proportion of deaths caused by asthma in the standard population, and for workers in offices and clinics of physicians, the asthma PMR was 1.39. For employees in health services workplaces not otherwise classified, the asthma PMR of 1.60 was the second highest reported. Of specific usual occupations examined, higher than expected PMRs were found for occupational therapists (3.66), respiratory therapists (2.66), health aides other than nursing (1.98), clinical laboratory technologists and technicians (1.71), nursing aides, orderlies, and attendants (1.66), health technologists and technicians (1.55), registered nurses (1.50), health and medical managers (1.49), and licensed practical nurses (1.45). Unfortunately, the exposures associated with their jobs cannot be determined from this data, limiting the inferences that can be made.²⁹

IONIZING RADIATION

Despite the wide use of ionizing radiation sources in health care for diagnosis and therapy, summary data on occupational exposures to ionizing radiation among health care workers are difficult to find. A 1990 review article relied heavily on a 1984 report from the Environmental Protection Agency.³³ A Medline search in June 2000 did not find any more recent articles reviewing ionizing radiation exposures of health care workers as a general occupational group.

The 1990 report, using 1980 data, estimated that 584,000 workers were employed in hospitals, clinics, private offices, and dental, podiatric, chiropractic, and veterinary clinics where ionizing radiation was used. Of these workers, 306,000 were categorized as "potentially" exposed because, despite potential occupational exposure, they received less than detectable exposures. In contrast, 276,000 workers received a measurable dose during some monitoring period in the year. Hospitals, private practice settings, and dental offices contributed the largest number of occupationally exposed workers. These three groups also contributed the largest fraction of the collective radiation exposure of the 276,000 workers. The mean annual whole-body dose of the exposed dental workers was substantially less than

that of exposed hospital and private practice workers. The exposures were strongly skewed toward low doses with 88% of workers receiving less than 1 mSv per year (the adult annual occupational exposure limit is 50 mSv per year).⁴⁰ The authors noted that collective exposures fell consistently over the time period examined (1965–1980).³³

LATEX ALLERGY

It is ironic that the increasing use of an occupational health protective strategy, latex gloves for universal precautions, has been accompanied by increasing reports of the adverse effects of allergy to natural rubber latex. True latex allergy is a reaction to heat and water-soluble proteins in rubber derived from the tree *Hevea brasiliensis* and is mediated by immunoglobulin E (IgE) antibodies. Antibody-mediated latex allergy must be differentiated from local reactions to chemical accelerants or antioxidants added to gloves during manufacturing.⁹

The prevalence of health care workers with IgE-mediated latex allergy varies from 8% to 12% of regularly exposed workers with the variation probably resulting from differing study groups and differing case definitions. By contrast, prevalence rates in the general population usually have ranged from 1% to 6%.⁷ Different assays of antilatelatex IgE may have different sensitivities and specificities and in turn may yield different estimates from skin-prick testing. These differences in testing methods used to estimate rates of sensitization or allergy and in the personnel groups studied may account for the wide range in prevalence estimates.⁹

WORKPLACE VIOLENCE

Despite their role as helping professionals, health care workers are at risk for injury and death from workplace violence. Many, if not most, categories of health care workers are at risk. Victims of work-related homicide, for example, have included pharmacists, physicians, registered nurses, nurses aides, dentists, technicians, medical records staff, aides, therapists, and optometrists.³² Violence is also a hazard to emergency medical workers who provide prehospital care and to staff working in the emergency room.^{8,37} The BLS survey reports the incidence of nonfatal injuries involving one or more days away from work as a result of assaults by another person. The BLS reported that in 1998, health care workers were victims of such assaults at a rate of 9.9 cases per 10,000 workers. This finding is almost five times the private industry rate of 2.0 cases per 10,000 workers (M. Wald, Bureau of Labor Statistics, Atlanta Regional Office, US Department of Labor, personal communication, June 2000).

Data on occupational homicides are reported through the Census of Fatal Occupational Injuries. Of 64 occupational fatalities in health services reported in 1998, 26.6% (17 deaths) were by homicide, which is more than double the 11.3% of occupational deaths caused by homicide in all private industry.¹³

FUTURE OF HEALTH CARE WORKER EPIDEMIOLOGY

This article has noted several times that the epidemiologic data regarding health care worker injury and illness, especially cause-specific data, are incomplete. This situation is improving, however. In November 1999, OSHA issued a Compliance Directive which stated that "[f]or recordkeeping purposes, an occupational bloodborne pathogens exposure incident (e.g., needle-stick, laceration, or splash) should be classified as an injury since it is usually the result of an instantaneous event or exposure."⁴² OSHA also has proposed a requirement in the revised recordkeeping rule that all injuries resulting from contaminated needles and sharps be recorded on the employer's OSHA logs to record injuries and illnesses. These steps will improve the ability of BLS data to capture occupational exposures to bloodborne pathogens.

As previously noted, however, bloodborne pathogens are only one of the categories of hazards to health care workers, and a broad surveillance system is needed to describe many of them. This system is being developed by the CDC. The National Surveillance System for Health Care Workers (NaSH) will collect exposure, infection, and denominator data from a national sample of participating hospitals. NaSH data on worker injuries and illnesses are collected through employee health and infection control records. At present, NaSH is a joint research project of the CDC's NIOSH, National Center for Infectious Diseases, National Center for HIV, STD, and TB Prevention, and National Immunization Program.³⁹ Sixty hospitals from 27 states currently are participating with the CDC in the development of NaSH.⁴ In its initial development, NaSH focused on occupational infectious diseases, but future plans include broadening to occupational traumatic injuries and injuries and illnesses from noninfectious causes. NaSH will also collect data on the circumstances of the exposure. By yielding national data, the NaSH system provides a better understanding of the magnitude of health care worker illness and injury and thereby guides strategic planning for prevention.

SUMMARY

Data from surveillance systems for illness, injury, and employment operated by the CDC and BLS are reviewed and discussed. Approximately 606,000 of 11,646,000 health care workers reported injuries or illnesses resulting in lost time or restricted activity in 1998 (7.7 per 100 full-time workers) of which 566,200 or 93% were injuries. Sixty-four occupational fatalities in health services were reported in 1998, including 17 (26%) by homicide. The overall incidence of diseases associated with repeated trauma was 15.2 cases per 10,000 health care workers. Nationally reported infectious diseases that occur among health care workers include HIV (55 documented and 136 possible cases reported through June 1999), hepatitis B (an estimated 400 cases in 1995 with the rate declining), and tuberculosis (approximately 500 cases reported in 1998). Illnesses resulting from other

infectious diseases and from chemical exposures are reported less commonly and probably are under-reported. New data collection systems are being devised.

CONCLUSION

Health care workers are exposed to a wide variety of occupational hazards. In some categories of injury and illness, health care workers incur rates that exceed other service industries and are comparable with those rates of workers in some of the most dangerous trades in private industry. These rates are not equally distributed across all types of hazards, however, and those hazards associated with the highest rates may present the most pressing need for prevention strategies to reduce the incidence of illness or injury. Other articles in this issue identify some of those strategies.

Efforts to prevent illness or injury in any workplace depend on accurate data to identify needs and successes. For this reason, collection of reliable data on injury and illness must be another occupational safety and health priority in the health care workplace. New data collection systems will yield information that can be used to reduce health care worker risk for injury or illness.

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