Occupational safety and health

Work-related hospitalizations in Massachusetts: racial/ethnic differences

Hospital discharge data are an important supplementary means of examining occupational health; researchers can use such data to assess disparities among racial and ethnic groups at the State level

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In Massachusetts, as in the United States as a whole, the fatal occupational injury rate for Hispanic workers (3.3 per 100,000 workers per year) is higher than that for white workers (2.2 per 100,000 workers per year).[1] Although some information about the risk of nonfatal occupational injuries among racial and ethnic groups is available nationally,[2] data for Massachusetts are limited. The workers' compensation data set maintained by the Massachusetts Department of Industrial Accidents does not include information about workers' race and ethnicity. By contrast, race and ethnicity information is a data element in the Bureau of Labor Statistics (BLS) Survey of Occupational Injuries and Illnesses,[3] but it is only an optional feature there, and it is missing from more than 25 percent of the cases reported in the Massachusetts BLS survey.[4] This article reports on the use of statewide hospital discharge data to describe patterns of serious occupational injuries (that is, injuries requiring hospitalization) among racial and ethnic groups in Massachusetts.

Methods

In Massachusetts, discharge records from all acute-care nongovernment hospitals[5] are collected quarterly by the Massachusetts Division of Health Care Finance and Policy, as mandated by regulation.[6] The records are then compiled into the annual Hospital Discharge Data set. Each discharge record contains information about patient demographics, including age, gender, race/Hispanic ethnicity, and zip code of residence; administrative information, including hospital charges and expected source of payment; and clinical information, including primary and up to 14 supplementary diagnoses, length of stay, and procedures administered during the hospitalization. Race and Hispanic ethnicity in this data set are mutually exclusive categories: individuals are classified as white, black, Asian, American Indian, Hispanic, and other or unknown. Race/ethnicity information may be collected upon admission or through health-care provider notes in the medical record and may be based on either observation of the patient or the patient's self-report. Diagnoses are coded according to the *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*).[7] Acute poisonings are classified as injuries in this system.

For the study presented in this article, the Massachusetts Hospital Discharge Data for calendar years 1996–2000 were examined; hospital inpatient stay (also referred to as hospitalization) was the basic unit of analysis. Hospitalizations of out-of-State residents at Massachusetts hospitals were excluded. Hospitalizations with a primary ICD-9 diagnosis code between 800 and 999 were considered hospitalizations for injury. Because this data

set contained no specific coding for work-relatedness of health conditions for which patients were hospitalized, the designation of workers' compensation as primary expected payer was used as a probable indicator of hospitalizations for work-related injuries.[8] The nature of the patient's injury was classified according to the Barell Injury Diagnosis Matrix, which is based on the ICD-9-CM.[9]

Rates of hospitalization for work-related injuries overall and for specific work-related injuries were computed for Asians, blacks, Hispanics, and whites. Rates were calculated as the average annual number of hospitalizations for work-related injuries, divided by the average annual number of labor force participants in Massachusetts, for the 5-year study period. Data on the numbers of workers in the labor force and occupations by race/ethnicity were obtained from the Current Population Survey (CPS) for calendar years 1996 through 2000.[10] Because self-employed workers were not eligible for workers' compensation during the study period, the self-employed were excluded from the denominators in calculating rates. Rate ratios for each racial/ethnic group were computed, with whites as the referent. Differences between rates were examined with a two-sided *z*-test at the 0.05 level of significance. Ninety-five-percent confidence intervals for rate ratios (RR) were calculated as $\exp((\ln(RR) \pm 1.96 \times \ln(SD))$. All statistical analyses were performed with SAS version 9.1.[11]

Results

From 1996 through 2000, workers' compensation insurance was the expected payer for 7,875 hospitalizations for treatment of injuries in Massachusetts. These work-related hospitalizations accounted for 7.9 percent of all injury-related hospitalizations in Massachusetts among working-age adults (16–64 years of age) during that period. The mean length of a hospital stay for a work-related injury was 4.3 days. The mean hospital charges per stay ranged from a high of $43,176 for work-related burns to a low of $5,149 for superficial injuries and contusions. The total dollar charges for all work-related injury hospitalizations in Massachusetts during those 5 years were $123,185,709.

Of the 7,875 hospitalizations for work-related injuries, 83 percent (6,551) were classified by the nature of the injury. The remaining 17 percent were classified as "adverse effects not elsewhere classified" or as "complications of surgical and medical care, not elsewhere classified" (ICD-9 codes 995–999). Among hospitalizations for work-related injuries classified by nature of injury, fractures were the most common (50.3 percent), followed by sprains and strains (14.1 percent) and open wounds (7.8 percent). Nearly three-quarters of these injuries involved the patients' lower (38.9 percent) or upper (33.0 percent) extremities, 8.9 percent involved the torso, and 5.6 percent were traumatic brain injuries.

Race/ethnicity information was available for 94 percent of the patients hospitalized for work-related injuries. The distribution of hospitalizations by nature of injury differed considerably among racial/ethnic groups. (See table 1.) Hispanic patients were more likely than white patients to have been hospitalized for treatment of open wounds, burns, amputations, and crushing injuries. Asian patients experienced proportionately more burns and amputations than did whites. Black patients were more likely to have sprains and strains than were any other racial/ethnic group.

Table 2 presents the average annual rates of hospitalization for work-related injuries by race/ethnicity. The hospitalization rates for all work-related injuries combined varied considerably across racial/ethnic groups, with a twofold difference observed between Hispanics and Asians. The hospitalization rates for specific work-related injuries

Table 1. Percent distribution of hospitalizations for work-related injuries and poisonings, by nature of injury and racial/ethnic group, Massachusetts, 1996–2000

[In percent]

Nature of injury[1]	Total	Asian	Black	Hispanic	White
N	6,551	106	308	396	5,271
Fractures	50.3	43.4	43.2	40.4	52.0
Sprains and strains	14.1	2.8	23.4	7.1	14.7
Open wounds	7.8	5.7	6.2	11.1	6.9
Internal organ	7.2	9.4	5.8	7.1	7.2
Burns	5.8	19.8	4.5	14.6	4.9
Amputations	3.7	6.6	6.2	8.3	3.1
Systemwide/late effects	3.0	3.8	2.3	2.5	3.1
Dislocation	2.2	4.7	2.3	2.0	2.2
Crushing	2.0	2.8	1.6	3.8	1.9
Superficial/contusions	1.5	.9	1.0	1.3	1.6
Nerves	1.0	.0	2.3	.5	1.0
Unspecified	.7	.0	1.0	.8	.7
Blood vessels	.6	.0	.3	.5	.6

[1] An additional 1,324 injury and poisoning cases had nature-of-injury codes of "certain adverse effects, not elsewhere classified" (ICD-9-CM code 995) or "complications of surgical and medical care, not elsewhere classified" (ICD-9-CM codes 996–999) and could not be classified into any of the categories listed in the table.

Table 2. Hospitalization rate for work-related injuries, by nature of injury and racial/ethnic group, Massachusetts, 1996–2000

Nature of injury	Asian	Black	Hispanic	White
All injuries	[1]26.7	38.2	[2]54.8	39.0
Fractures	[1]11.6	[1]16.5	[2]22.1	20.3
Sprains and strains	[1].8	[2]8.9	3.9	5.7
Open wounds	[1]1.5	2.4	[2]6.1	2.7
Internal organs	2.5	2.2	3.9	2.8
Burns	[2]5.3	1.7	[2]8.0	1.9
Amputations	1.8	2.4	[2]4.6	1.2
Systemwide/late effects	([3])	.9	1.4	1.2
Dislocations	1.3	.9	1.1	.9
Crushing	([3])	.6	2.0	.7
Superficial/contusions	([3])	([3])	.7	.6
Nerves	([3])	.9	([3])	.4
Unspecified	([3])	.4	([3])	.3
Blood vessels	([3])	([3])	.3	.2

[1] Injury rate is significantly less than rate for whites ($p < 0.05$).
[2] Injury rate is significantly greater than rate for whites ($p < 0.05$).
[3] Numerator for this stratum is less than 5.

NOTE: Hospitalization rate = (average annual number of work-related injuries ÷ average annual number participating in labor force) × 100,000.

varied even more across racial/ethnic groups. Hispanics showed significantly higher hospitalization rates than whites in four nature-of-injury categories, accounting for nearly 75 percent of all work-related injuries among Hispanics: burns (RR(95-percent confidence interval) = 4.2 (3.2, 5.6)),[12] amputations (RR = 3.8 (2.6, 5.5)), crushing injuries (RR = 2.9 (1.7, 4.9)), and open wounds (RR = 2.2 (1.6, 3.1)). Hispanics had a significantly lower rate of hospitalization than whites for work-related sprains and strains (RR = 0.7 (0.5, 0.98)). Asians had a significantly elevated hospitalization rate for work-related burns (RR = 2.8(1.8, 4.4)) and significantly decreased rates for fractures (RR = 0.6 (0.4, 0.8)) and for sprains and strains (RR = 0.1 (0.04, 0.4)), compared with whites. Black workers had significantly higher hospitalization rates than white workers for work-related amputations (RR = 1.9 (1.2, 3.1)) and for sprains and strains (RR = 1.6 (1.2, 2.0)) and a significantly lower risk of hospitalization for work-related fractures (RR = 0.81 (0.7, 0.97)).

CPS data were used to examine the occupational distribution of the Massachusetts workforce by race and ethnicity. The 10 most frequent occupations for each of the racial/ethnic groups considered in this article are listed in exhibit 1. Among the most common occupations shown for Asians, Blacks, and Hispanics were a number that exhibit a high likelihood of incurring the types of injuries that show elevated risks of hospitalizations for these worker populations in the Hospital Discharge Data. For example, the category of nursing aides, orderlies, and attendants, an occupation at high risk for sprain and strain injuries, was the most common occupation among blacks. High rates of hospitalization for work-related burns among both Asians and Hispanics were consistent with their relatively common employment as cooks compared with whites. The high rates of work-related amputations observed among black and Hispanic patients was consistent with their relatively common employment as machine operators and laborers in Massachusetts.

Discussion

This analysis of hospital discharge data from Massachusetts suggests that there is substantial variation in rates of serious work-related injuries among racial and ethnic groups and that Hispanic workers, in particular, are at high risk for work-related injuries resulting in hospitalization. Hispanics had significantly higher rates of hospitalization than did whites for all work-related injuries combined, as well as for a number of specific types of injury. Black workers had higher rates of hospitalization for work-related strains and sprains and amputations than did white workers. While Asians had lower rates of hospitalization than whites for work-related injuries overall, they had a significantly higher rate for work-related burns. The findings regarding hospitalization rates for a number of specific injuries were consistent with the employment patterns of racial and ethnic groups in Massachusetts in occupations at high risk for these types of injuries. Further research using additional data sources will be needed to assess the exact relationship between industry-specific risks and hospitalization rates.

In a variety of previous studies, Hispanic workers have been found to have higher rates of fatal occupational injuries than white workers.[13] The findings presented in this article suggest that Hispanic workers also are at higher risk for serious, nonfatal occupational injuries.[14] However, a recent analysis of National Health Information Survey data from 1997 to 1999 found lower rates of all work-related medically

treated injuries for Hispanics, black Non-Hispanics, and the "other" race/ethnicity category than for non-Hispanic whites.[15] These differences in the findings of the two studies may be attributable, at least in part, to the nature of the injuries considered. All medically treated injuries may be disproportionately undercounted in minority and immigrant populations, due to differences in access to care, differences in perceptions of health conditions, fear of discrimination, and concerns about one's legal status that may inhibit reporting of work-related injuries.[16] These barriers to reporting may be less important in cases of work-related injuries serious enough to require hospitalization. Consequently, studies of hospitalization for work-related injuries may provide a more consistent and complete ascertainment of such injuries across the racial/ethnic groups. From an occupational health surveillance standpoint, hospitalizations for work-related injuries may offer a less biased picture of injury risk by race and ethnicity than is afforded by data on all medically treated injuries.

The increased risk of hospitalization for work-related injuries among minority populations likely reflects their disproportionate employment in high-risk industries and occupations.[17] The results of the study presented herein show a correspondence between high rates for certain types of injuries and racial/ethnic group employment in high-risk occupations. However, these results are not fully consistent across the types of injuries and racial/ethnic groups. For example, working as a cook is the fourth most frequent occupation among Massachusetts blacks, yet blacks do not show an elevated rate of burns compared with whites, as do Asian and Hispanics. The association between elevated injury rates, on the one hand, and occupation and industry, on the other, would be better established with industry- and occupation-specific rates; however, information on the occupation and industry of employment of hospitalized patients is not currently available in the Massachusetts Hospital Discharge Data set. In a recent analysis of Massachusetts emergency department data, the name of the employer was found to be available in paper medical records for the great majority of work-related cases (89 percent)[18] and can be included in electronic data sets. This information is likely also readily available in the medical records of hospitalized patients and could be requested for focused studies of injury rates by industry.

Exhibit 1. Ten most frequent occupations, by racial/ethnic group,[1] Massachusetts, 1996–2000

	White	Black	Asian	Hispanic
1	Managers and administrators, n.e.c.	Nursing aides, orderlies, and attendants	Computer systems analysts and scientists	Janitors and cleaners
2	Supervisors and proprietors, sales occupations	Janitors and cleaners	Cooks	Nursing aides, orderlies, and attendants
3	Secretaries	Cashiers	Cashiers	Cooks
4	Registered nurses	Cooks	Managers and administrators, n.e.c.	Miscellaneous machine operators, n.e.c.
5	Cashiers	Guards and police, except public service	Accountants and auditors	Maids and housemen
6	Computer systems analysts and scientists	Maids and housemen	Postsecondary teachers, subject not specified	Cashiers
7	Truckdrivers	Miscellaneous machine operators, n.e.c.	Waiters and waitresses	Miscellaneous food preparation occupations
8	Accountants and auditors	Laborers, except construction	Miscellaneous machine operators, n.e.c.	Assemblers
9	Janitors and cleaners	Registered nurses	Assemblers	Supervisors and proprietors, sales occupations
10	Nursing aides, orderlies, and attendants	Managers and administrators, n.e.c.	Electrical/electronic equipment assemblers	Hand packers and packagers

In the CPS, race and Hispanic ethnicity are not mutually exclusive groups.

SOURCE: Current Population Survey.

NOTE: n.e.c. = not elsewhere classified.

Employment patterns alone do not explain the high risk of serious traumatic injury faced by minority workers. One study found that Hispanic construction workers had high fatal occupational injury rates compared with white workers within the same construction occupations.[19] Another study found high occupational fatality rates among blacks after controlling for employment structure, suggesting that "within-job" factors such as race-based task assignments also may contribute to the disparity in risk.[20] In yet a third study, Hispanic workers and, to a lesser extent, black workers in the South had higher fatal injury rates than non-Hispanic workers in comparable occupations and industries.[21] Other possible explanations for the high rate of hospitalization for work-related injuries among Hispanics include language, literacy, and cultural barriers at work; a comparative lack of information about health and safety rights and resources; and limited job opportunities and concerns about their immigrant status that make minority and immigrant workers hesitant to exercise their rights. Also, employers may be less likely to provide training and protective equipment for temporary or undocumented workers.

One limitation in using the Hospital Discharge Data to study occupational injury is that there are no specific variables that directly indicate the work-relatedness of a patient's injury. Thus, the work-relatedness of various conditions must be inferred indirectly from whether workers' compensation insurance is the expected payer. Several studies have demonstrated that the designation of workers' compensation payment on hospital records is a good indicator of the work-relatedness of an injury. In one study, the designation of workers' compensation as expected payer was both a highly sensitive (84 percent) and a highly specific (98 percent) indicator of work-relatedness in an investigation of hospitalized occupational injuries.[22] A recent assessment of emergency department data in Massachusetts found nearly identical results.[23] Thus, reliance on payment by workers' compensation likely yields a reasonable, but conservative, estimate of work-related hospitalizations.

Among self-employed workers, who make up about 10 percent of the Massachusetts workforce, most are not eligible for workers' compensation insurance, so injuries to self-employed workers are unlikely to be detected by that indicator. There is also considerable evidence that many workers with traumatic injuries who are eligible for workers' compensation do not apply for benefits.[24] Patients' willingness to report their injuries as work related and to apply for workers' compensation is affected by a wide range of social and economic factors, including the availability of other health insurance, the possibility of barriers to applying for compensation, fear of discrimination by current or future employers because of one's workers' compensation history, the person's legal or illegal employment status and immigration status, and the individual's personal relationship with the employer. While some of these barriers may be less important in cases of work-related injuries severe enough to require hospitalization, the fear of discrimination, concerns about one's legal status, and the unavailability of workers' compensation insurance may be more prominent among the minority populations examined in this article. Many immigrants and minorities in low-paying jobs work for employers who might not carry workers' compensation insurance or who might not want employees to submit claims. Payment for these hospitalizations might be shifted to the employees' personal health insurance (if available and if such hospitalizations are covered) or to Medicaid, or the hospitalizations might be covered under the State's free-care pool.[25]

In addition, a recent survey of more than 1,400 community health center patients in Massachusetts found that minorities and immigrant workers were less aware of their rights to workers' compensation insurance than were white workers and native-born workers. Consequently, the minority and immigrant workers may file disproportionately fewer claims for benefits. Hispanic and Asian workers were the most likely to have never heard of workers' compensation (49 percent and 48 percent, respectively), compared with black workers (36 percent) and white workers (21 percent).[26]

Another limitation of this analysis involves the difference in categorization of race/ethnicity in the data sources for the numerators and denominators used to calculate rates. As mentioned in the "Methods" section, race and Hispanic ethnicity are mutually exclusive in the Hospital Discharge Data. By contrast, in the CPS, race and Hispanic ethnicity are not mutually exclusive, and thus the racial/ethnic group denominators count some members of the labor force twice (for example, once as Hispanic and once as Black). This disparity could lead to underestimates of the rates of hospitalization for injury among racial/ethnic groups. However, there may be a countervailing undercount in the CPS: minority racial/ethnic groups may be disproportionately excluded from the survey due to language barriers, fewer telephones, or higher refusal rates than whites.

A number of reports have raised concerns about the validity of race and ethnicity information in health-care data.[27] A study of hospital data from the Department of Veterans Affairs found that agreement of administrative race/ethnicity data with self-identified race/ethnicity reports ranged from 75 percent to more than 90 percent, with agreement being higher for whites and blacks and lower for Hispanics and Asians, who were classified into an administrative "other" race/ethnicity category.[28] Similarly, a study in two community health clinics found agreement between administrative data and self-reports of 83 percent for blacks and 94 percent for Hispanics on responses to open-ended race/ethnicity ques-

tions and of 67 percent for blacks and 77 percent for Hispanics on forced-choice race/ethnicity questions.[29] The race and ethnicity information in the Massachusetts Hospital Discharge Data, while notably complete, has not been independently validated. An evaluation of birth registration race/ethnicity information for newborns and mothers has shown good agreement between birth-certificate fetal-death data and the Massachusetts Hospital Discharge data set,[30] but the extent to which the agreement extends to hospitalizations for other conditions is not known. Also, the accuracy of reporting of this information may vary by hospital. Research that validates such information is needed. Ongoing efforts to standardize the collection of race and ethnicity data by medical registrars should improve the validity and reliability of these data in the future.[31]

The findings presented in this article underscore the importance of research and intervention to address the occupational health needs of minority and immigrant workers, as well as the importance of maintaining a special emphasis on these populations.[32] Hospital discharge data, which are available in most States, are an important supplementary means of examining occupational health and can be effective in assessing disparities in serious occupational injuries among racial and ethnic groups at the State level. Although it remains to be validated, the race and ethnicity information in the Massachusetts Hospital Discharge data set is more complete than information from other sources on nonfatal work-related injuries. Further, hospital discharge data may be less subject to some of the barriers that limit the capture of information on work-related injuries in other data sets. □

Notes

[1] See *Fatal Occupational Injuries in Massachusetts, 1991–1999* (Massachusetts Department of Health, September 2002); Scott Richardson, John Ruser, and Peggy Suarez, "Hispanic Workers in the United States: An Analysis of Employment Distributions, Fatal Occupational Injury Data, and Non-fatal Occupational Injury and Illnesses," in *Safety Is* Seguridad (Washington, DC, National Research Council of the National Academies, 2003); and Xiuwen Dong and James W. Platner, "Occupational Fatalities of Hispanic Construction Workers from 1992 to 2000," *American Journal of Industrial Medicine*, January 2004, pp. 45–54.

[2] See Allard E. Dembe, Judith A. Savageau, Benjamin C. Amick, III, and Steven M. Banks, "Racial and Ethnic Variations in Office-Based Medical Care for Work-Related Injuries and Illnesses," *Journal of the National Medical Association*, April 2005, pp. 498–507; Allard E. Dembe, "Access to Medical Care for Occupational Disorders: Difficulties and Disparities," *Journal of Health and Social Policy*, December 2001, pp. 19–33; and Gordon S. Smith, Helen M. Wellman, Gary S. Sorock, Margaret Warner, Theodore K. Courtney, Glenn S. Pransky, and Lois A. Fingerhut, "Injuries at Work in the U.S. Adult Population: Contributions to the Total Injury Burden, "*American Journal of Public Health*, July 2005, pp. 1213–19.

[3] Richardson, Ruser, and Suarez, "Hispanic Workers in the United States."

[4] Massachusetts Survey of Occupational Injuries and Illnesses, 1997–2003.

[5] The number of hospitals reporting varies over time due to mergers and reorganizations. During the period of the study, between 80 and 87 hospitals reported data.

[6] Code of Massachusetts Regulations, 114.1CMR 17.00, Requirement for the Submission of Hospital Case Mix and Charge Data.

[7] *International Classification of Diseases, Ninth Revision, Clinical Modifications (ICD-9-CM)* (Geneva, World Health Organization, 1979).

[8] Some hospitals reported no workers' compensation cases for 1 or more calendar years during the study period. The annual admission reports from hospitals reporting no workers' compensation cases for the year accounted for 3 percent of all admissions and 3.5 percent of admissions for injury for working-age adults (16 through 64 years) over the surveillance period.

[9] Vita Barell, Limor Aharonson-Daniel, Lois A. Fingerhut, Ellen J. Mackenzie, Arnona Ziv, Valentina Boyko, Avi Abargel, Malka Avitzour, and Rafael-Joseph Heruti, "An Introduction to the Barell Body Region by Nature of Injury Diagnosis Matrix," *Injury Prevention*, June 2002, pp. 91–96.

[10] The CPS is a national monthly survey of approximately 60,000 households conducted by the Bureau of the Census for the Bureau of Labor Statistics. This monthly survey of the population uses a sample of households that is designed to represent the civilian noninstitutional population of the United States.

[11] SAS Institute, Cary, NC.

[12] The ordered pair denotes the lower and upper 95-percent confidence limits of the relative risk.

[13] See, for example, Richardson, Ruser, and Suarez, "Hispanic Workers in the United States"; and Dong and Platner, "Occupational Fatalities of Hispanic Construction Workers."

[14] See Richardson, Ruser, and Suarez, "Hispanic Workers in the United States"; Gary S. Sorock, Elaine Smith, and Nancy Hall, "Hospitalized Occupational Finger Amputations, New Jersey, 1985 and 1986," *American Journal of Industrial Medicine*, March 1993, pp. 439–47; and Judith T. L. Anderson, Katherine L. Hunting, and Laura S. Welch, "Injury and Employment Patterns among Hispanic Construction Workers," *Journal of Occupational and Environmental Medicine*, February 2000, pp. 176–86.

[15] Smith, Wellman, Sorock, Warner, Courtney, Pransky, and Fingerhut, "Injuries at Work in the U.S. Adult Population."

[16] Lenore S. Azaroff, Charles Levenstein, and David H. Wegman, "Occupational Injury and Illness Surveillance: Conceptual Filters Explain Underreporting," *American Journal of Public Health*, September 2002, pp. 1421–29.

[17] Richardson, Ruser, and Suarez, "Hispanic Workers in the United States."

[18] Phillip R. Hunt, Holly Hackman, and Letitia Davis, "Availability of Information on Patient Employer and Work-relatedness and Accuracy of E-codes in Emergency Department Medical Records," paper presented at the Council of State and Territorial Epidemiologists Annual Conference, Albuquerque, NM, June 2005.

[19] Dong and Platner, "Occupational Fatalities of Hispanic Construction Workers."

[20] Dana Loomis and David Richardson, "Race and the Risk of Fatal Injury at Work," *American Journal of Public Health*, January 1998, pp. 40–44.

[21] David B. Richardson, Dana Loomis, James Bena, and John Bailer, "Fatal Occupational Injury in Southern and Non-Southern States, by Race and Hispanic Ethnicity," *American Journal of Public Health*, October 2004, pp. 1756–61.

[22] Gary S. Sorock, Elaine Smith, and Nancy Hall, "An Evaluation of New Jersey's Hospital Discharge Database for Surveillance of Severe Occupational Injuries," *American Journal of Industrial Medicine*, March 1993, pp. 427–37.

[23] Hunt, Hackman, and Davis, "Availability of Information."

[24] Jeff Biddle, Karen Roberts, Kenneth D. Rosenman, and Edward M. Welch, "What Percentage of Workers with Work-related Illnesses Receive Workers' Compensation Benefits?" *Journal of Occupational and Environmental Medicine*, April 1998, pp. 325–31.

[25] Azaroff, Levenstein, and Wegman, "Occupational Injury and Illness Surveillance."

[26] Elise Pechter and Kerry Souza, "Occupational Health Surveillance of Low-income Minority and Immigrant Workers through Community Health Centers," paper presented at the Council of State and Territorial Epidemiologists Annual Conference, Albuquerque, NM, June 2005.

[27] See David R. Williams, "The Monitoring of Racial/Ethnic Status in the USA: Data Quality Issues," *Ethnicity and Health*, August 1999, pp. 121–37; Susan L. Arday, David R. Arday, Stephanie Monroe, and Jianyi Zhang, "HCFA's Racial and Ethnic Data: Current Accuracy and Recent Improvements," *Health Care Financing Review*, summer 2000, pp. 107–16; and Susan Moscou, Matthew R. Anderson, Judith B. Kaplan, and Lisa Valencia, "Validity of Racial/Ethnic Classifications in Medical Records Data: An Exploratory Study," *American Journal of Public Health*, July 2003, pp. 1084–86.

[28] Nancy R. Kressin, Bei-Hung Chang, Ann Hendricks, and Lewis E. Kazis, "Agreement between Administrative Data and Patients' Self-reports of Race/Ethnicity," *American Journal of Public Health*, October 2003, pp. 1734–39.

[29] Moscou, Anderson, Kaplan, and Valencia, "Validity of Racial/Ethnic Classifications."

[30] Personal communication, Bruce B. Cohen, Massachusetts Department of Public Health, June 2005.

[31] See Romana Hasnain-Wynia, Debra Pierce, and Mary A. Pittman, *Who, When and How: The Current State of Race, Ethnicity and Primary Language Data Collection in Hospitals* (New York, The Commonwealth Fund, May 2004); and Vali Firoozeh, *Patient Race and Ethnicity: Improving Hospital Data Collection and Reporting* (Princeton, NJ, New Jersey Hospital Association, Health Research and Education Trust of New Jersey, 2004); on the Internet at **http://www.njha.com**.

[32] National Institute for Occupational Safety and Health (NIOSH), *National Occupational Research Agenda* (Cincinnati, NIOSH, 1996).