Occupational Injuries Among Older Workers With Disabilities: A Prospective Cohort Study of the Health and Retirement Survey, 1992 to 1994

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ABSTRACT

Objectives. We tested the hypothesis that among older workers, disabilities in general, and hearing and visual impairments in particular, are risk factors for occupational injuries.

Methods. Using the first 2 interviews of the Health and Retirement Study, a nationally representative survey of Americans aged 51 to 61 years, we conducted a prospective cohort study of 5600 employed nonfarmers.

Results. Testing a logistic regression model developed in a previous cross-sectional study, we found that the following occupations and risk factors were associated with occupational injury as estimated by odds ratios: service personnel, odds ratio = 1.71 (95% confidence interval = 1.13, 2.57); mechanics and repairers, 3.47 (1.98, 6.10); operators and assemblers, 2.33 (1.51, 3.61); laborers, 3.16 (1.67, 5.98); jobs requiring heavy lifting, 2.05 (1.55, 2.70); self-employment, 0.50 (0.34, 0.73); and self-reported disability, 1.58 (1.14, 2.19). Replacing the general disability variable with specific hearing and visual impairment variables, we found that poor hearing (1.35 [0.95, 1.93]) and poor sight (1.45 [0.94, 2.22]) both had elevated odds ratios.

Conclusions. Poor sight and poor hearing, as well as work disabilities in general, are associated with occupational injuries among older workers. (*Am J Public Health.* 1998;88: 1691–1695)

As we approach the new century, the mean age of the US workforce is increasing significantly. The aging of baby boomers—people born between 1946 and 1964—will increase the mean age of the workforce from 37 in 1992 to 41 in 2005.[1] From 1994 to 2005, the number of working men 55 to 64 years of age is expected to increase by 43%; the number of working women in that age group is expected to increase by 63%.[2]

Many of these older workers continue to work in spite of a wide range of medical impairments. Data from the Census Bureau's 1988 Current Population Survey[3] suggest that 6.9% of workers 55 to 64 years of age have some medical impairment that limits their work in some way. The Americans with Disabilities Act can be expected to increase the percentage of older workers with medical impairments. Passed in 1991, the act requires that all employers with 15 or more employees make any reasonable accommodations to allow workers with disabilities to participate in the workforce.

However, previous studies have suggested that workers with disabilities, in particular sensory impairments, are at increased risk for occupational injuries. In a study of Dutch shipyard workers, Moll van Charante et al.[4] found an association between occupational injuries and impaired hearing. A study of postal workers found that a wide variety of disabilities, including disabilities of the lower extremities and psychiatric disabilities, were associated with occupational back injuries.[5] In a cross-sectional, exploratory analysis of a nationally representative sample of Americans, we found that older workers with impaired hearing or sight had increased risks of occupational injuries, with odds ratios of 1.60 and 1.53, respectively.[6] We confirmed these results in 2 retrospective cohort studies using data from the National Health Interview Survey (NHIS).[7,8]

We report here on a prospective cohort study embedded in the nationally representative sample of older workers in the Health and Retirement Study, designed to test the hypothesis that disabilities, and more specifically impaired hearing and sight, are risk factors for occupational injuries. To our knowledge, this is the first prospective cohort study to address this issue in a nationally representative cohort. In controlling for occupation, self-employment, and heavy lifting while measuring the risk associated with disabilities, this study aims to validate the cross-sectional model we previously derived from the first interview of the Health and Retirement Study.

Methods

Cohort

With funding from the National Institute on Aging, the Institute for Social Research at the University of Michigan designed and implemented the Health and Retirement Study to assess the role of economics, health, and social factors in the retirement process.[9] Using a multistage area probability sample of the continental United States, the Health and Retirement Study selected subjects over a period of 45 weeks

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This paper was accepted May 22, 1998.

beginning in April 1992. A household was considered eligible if it contained a person born between 1931 and 1941, that is, between 51 and 61 years old at the time of sampling. The household response rate in the first interview was 82%. Of the initial cohort of 9756 subjects between 51 and 61 years of age, 7089 were employed during the year preceding the interview and thus were at risk for occupational injuries. (Because our earlier work suggested that the 235 farmers in the survey had different patterns of injury risk from the rest of the cohort,[10] we excluded them from the present analysis.) Over the 7-month period beginning April 1, 1994, and continuing into December 1994, the Health and Retirement Study reinterviewed the cohort participants. We report here on the 5600 subjects (82% of those interviewed in 1992) who participated in the second interview and had worked either full- or part-time between the 2 interviews.

TABLE 1—Categories of Occupational Codes

Occupation	National Health Interview Survey Recode[a]
Executives, managers, and professionals	01–11
Sales personnel	14–16
Administrative support	17–21
Service Personnel	12–13, 22–28
Mechanics and repairers	32–34
Operators and assemblers	35–36
Laborers	37–41

[a]US Dept of Health and Human Services, National Center for Health Statistics. *National Health Interview Survey, 1986.* Appendix A, recode 1. Washington, DC: US Dept of Health and Human Services; 1986.

Variables

The second Health and Retirement Study interview (Wave II) defined occupational injuries by the question: "Since [WAVE 1 MONTH/YEAR], have you had any injuries at work that required special medical attention or treatment or interfered with your work activities?" The study also asked how many injuries had been experienced and the date of the most recent injury. The Health and Retirement Study did not solicit further details on the nature, severity, or circumstances of the injury.

In the present study, we considered 2 groups of risk factors. The first group contained the risk factors included in our previously defined model.[6] We classified occupation in the 7 categories of census occupation codes[11] defined by the NHIS[12] (see Table 1). We compared those who reported that their jobs required heavy lifting all or most of the time with those who did not; the self-employed with those who worked for others; those who reported an impairment or health problem that limited their work capacity with those who did not; those whose hearing, even with a hearing aid, was poor or fair with those who reported no hearing impairment; those whose sight, even with glasses, was poor or fair with those who reported no sight impairment; and those whose jobs required good vision all or most of the time with those whose jobs did not.

The second group contained variables that were thought to be potential risk factors for occupational injury but were not included in our previous cross-sectional model[6] because we could not ascertain whether they preceded and, potentially, caused the injury or whether they were a consequence of the injury. Here, we focus on those variables that were statistically significantly associated with occupational injury in the cross-sectional analysis after control for occupation, heavy lifting, self-employment, poor hearing, and poor vision. These variables include depressive symptoms—the 30% with the most depressive symptoms from the Center for Epidemiological Studies Depression Scale (CES-D)[13] compared with the other 70%; expression of some difficulty with the activities of daily living—getting up after sitting, stooping, pushing large objects, lifting 10 lb, or walking several blocks; expression of fair or poor emotional health; and expression of dissatisfaction with health, finances, job, and life overall.

Analysis

Our analysis aimed to assess the validity of the models we developed on the basis of cross-sectional study of the first Health and Retirement Study interview using the prospective injury data from the second interview. First, we calculated the univariate associations between the risk factors defined in the first interview and the injury outcome reported in the second interview. In all these analyses, we compared those who had 1 or more injuries with those who had no injuries.

Second, we recalculated 2 logistic regression models from our previous work[6] using the risk factor data from the first interview and the injury outcome data from the second interview. The first model included the following risk factors: occupation, a job requiring heavy lifting, self-employment, self-reported work disability, and a job requiring good vision. The second model replaced the general measure of self-reported work disability with 2 specific sensory impairments—poor hearing and poor sight.

Third, we calculated the association between injury and the risk factors that were statistically significant in the cross-sectional analysis but whose temporal directionality was unclear: depressive symptoms; difficulty with getting up after sitting, stooping, pushing large objects, lifting 10 lb, or walking several blocks; poor emotional health; and dissatisfaction with health, finances, job, and life overall. We calculated each of these associations while controlling for occupation, heavy lifting, self-employment, poor hearing, and poor sight. In all our calculations, to account for the complex sample design, we used SUDAAN[14] software to calculate standard errors and associated confidence intervals for the estimated odds ratios.

Results

Table 2 presents the crude odds ratios and their confidence intervals for the associations between the various risk factors in 1992 and the occupational injuries in the following 2 years. Taken together, the overall results in this longitudinal analysis are similar to the results of our previously published cross-sectional analysis.[6] As before, occupation remains the strongest risk factor for occupational injury, with higher risks for mechanics and repairers, operators and assemblers, and laborers than for executives, managers, and professionals. Other risk factors for occupational injuries included male gender; less education; obesity; self-report of disability, sight, or hearing; and several job requirements. The self-employed continued to have a lower risk of occupational injury.

Table 3 compares 2 logistic regression models developed from the cross-sectional data collected in 1992 with the same models recalculated using the risk factors from 1992 and the injuries reported over the next 2 years. The first model contained the risk factors of occupation, a job requiring heavy lifting, self-employment, disability, and a job requiring good vision. When replicated by using prospective data, this model had a pattern of odds ratios similar to the one we found (but did not report) in the cross-sectional analysis.[6] However, the adjusted

TABLE 2—Univariate Associations Between Risk Factors in 1992 and Occupational Injuries From 1992 to 1994 Among 5034 Workers 51 to 61 Years Old in the Health and Retirement Study

Risk Factor	Unweighted No. With Risk Factor	Unweighted No. With Occupational Injuries	OR	95% CI
Occupation				
Executives, managers, professionals	1636	54	1	. . .
Sales personnel	483	25	1.51	0.94, 2.42
Administrative support	802	43	1.74	1.12, 2.70
Service personnel	756	59	2.43	1.60, 3.71
Mechanics and repairers	212	30	5.05	2.88, 8.86
Operators and assemblers	943	101	3.43	2.34, 5.01
Laborers	193	26	4.39	2.51, 7.68
Age (55–61 y vs 51–54 y)	2660	160	0.78	0.58, 1.05
Male (vs female)	2645	207	1.45	1.12, 1.87
Black (vs non-Black)	763	52	1.03	0.71, 1.50
Hispanic (vs non-Hispanic)	351	33	1.29	0.89, 1.88
Education (≤12 y vs more)	2879	250	2.35	1.86, 2.97
Obesity	1282	111	1.42	1.07, 1.87
Alcohol dependence	316	31	1.42	0.91, 2.21
Disabled from work (self-reported)	417	41	1.74	1.25, 2.41
Sight	452	53	1.81	1.23, 2.67
Hearing	580	58	1.72	1.23, 2.41
Job requirements				
Physical effort	1938	199	2.65	2.06, 3.41
Stooping or kneeling	1288	136	2.08	1.56, 2.77
Heavy lifting	2195	213	2.63	2.05, 3.37
Good vision	2641	178	1.03	0.76, 1.39
Concentration	2416	179	1.09	0.88, 1.33
Good people skills	1749	128	1.26	0.97, 1.64
Years of experience (>3 vs ≤3)	841	56	1.20	0.92, 1.55
Self-employment	767	30	0.51	0.36, 0.73

Note. OR = odds ratio; CI = confidence interval.

odds ratios for the occupation categories increased somewhat in the prospective analysis, while the adjusted odds ratios for a job requiring heavy lifting, self-employment, and disability were all closer to 1. The adjusted odds ratio for a job requiring good vision decreased to 1.11 and was not statistically significant.

The second model examined the specific sensory disabilities—poor hearing and poor sight—instead of the more general disability variable. Again, the overall pattern of risk factors was similar to that of the first model. The adjusted odds ratios for occupational categories were slightly higher in the longitudinal analysis than they had been in the cross-sectional analysis. The other adjusted odds ratios were closer to 1. The *P* values for poor hearing and poor sight were both .09. A job requiring good vision was no longer significant at the $\alpha = 0.05$ level.

In the previously reported cross-sectional analysis,[6] a series of variables including depression, difficulty with a variety of activities of daily living, poor emotional health, and dissatisfaction with health, finances, job, and life overall was associated with increased risk of occupational injury. In that cross-sectional analysis, we could not distinguish the direction of causality. For example, did depression cause the injuries or did the injuries lead to the depression? Here, we addressed this issue by calculating the association of the risk factors measured in 1992 with occupational injuries that occurred from 1992 until 1994, thus ensuring that the potential risk factors preceded the injuries. Each of these analyses summarized in Table 4 controlled for occupation, heavy lifting, self-employment, poor sight, and poor hearing. Several of these variables—including depression; difficulty with getting up after sitting, lifting 10 lb, or walking several blocks; and dissatisfaction with finances—continued to be significantly associated with occupational injuries in the longitudinal study; the others, however, were not.

Discussion

This prospective study of risk factors for occupational injuries lends support to our previously reported cross-sectional analysis of the Health and Retirement Survey.[6] As expected, occupation—a marker for job-specific exposures—shows a clear association with injury experience. The workers in the more physically demanding occupations, such as laborers, mechanics, and assemblers, had injury risks 2 and 3 times those of the executives, managers, and professionals. Even after control for occupation, however, the adjusted odds of injury for workers with jobs requiring heavy lifting were estimated to be twice as high as for those with less demanding work. Most likely, this result reflects the workers' accurately identifying the most physically demanding jobs in each occupational class. Alternatively, the workers' perceptions may have reflected not just the physical demands of their work but also the match between their own capabilities and the demands of their jobs. For example, a strong worker who can lift 50 lb might not perceive a job lifting 15-lb parcels as requiring heavy lifting, while a weaker worker who can lift only 25 lb might perceive the same job as requiring very heavy lifting. Keyserling et al.[15] suggested that such mismatches between a worker's capabilities and the job's demands were associated with an increased risk of back injuries.

Again, self-employed workers had a decreased injury risk—about half that of those who worked for others. This was true in spite of the fact that self-employed workers, on average, work over 12% more hours per week than those who work for others[16] and thus are at risk of occupational injuries for a longer time each week. Perhaps self-employed workers have more flexibility to build safety into their work environment than do workers employed by others. Alternatively, self-

TABLE 3—Logistic Regression Models of Risk Factors Predicting Occupational Injuries Among 4883 Workers 51 to 61 Years Old in the Health and Retirement Study, 1992–1994

	Model With Any Self-Reported Disability				Model With Auditory and Visual Impairments			
	Cross-Sectional		Longitudinal		Cross-Sectional		Longitudinal	
Risk Factor	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Occupation								
Executives, managers, and professionals	1	...	1	...	1	...	1	...
Sales personnel	0.98	0.60, 1.60	1.41	0.86, 2.32	1.01	0.62, 1.66	1.44	0.86, 2.32
Administrative support	1.17	0.68, 2.04	1.53	0.99, 2.34	1.19	0.69, 2.04	1.54	0.99, 2.34
Service personnel	1.68	1.17, 2.40	1.71	1.13, 2.57	1.68	1.18, 2.39	1.69	1.13, 2.57
Mechanics and repairers	2.41	1.55, 3.73	3.47	1.98, 6.10	2.27	1.49, 3.46	3.33	1.98, 6.10
Operators and assemblers	1.91	1.01, 3.61	2.33	1.51, 3.61	1.70	0.93, 3.09	2.19	1.51, 3.61
Laborers	2.34	1.35, 4.06	3.16	1.67, 5.98	2.18	1.29, 3.67	3.06	1.67, 5.98
Job requirements								
Heavy lifting	2.80	2.04, 3.84	2.05	1.55, 2.70	2.75	2.00, 3.78	2.095	1.55, 2.70
Good vision	1.38	0.99, 1.92	1.11	0.80, 1.54	1.43	1.04, 1.98	1.14	0.80, 1.54
Self-employment	0.44	0.29, 0.65	0.50	0.34, 0.73	0.47	0.32, 0.69	0.51	0.34, 0.73
Disabled	2.15	1.45, 3.20	1.58	1.14, 2.19	...	...	...	...
Poor hearing	...	...	...	...	1.60	1.11, 2.30	1.35	0.95, 1.93
Poor sight	...	...	...	...	1.53	1.11, 2.09	1.45	0.94, 2.22

Note. The difference between the sample used here and that used in Table 2 stems from missing data on specific risk factors. OR = odds ratio; CI = confidence interval.

employed workers may choose work better suited to their capabilities.

Finally, even after control for occupation, heavy lifting, and self-employment, self-reported disability (odds ratio = 1.58 (95% confidence interval = 1.14, 2.19]) and specifically poor hearing (1.35 [0.95, 1.93]) and poor sight (1.45 [0.94, 2.22]) remain risk factors for occupational injury. A retrospective cohort study of occupational injuries in the NHIS[8] found similar associations between impairments and occupational injuries—disability (1.32 [1.16, 1.51]), blindness (2.98 [1.22, 7.26]), visual impairment (1.40 [0.89, 2.21]), deafness (2.42 [1.33, 4.39]), and hearing impairment (1.65 [1.38, 1.98]).

The present study has 3 major strengths compared with other work in this field. First, it is set within a large, nationally representative sample with an 82% participation rate—arguing in favor of generalizing these results to the population of older workers in the United States. Second, its prospective design ensures that the risk factors preceded the injury outcomes and that the occurrence of an injury did not influence the recall of any specific risk factors. Third, the extensive questionnaire used in the HRS allows for the control of variables such as job requirements that are not measured by the NHIS.

However, the study has several limitations as well. First, the parameter estimates for some outcomes such as poor hearing may be underestimated because of misclassification bias. One would expect that poor hearing at the time of an injury could have put the cohort member at risk for that injury. In order to control recall bias, however, we measured the risk factor at the first interview and counted injuries in the following 2 years. Thus, it is possible that a risk factor status, such as hearing, had changed before the injury took place. It may have been improved by a new hearing aid or have worsened by the progression of disease. Such random misclassification would tend to decrease the strength of the association between injury and the risk factor. To assess the potential magnitude of this misclassification bias,[17] we calculated the associations between poor sight, poor hearing, and injury for the entire cohort and repeated them for the subcohort of workers whose sight or vision did not change between the 2 Health and Retirement Study interviews. In both cases, the calculations controlled for occupation, self-employment, and heavy lifting. We found little increase in the association between occupational injury and poor sight (from odds ratio = 1.51 [95% confidence interval = 1.00, 2.29] to 1.52 [0.88, 2.63]) but a substantial increase in the association between occupational injury and poor hearing (from 1.40 [1.00, 1.97] to 1.91 [1.31, 2.80]) when we restricted our calculations to those whose risk factor status had been stable over 2 years. These results suggest that misclassification bias may have reduced the estimate of the risk associated with poor hearing by over 50%.

Second, although the data set contained a wealth of information on potential injury

TABLE 4—Logistic Regression Analyses of Risk Factors Associated With Occupational Injury After Control for Occupation, Heavy Lifting, Self-Employment, Poor Sight and Hearing, Among Workers 51 to 61 Years Old in the Health and Retirement Study, 1992–1994

Risk Factor	OR	95% CI
High depression	1.37	1.05, 1.77
Some difficulty with—		
Getting up after sitting	1.70	1.35, 2.14
Stooping	1.25	0.97, 1.62
Pushing large objects	1.11	0.81, 1.53
Lifting 10 lb	1.49	1.12, 1.99
Walking several blocks	1.44	1.10, 1.88
Poor emotional health	1.24	0.86, 1.80
Dissatisfaction with—		
Health	1.34	0.95, 1.88
Finances	1.48	1.13, 1.93
Job	1.22	0.85, 1.74
Life overall	1.35	0.88, 2.06

Note. OR = odds ratio; CI = confidence interval.

risk factors, it contained no information on the nature, severity, or circumstances of the injuries. Thus, we could not investigate whether the risk factors for more severe injuries differed from those for less severe injuries or whether risk factors for machine-related injuries differed from those for slips and falls. Third, since we only had data on a worker's primary occupation, we could not exclude the possibility that some of the workers were injured while working a second job in a different occupation.

Taken together with previous cross-sectional[6] and retrospective cohort studies,[8] this prospective cohort study provides strong support for an association between preexisting disabilities and subsequent workplace injuries—even after control for occupation and self-employment status. As the workforce ages and the Americans with Disabilities Act continues to be enforced, the number of older Americans working with a variety of impairments will likely increase. Our data suggest that we will need to pay close attention to accommodating these impairments in order to prevent occupational injuries. □

Acknowledgments

This work was supported in part by grants from the National Center for Injury Prevention and Control (R49 CCR703640-08) and from the National Institute for Occupational Safety and Health (1 K01 OHAG00150-03).

We would like to thank Joan Radloff for her technical assistance.

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