Scand J Work Environ Health 2008;34(2):158-164

<https://doi.org/10.5271/sjweh.1217>

Published online: 08 May 2008, Issue date: 31 Apr 2008

Urban-rural differences in work disability after an occupational injury

by [Young AE](#), [Wasiak R](#), [Webster BS](#), [Shayne RGF](#)

Affiliation: Center for Disability Research, Liberty Mutual Research Institute for Safety, 71 Frankland Road, Hopkinton, MA 07148, United States. AmandaE.Young@LibertyMutual.com

Corrections

See [2012;38\(6\):604](#) for a correction.

The following articles refer to this text: [2010;36\(4\):332-338](#); [2010;36\(6\):515-516](#); [2012;38\(6\):604](#)

Key terms: [disability outcome](#); [geographic variation](#); [occupational injury](#); [return to work](#); [rural health](#); [urban-rural difference](#); [work disability](#); [work-related injury](#)

This article in PubMed: www.ncbi.nlm.nih.gov/pubmed/18470437

This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/).

Urban–rural differences in work disability after an occupational injury

by Amanda E Young, PhD,¹ Radoslaw Wasiak, PhD,¹ Barbara S Webster, PA-C,¹ Rebecca GF Shayne, MPH¹

Young AE, Wasiak R, Webster BS, Shayne RGF. Urban–rural differences in work disability after an occupational injury. *Scand J Work Environ Health*. 2008;34(2):158–164.

Objectives In comparison with their urban counterparts, people living in rural areas have been found to experience higher rates of morbidity and mortality and have inferior health outcomes after illnesses and injuries. The current study sought to determine if this trend extends to work-disability outcomes after work-related injuries.

Methods This study was a retrospective cohort study using data on workers' compensation claims. Rurality was defined at the postal-code level on the basis of United States 2000 census data. Work disability was measured using the number of full days a person was off work in the 2 years following an injury. Regression analyses were used to test the association between rurality and the duration of work disability after a work-related bone fracture.

Results The claimants with higher rurality experienced less work disability than those with lower rurality. This relationship remained after control for the impact of age, gender, part of body injured, occupation, and industry.

Conclusions Rurality was found to be related to work disability. However, rather than being associated with more time off after an injury, as could be expected on the basis of past findings, increased rurality was found to be associated with less time off work. The findings suggest that features of rural environments, cultures, and behavioral patterns may facilitate return to work.

Key terms disability outcome; geographic variation; return to work; rural health; work-related injury.

Although occupational injury rates are on the decline (1), recovery from an injury, including time to return to work, remains a significant public health issue. Time away from the workplace (or work disability) not only affects a person's economic, psychological, and physical well-being, but also the economic and social health of society (2, 3). As such, it is important to examine factors that are related to the experience of work disability, for doing so may provide insight into what could be done to reduce the economic and social burden of injury. Research has found numerous correlates for the outcomes of occupational injuries. However, to date, the relationship between work disability and the ruralness of one's residential location (hereafter referred to as rurality) has not been investigated.

A review of the literature identified numerous statistics indicating that rural residents in the United States (US) experience greater rates of morbidity and mortality in comparison with their urban counterparts (4). Furthermore, it has been found that, in comparison with their

metropolitan peers, rural residents experience worse health outcomes after a variety of ill-health conditions (5–11). Studies investigating the association between rurality and return to work have identified a similar trend. A prospective cohort study investigating the relationship between residential status and work-related outcomes among patients who had a myocardial infarction found that those who lived in a metropolitan location returned to work more often than their nonmetropolitan peers (8). Similarly, it was found that people in rural areas had inferior return-to-work outcomes after spinal cord injury (12). In addition, a study of return to work after traumatic brain injury found that people in rural areas received fewer return-to-work services (eg, vocational counseling) (13).

Although there is evidence that rural residents experience worse health after injuries and illnesses, to date no study has specifically examined whether the duration of work disability is related to rurality. Our study was aimed at addressing this void by investigating whether

¹ Center for Disability Research, Liberty Mutual Research Institute for Safety, Hopkinton, Massachusetts, United States.

Reprint requests to: Dr Amanda E Young, Center for Disability Research, Liberty Mutual Research Institute for Safety, 71 Frankland Road, Hopkinton, MA 07148, United States. [AmandaE.Young@LibertyMutual.com]

people with occupational injuries experience differing durations of work disability related to the rurality of their residential location. In addition, the study sought to determine whether previously identified correlates of work disability explain any observed differences.

Study population and methods

A retrospective cohort design was used to address the study objectives. Data were extracted from the administrative records of a large insurance company, which accounts for 8–10% of US workers' compensation coverage and has a wide distribution of coverage by state, industry type, and company size (14). All workers from California, Florida, Illinois, Indiana, Michigan, New York, Oregon, Pennsylvania, and Texas who filed a new and accepted workers' compensation claim for a bone fracture between 1 January 2000 and 31 December 2001 were assessed for inclusion. The states were chosen for study on the basis of their high market share (ie, where the insurer had a substantial proportion of the workers' compensation market), the diversity in geographic locale, and urban versus rural composition. The number of states chosen was limited so that jurisdictional differences could be controlled in the analysis. Bone fractures were selected since they are injuries for which the place of residence is unlikely to affect initial care-seeking behavior. Furthermore, unlike many other injuries with less definitive diagnoses, such as low-back pain, fractures have well-defined treatments (15) that are likely to be similar regardless of where care is sought. The cases were selected on the basis of the nature of the injury codes. These codes are assigned by trained insurance industry coders and are selected on the basis of the injury description, as reported on the "First Report of Injury" form. As a control for severity, those with multiple injuries were excluded. A total of 11 576 cases were included in the analysis; sample characteristics are presented in table 1.

Measures

The options for defining rurality are numerous, and they all have their strengths and weaknesses (16). On the basis of the limitations associated with county-level classification methods and the desire for greater specificity, a postal-code classification method was adopted. This method employed the US Census Bureau's urban and rural taxonomy, which defines the urbanization of an area by its population density (17). Claimants' residential zip codes at the time of their injuries were assigned a "rurality" percentage based on the population figures for

the year 2000 (18). This score was derived by dividing the number of people defined as living in a "rural" area of a zip code by the total population of the zip code and then multiplying by 100. For example, if the fictitious zip code 09999 has a population of 30 000 people, with 10 000 persons living in an urban area and the remaining 20 000 living in a rural area, the "rurality" of zip code 09999 is 66%. After the calculation, the rurality scores were collapsed into percentage rural groupings (table 2).

Table 1. Demographic characteristics of the study sample (ie, 11 576 workers with compensable work-related fractures).

Demographic characteristic	Frequency	%
Jurisdiction state		
California	2024	17.5
Florida	1243	10.7
Illinois	1647	14.2
Indiana	949	8.2
Michigan	792	6.8
New York	1079	9.3
Oregon	1005	9.7
Pennsylvania	1136	9.8
Texas	1701	14.7
Age group		
<25 years	1648	14.2
25–34 years	2690	23.2
35–44 years	2972	25.7
45–54 years	2580	22.3
≥55 years	1686	14.6
Gender		
Male	8300	71.7
Female	3275	28.3
Missing	1	0.0
Part of body		
Head, neck or trunk	1187	10.3
Upper extremities	3012	26.0
Lower extremities	3242	28.0
Fingers or toes	4135	35.7
Occupation		
Legislators, senior officials, and managers	696	6.0
Professionals	502	4.3
Technicians and associate professionals	1137	9.8
Clerks	688	5.9
Service workers and sales workers	994	8.6
Skilled agricultural and fishery workers	59	0.5
Craft and related trades workers	1673	14.5
Plant and machine operators and assemblers	2802	24.2
Elementary occupations	2786	24.1
Missing	239	2.1
Industry		
Agriculture, forestry, and fishing	192	1.7
Mining	138	1.2
Construction	815	7.0
Manufacturing	2947	25.5
Transport	2160	18.7
Wholesale trade	496	4.3
Retail trade	1620	14.0
Finance	514	4.4
Service	2616	23.0
Public administration	45	0.4
Missing	33	0.3

Table 2. Association between rurality and work disability after a work-related fracture.

Rural grouping	Entire sample (N=11 576)		Workers with at least 8 days off work (N=5618)	
	N	Percentage with at least 8 days off work	N	Mean of days off work
0–9%	7446	50.7	3778	125.6
10–19%	1034	45.2	467	114.2
20–29%	737	43.4	320	118.6
30–39%	496	42.9	213	107.3
40–49%	382	41.1	157	95.0
50–59%	237	49.4	117	134.2
60–69%	164	45.7	75	120.1
70–79%	121	47.9	58	131.0
80–89%	39	46.2	18	172.5
90–100%	920	45.1	415	112.5

Variables with a known relationship to work disability were selected to determine if any observed rurality effect remained when the variance explained by population differences were taken into account. Although the data were limited by what was contained within the administrative database, information on age, gender, part of body injured, state, industry, and occupation was available. Employer and occupational data are recorded within the administrative database in text form. These data were manually coded by research staff for industry and occupation using the Standard Industry Classification (SIC) (19) and the International Standard Classification of Occupation (ISCO-88) taxonomies (20).

Two measures of work disability were employed. The first was calculated on the basis of the total number of full days a person was off work due to an injury. This process involved extracting the number of full lost workdays for which the claimants received payment (ie, temporary total indemnity) and then approximating work-disability duration by taking into consideration state legislation regarding waiting (ie, number of lost workdays before indemnity payments began) and retroactive periods (ie, number of lost workdays before claimants are paid for waiting-period days). In cases in which the number of days paid was less than the retroactive period, the number of waiting days was added to the number of days paid. This approximation method has been used by members of the research team and is explained in more detail in earlier papers (21). So that all of the people had the same opportunity for time off, data were extracted on an individual basis, with the data collection starting on the date of injury and ending 730 days (2 years) later. [Note: People who died within 2 years of their injury were excluded from the sample.] The second measure was a dichotomization in which work-disability duration (as previously described) was collapsed to “7 days or less” or “8 days or more”. This

dichotomization was chosen because (i) variation in state legislation meant that, in some states, claimants were not paid indemnity until they were away from work for more than a week (22) and (ii) more than a week away from work was thought to be clinically meaningful. Both the continuous and dichotomized measures were subject to analysis.

Data analysis

Analyses were performed on the following two datasets: (i) initially the entire sample (N=11 576) and (ii) then only those who had more than 7 days of work disability (N=5618). Regression analyses (logistic and linear) were used to model the association between rurality and whether or not a person was off work for more than a week, after control for potential confounders. The robustness of the findings was tested by performing linear regressions on a subsample that excluded 5% of those with the longest work-disability duration. In the case of the multivariate analysis, to simplify the interpretation and achieve acceptable cell size, covariates were collapsed when possible. In the case of age, the following three categories were formed: <25, 25–34, and ≥35 years. The part of the body injured was dichotomized to fingers and toes versus the remainder of the body. Occupation was dichotomized as white-collar versus blue-collar. Finally, industry was collapsed into four categories based on sample size and industrial similarities. These groupings were (i) manufacturing, (ii) wholesale and retail trades, service, finance, and public administration, (iii) transport, and (iv) agriculture, mining and construction. The time off work and rurality distributions were both highly positively skewed. There were 89 cases with 730 days off (ie, these persons had been out of work for the entire 2-year data collection period); however, these absences were not related to rurality in that the extreme values occurred across the rurality continuum.

Results

The relationship between rurality and work disability was tested using various groupings, and, although the relationship was not found to be linear, a consistent relationship was observed. The rurality percentile groupings for the two dependent measures are presented in table 2. The least rural group (ie, 0–9%) had the highest percentage of persons with more than a week away from work (51%). As rurality increased, this percentage declined, until rurality reached 50%. At this point the percentage of people off work for more than a week increased. It then leveled out at 46% for the most rural grouping. A similar trend was observed when disability duration

for those off work for more than a week was examined (table 2).

The limited sample size in the more rural groups meant that the estimates were highly unstable. Thus further aggregation was required. To create groupings that would allow further analysis, we decided to assign groupings so that approximately 1000 cases were in each of the more rural groups. This procedure resulted in the groupings of 0–9% (N=7446), 10–19% (N=1034), 20–39% (N=1233), 40–89% (N=943), and ≥90% (N=920). Figure 1 presents the mean disability durations, with their 95% confidence intervals (95% CI), for each of these rural groupings. An analysis of variance with posthoc testing indicated that, with the exception of the 40–89% grouping, the 0–9% group significantly differed from the other groups. The more rural groups were not found to differ from one another.

Multivariate analyses

Logistic regression was used to determine if rurality was related to the likelihood of being off work for more than a week. The cell-size requirements and a lack of significance between the more rural groupings resulted in the choice of the dichotomization “0–9% rural” versus “10–100% rural” for further analyses. The crude effect of rurality on the likelihood of being off work was statistically significant—people living in rural areas were less likely to be away from work for a week or more [odds ratio (OR) 0.78, 95% CI 0.72–0.84]. After control for confounders, the effect of rurality was dampened, but remained significant with the adjusted OR equal to 0.86 (95% CI 0.79–0.94). Other odds ratios and 95% confidence intervals for the model variables are shown in table 3. A test of the full model, including the variables with dummy variables as detailed in table 3, indicated that the model was statistically reliable ($P < 0.0001$) and that, as a set, the variables distinguished between those who had a week or less of work disability from those who had more than a week. However, the explained variance was relatively small (Cox & Snell $R^2 = 0.15$). Overall, 66.4% of the cases were correctly classified (C statistic=0.722). Classification success was better for those who had more than a week of work disability (72.2% versus 60.9%). According to the Wald criterion, all of the variables reliably predicted whether a person would be work-disabled for more than a week (table 3).

Multiple linear regression was used to determine whether, among those who were work-disabled for more than a week (N=5618), the more rural group had less work disability when the other variables were entered into the model (due to missing data, for this analysis N=5512). Due to the skewness of the distribution of the lost-time data, log transformation was applied. Consequently, the

parameter estimates reported for the variables should be interpreted as percentage effects. [See the notes in table 4.] Table 4 contains the parameter estimates (B), the 95% confidence intervals, and the semipartial correlations (sr^2). After control for confounders, living in a rural area

Figure 1. Mean time off work (with 95% confidence intervals) for the various rurality groupings.

Table 3. Association between rurality and whether or not a person was away from the workplace for a week or more after a work-related fracture when the effect of selected confounders was taken into consideration (N=11 307). (95% CI = 95% confidence interval)

Variable	Wald test (χ^2)	P-value	Odds ratio	95% CI
Age category (<25 versus >35 years)	15.31	<0.001	0.74	0.65–0.83
Age category (26–35 versus >35 years)	0.08	0.778	0.87	0.79–0.96
Gender (female = 1)	10.29	0.001	1.18	1.07–1.30
Body part (nondigit = 1)	1080.37	<0.001	4.44	4.06–4.85
Occupation (blue-collar = 1)	177.40	<0.001	1.95	1.77–2.16
Industry ^a (1 versus 4)	135.40	<0.001	0.55	0.47–0.64
Industry ^a (2 versus 4)	5.52	0.019	0.79	0.68–0.92
Industry ^a (3 versus 4)	82.00	<0.001	1.25	1.07–1.47
Percentage rural (more rural = 1)	10.39	0.001	0.86	0.79–0.94
State (California versus Texas)	68.10	<0.001	1.42	1.23–1.64
State (Florida versus Texas)	37.38	<0.001	0.65	0.56–0.77
State (Illinois versus Texas)	30.56	<0.001	1.26	1.08–1.46
State (Indiana versus Texas)	32.88	<0.001	0.63	0.53–0.76
State (Michigan versus Texas)	5.21	0.022	0.80	0.66–0.96
State (New York versus Texas)	11.76	0.001	1.17	0.99–1.38
State (Oregon versus Texas)	0.02	0.878	0.93	0.78–1.11
State (Pennsylvania versus Texas)	0.59	0.443	0.90	0.76–1.06

^a 1 = manufacturing; 2 = wholesale and retail trades, services, public administration and finances; 3 = transport; 4 = agriculture, mining and construction.

Table 4. Association between rurality and the natural logarithm of work-disability duration when the effect of selected confounders was taken into consideration (N=5512). Note: unless otherwise noted, the impact of a variable should be interpreted in terms of the “percentage effect” of the variable, which is calculated as follows: $100 \times [\exp(B)-1]$, where B is the parameter estimate. The impact of the “age category” variable is equal to $B \times x$, where B is the regression coefficient for variable x ; therefore, the impact varies as the value of this variable changes. (95% CI = 95% confidence interval, sr^2 = semipartial correlations)

Variable	B	P-value	95% CI	sr^2
Intercept	3.66	<0.001	3.49–3.82	
Age category (1 = <25 years, 2 = 25–34 years, 3 = ≥35 years)	0.15	0.008	0.11–0.19	0.009
Gender (female = 1)	0.01	0.810	-0.06–0.08	0.000
Body part (nondigit = 1)	0.65	<0.001	0.58–0.72	0.055
Occupation (blue-collar = 1)	0.21	<0.001	0.14–0.28	0.006
Industry ^a (1 versus 4)	-0.33	<0.001	-0.43–-0.22	0.006
Industry ^a (2 versus 4)	-0.33	<0.001	-0.43–-0.23	0.007
Industry ^a (3 versus 4)	-0.26	<0.001	-0.37–-0.16	0.004
Percentage rural (more rural = 1)	-0.11	0.001	-0.17–-0.04	0.002
State (California versus Texas)	-0.15	0.003	-0.24–-0.05	0.001
State (Florida versus Texas)	-0.24	<0.001	-0.35–-0.12	0.003
State (Illinois versus Texas)	-0.26	<0.001	-0.36–-0.16	0.004
State (Indiana versus Texas)	-0.45	<0.001	-0.59–-0.32	0.007
State (Michigan versus Texas)	-0.26	<0.001	-0.39–-0.12	0.002
State (New York versus Texas)	-0.29	<0.001	-0.40–-0.18	0.004
State (Oregon versus Texas)	-0.59	<0.001	-0.72–-0.47	0.015
State (Pennsylvania versus Texas)	-0.09	0.147	-0.20–-0.03	0.000

^a 1 = manufacturing; 2 = wholesale and retail trades, services, public administration and finances; 3 = transport; 4 = agriculture, mining and construction.

was associated with a 10.4% reduction in the duration of work disability (95% CI -15.6% to -3.9%). The R for regression differed significantly from zero ($P<0.0001$); however, the explained variance was small ($R^2=0.10$). The results indicate that all of the variables, excluding gender, were related to work-disability duration, the part of the body being responsible for most of the variance explained. The results from both the logistic and linear regressions indicted that the crude and adjusted effect of rurality was consistent across industries (ie, when the analyses were conducted separately for each industry, the coefficient signs and significance were the same). The sample size did not allow us to analyze the effect of rurality at the state level.

Discussion

The results of this study indicate that work-disability outcomes of occupational injuries do differ when urban versus rural comparisons are made. A simple bivariate analysis indicated that highly urban residents experienced greater work disability, and multivariate investigations revealed that this observation was maintained

after control for demographic differences. The results run counter to prior findings concerning morbidity and mortality and raised the question of why rural residents experience less work disability. A possible explanation may be related to health care use in that it has been found that longer work disability is associated with an increased use of medical care (23). Limited access to health care professionals in rural areas (24–27) may decrease work-disability duration by making it more difficult for rural residents to obtain work-disability certification. Although restricted access to health care may help to explain the observed trend, it can be anticipated that those in more urbanized areas (eg, those in the 10–30% group) would have relatively good access to care. In these cases, limited access may be less of a factor than rural-style help-seeking behavior.

Other reasons why those in rural areas may have better outcomes include increased hardiness and resilience and a stronger work ethic. Characteristics attributed to rural people include a high value placed on achievement, hard work, and determination, as well as greater hardiness and likelihood in accepting the challenges of life (28). Furthermore, high levels of self-determination, independence, and dignity and views on privacy present in rural populations (29) may mean that rural residents are less willing to accept financial support. Rural residents are also typified as having a stronger work ethic and stronger commitment to their employers. Such findings suggest that, in comparison with their metropolitan peers, rural residents may feel a stronger commitment to making a speedy return to the workplace. Another possible explanation may be a greater access and use of legal representation in urban areas. Workers' compensation claimants represented by lawyers have an average of 4.5 times higher claim costs in relation to both more medical services and prolonged disability (National Council on Compensation Insurance. NCCI Low Back Study: unpublished report. New York: National Council on Compensation Insurance; 1984), and litigation has been shown to be associated with a decreased probability of return to work and interrupted case management (30, 31).

As with all research, the limitations of our study need to be taken into consideration when the results are interpreted. First, the data source did not permit a direct validation of the measures of work absence. An adjustment of indemnity payments due to overpayment, vacation, and work stoppage may be interpreted as additional work disability in administrative data. Actual work disability is not recorded if it does not exceed a waiting period. It is also the case that additional work disability may not be observed. In this study, continued disability may be missed if the employee did not return to work after the claim was closed. Another limitation concerns the fact that some workers' compensation claims are settled in lump sum payments for future medical and indemnity

payments. In such cases, censoring of the data on the duration of work disability is observed. In our sample, 490 cases with lump sum settlements were identified. The results of multivariate logistic and linear regression analyses on a subsample that excluded these persons did not differ in terms of significance and signs of parameter estimates. However, small differences in the magnitude of the parameter estimates were observed.

While the insurer from which claims data were drawn had a substantial market share and a wide distribution of coverage by state, industry type, and company size, it did not cover federal government employees, railroad workers, longshoreman, and harbor workers, since these workers are covered by separate federal government programs (32). In addition, it did not cover workers from states that prohibit private insurance carriers. As such, it is not known whether the observed effect generalizes to persons receiving workers' compensation under such arrangements. An additional limitation is related to the loss of sensitivity associated with collapsing variables. The work-related variables (ie, industry and occupation) were reduced to crude categories. As such, substantial residual confounding may have existed. With regard to rurality, an inspection of rurally grouped work-disability means suggested that the relationship between rurality and work disability is not linear in that there is a steady decrease until 40–50% rural, at which point the rates once again rise and then fall in the case of the most rural grouping (ie, 90–100%). Although this trend is intriguing, sample size restrictions prevented further investigation of the phenomenon.

Although the study has limitations, it also has strengths. The sample is large and comprehensive. The states were chosen for representativeness and thus increased the likelihood of the generalizability of the findings. The state rurality means of the sample were generally within one to two percentage points of the state population figures (also calculated using census 2000 data). Altogether, 14.2% of the population in the sampled states lived in rural areas according to the definition of the US Census Bureau, state proportions ranging from 5.5% in California to 29.3% in Indiana. Altogether, 17.4% of the sample was defined as rural—slightly more than the population demographics. When comparisons are made with reports of the Bureau of Labor Statistics on the number of fractures resulting in time off by industry, similar proportions are observed, the exceptions being an underrepresentation in construction (11%) and an overrepresentation among transportation and service workers (9% and 6%, respectively). All of the other industries were within four percentage points of the national population figures. The proportions were also similar when comparisons were made with data from the Bureau of Labor Statistics, which reported fractures by occupation.

This study focused on traumatic injury. The extent to which findings are applicable beyond fractures is unknown. However, given the psychosocial characteristics discussed, it can be suspected that the observed differences would be more pronounced for injuries with less definitive diagnoses, such as low-back pain, for which the treatment choices are more varied and care seeking is more likely to be influenced by personal choice. The current sample may not include a true representation of the entire working population; rather the sample represents a typical distribution of occupations among those with injuries covered by workers' compensation. This situation should be taken into consideration when findings are extrapolated to broader populations.

In our study, aggregate disability duration was investigated. Questions that remain include whether or not people in more rural areas return to work faster, whether they maintain their first return to work, or whether their shorter duration of work disability is associated with subsequent or multiple work-disability episodes, and whether more rural populations have the same rates of work-disability recurrence. Although rural residents exhibit characteristics that may help them experience decreased work disability, these characteristics may also mean that they do not seek health care, the result being a greater risk of re-injury. In this study, the focus was on compensated time away from work. Consequently, days with restricted duty were not included in the calculations of the duration of work disability. Given a shift in the composition of lost workday injuries towards increased use of days with restricted activity (33), future research might usefully focus on outcomes encompassing duration of restricted duty.

In conclusion, although research has shown that there is a general trend for those in rural areas to experience increased rates of mortality and morbidity and achieve inferior health outcomes, at least in terms of the measures employed, it would seem that this trend does not extend to work-disability outcomes after work-related injuries. Our findings suggest that features of rural environments, cultures, and behavioral patterns may facilitate return to work after injury, the implication being that the disability management of urban residents may be informed by the experience of rural residents. Further investigation into the reasons why differences exist has the potential to result in the identification of strategies that may be useful in decreasing work disability in urban populations.

Acknowledgments

This research was performed at and funded by the Liberty Mutual Research Institute for Safety.

Santosh Verma, Andrea Blakemore, Jason Chou, and Manuel Cifuentes are acknowledged for their assistance with this work.

References

- Improvements in workplace safety—United States, 1900–1999. *MMWR Morb Mortal Wkly Rep.* 1999;48(22):461–9.
- Weil D. Valuing the economic consequences of work injury and illness: a comparison of methods and findings. *Am J Ind Med.* 2001;40(4):418–37.
- Dembe AE. The social consequences of occupational injuries and illnesses. *Am J Ind Med.* 2001;40(4):403–17.
- Eberhardt MS, Pamuk ER. The importance of place of residence: examining health in rural and nonrural areas. *Am J Public Health.* 2004;94(10):1682–6.
- Adams CE, Michel Y, DeFrates D, Corbett CF. Effect of locale on health status and direct care time of rural versus urban home health patients. *J Nurs Adm.* 2001;31(5):244–51.
- Gabella B, Hoffman RE, Marine WW, Stallones L. Urban and rural traumatic brain injuries in Colorado. *Ann Epidemiol.* 1997;7(3):207–12.
- Lee AH, Somerford PJ, Yau KK. Factors influencing survival after stroke in Western Australia. *Med J Aust.* 2003;179(6):289–93.
- Maeland JG, Havik OE. Return to work after a myocardial infarction: the influence of background factors, work characteristics and illness severity. *Scand J Soc Med.* 1986;14(4):183–95.
- Sanders KM, Nicholson GC, Ugoni AM, Seeman E, Pasco JA, Kotowicz MA. Fracture rates lower in rural than urban communities: the Geelong Osteoporosis Study. *J Epidemiol Community Health.* 2002;56(6):466–70.
- Schlenker RE, Powell MC, Goodrich GK. Rural-urban home health care differences before the Balanced Budget Act of 1997. *J Rural Health.* 2002;18(2):359–72.
- Schootman M, Fuortes L. Functional status following traumatic brain injuries: population-based rural-urban differences. *Brain Inj.* 1999;13(12):995–1004.
- Young AE, Strasser R, Murphy GC. Agricultural workers' return to work following spinal cord injury: a comparison with other industry workers. *Disabil Rehabil.* 2004;26(17):1013–22.
- Johnstone B, Price T, Bounds T, Schopp LH, Schootman M, Schumate D. Rural/urban differences in vocational outcomes for state vocational rehabilitation clients with TBI. *NeuroRehabilitation.* 2003;18(3):197–203.
- Murphy PL, Sorock GS, Courtney TK, Webster BS, Leamon TB. Injury and illness in the American workplace: a comparison of data sources. *Am J Ind Med.* 1996;30(2):130–41.
- Johnson WG, Baldwin ML, Burton JF Jr. Why is the treatment of work-related injuries so costly?: new evidence from California. *Inquiry.* 1996;33(1):53–65.
- Hart LG, Larson EH, Lishner DM. Rural definitions for health policy and research. *Am J Public Health.* 2005;95(7):1149–55.
- US Census Bureau. Census 2000 Urban and Rural Classification. Washington (DC): US Department of Commerce, Bureau of the Census Geography Division; 2002.
- US Census Bureau. Census of population and housing, 2000: summary file 3. Washington DC: US Department of Commerce, Bureau of the Census; 2003.
- US Office of Management and Budget, Executive Office of the President. Standard industrial classification (SIC) manual. Washington (DC): GPO; 1987.
- International Labour Office (ILO). ISCO-88: International Standard Classification of Occupations. Geneva: ILO; 1990.
- Wasiak R, Pransky G, Yao P. Geographic variation in surgical treatment for work-related carpal tunnel syndrome: does improved return to work matter? *Work.* 2006;26:3–11.
- Burton J. A primer on workers' compensation. *Work Compens Policy Rev.* 2004;4(6):2–16.
- Mahmud MA, Webster BS, Courtney TK, Matz S, Tacci JA, Christiani DC. Clinical management and the duration of disability for work-related low back pain. *J Occup Environ Med.* 2000;42(12):1178–87.
- Heckman T, Somlai A, Peters J, Walker J, Otto-Salaj L, Galdabini C, et al. Barriers to care among persons living with HIV/AIDS in urban and rural areas. *AIDS Care.* 1998;10(3):365–75.
- Veitch P, Sheehan M, Holmes J, Doolan T, Wallace A. Barriers to the use of urban medical services by rural and remote area households. *Aust J Rural Health.* 1996;4(2):104–10.
- Hart L, Salsberg E, Phillips D, Lishner D. Rural health care providers in the United States. *J Non-metrop Health.* 2002;18 suppl:211–32.
- Ricketts K, Johnson-Webb K, Randolph R. Populations and places in rural America. In: Ricketts T, editor. *Non-metropolitan health in the United States.* New York (NY): Oxford University Press; 1999. p 7–24.
- Craft BJ, Grasser C, Johnson DR, Ortega ST. Coping strength and adversity of depression or alcohol use: the human spirit or ruralness? *Rural Mental Health.* 2001;Winter:19–26.
- Lee HJ. Rural elderly individuals: strategies for delivery of nursing care. *Nurs Clin North Am.* 1993;28(1):219–230.
- Blackwell TL, Leierer S, Haupt S, Kampotsis A. Predictors of vocational rehabilitation return to work outcomes in workers compensation. *Rehabil Couns Bull.* 2003;46(54–57).
- Dichraff RM. When the injured worker retains an attorney: the relationship between attorney involvement and case outcome. *AAOHN J.* 1993;41(10):491–8.
- Pransky G, Wasiak R, Himmelstein J. Disability systems: the physician's role. *Clin Occup Environ Med.* 2001;1(4): 829–42.
- Ruser J. The changing composition of lost-workday injuries. *Mon Labor Rev.* 1999;122(6):11–17.

Received for publication: 13 April 2007