Health Status and Risk Indicator Trends of the Aging US Health Care Workforce

David J. Lee, PhD, Lora E. Fleming, MD, PhD, MPH, MSc, William G. LeBlanc, PhD, Kristopher L. Arheart, EdD, Kenneth F. Ferraro, PhD, Marcie Pitt-Catsouphes, PhD, Carles Muntaner, MD, PhD, Cristina A. Fernandez, MSEd, Alberto J. Caban-Martinez, DO, PhD, MPH, Evelyn P. Davila, PhD, Frank C. Bandiera, MPH, John E. Lewis, PhD, and Diana Kachan, BS

Objectives: To describe the health status and risk indicator trends in a representative sample of US health care workers aged 45 years and older. **Methods:** Using pooled data from the 1997 to 2009 National Health Interview Survey, logistic regression analyses were performed to determine whether age-group specific morbidity risks differed within occupational subgroups of the health care workforce ($N = 6509$). Health and morbidity trends were examined via complex survey adjusted and weighted chi-squared tests. **Results:** Rates of functional limitation and hypertension increased among diagnosing/assessing health care workers. The prevalence of hearing impairment, cancer, and hypertension was two to three times greater in health-diagnosing/assessing workers aged 60 years and older than in younger workers. Health care service workers were up to 19 times more likely to be obese than workers who diagnose/assess health. **Conclusions:** Healthier workplaces and targeted interventions are needed to optimize the ability to meet health care demands of this aging workforce.

The US workforce is growing older as more people delay retirement or continue working in their later years.[1,2] According to the Bureau of Labor Statistics, the proportion of workers 55 years and older is projected to increase from 18.1% of the labor force in 2008 to 23.9% in 2018.[3] This phenomenon extends to the health care workforce, in which more workers will be needed to meet rising health care demands, both in terms of volume and the complexity of care.[4] With few exceptions, little is known about the health status of older US health care workers.[5] In general, older workers typically experience physical and cognitive changes due to aging.[6] Examples of physical and cognitive changes that accelerate after middle age include decline of visual and hearing acuity, overall decline in health, increase in body mass index, and increased risk of hypertension and coronary artery disease.[7–9] Health care workers are at an increased risk for a wide range of hazards, occupational injuries, and illnesses due to these underlying physical and cognitive changes combined with physical job demands, extended work schedules, and exposure to chemicals and pathogens.[10] Furthermore, health care workforce job-specific demands can vary considerably, from sedentary to physically demanding work activities. The level of physical demands associated with a given job may, therefore, influence the likelihood of continued employment as workers age. For example, nurse's aides often engage in physically demanding work, such as heavy lifting.[10] Incidence rates of musculoskeletal disorders among these workers are among the highest in the US workforce and have recently been increasing.[11,12] The aim of this study was to investigate health status and risk indicator trends in a large representative sample of US health care workers aged 45 years and older.

METHODS

Description of Survey

The National Health Interview Survey (NHIS) is an annual multipurpose household survey designed to be representative of the US civilian noninstitutionalized population.[13] Annual response rates of the 1997 to 2009 adult core, in which information about health and occupational status was collected, averaged 71.3% (range, 62.6 to 80.4).[14–26]

Measures

Occupational Classification

Participants aged 18 years or older were asked about employment status during the week prior to their NHIS interview.[27] Between 1997 and 2004, the NHIS used a 41-category recode of the 1990 Standard Occupational Classification System Census codes for occupation, which permitted the classification of health care workers into four categories[28]: (1) health-diagnosing occupations (eg, physicians); (2) health-assessing and treating occupations (eg, registered nurses); (3) health technologist and technician occupations (eg, licensed practical nurses); and (4) health service occupations (eg, health and nursing aides). Table 1 includes all of the classifications included in the four categories. In 2005, a revision of the 2000 Standard Occupational Classification codes was used to classify occupations.[29,30] This necessitated collapsing workers into two categories: (1) "health-diagnosing/assessing/treating occupations," and (2) "health technologists/technicians and service occupations," to examine trends over the 1997 to 2009 study period.

Health Status and Risk Indicators

All selected health status and risk indicator measures were consistently assessed from 1997 to 2009 and used in previous publications.[5,31,32] These included 12 items assessing functional limitations (eg, "walk a quarter mile" and "push or pull large objects"). In this study, the report of any limitation was coded as having "any limited functioning" and three or more limitations were coded as having "limited functioning in three or more domains." Obesity was defined as a body mass index of 30.0 kg/m^2 or more, and severe obesity was defined as a body mass index of 35.0 kg/m^2 or more. Report of current visual or hearing impairment was coded as previously described.[31] Lifetime histories of health care provider–diagnosed cancer and hypertension and overall health status were reported.

From the Department of Epidemiology and Public Health (Drs Lee, Fleming, LeBlanc, Arheart, Caban-Martinez, Davila, Mr Bandiera, Ms Fernandez, and Ms Kachan), and Department of Psychiatry and Behavioral Sciences (Dr Lewis), University of Miami Miller School of Medicine, Miami, Fla.; European Centre of Environment and Human Health (ECEHH) (Dr Fleming), University of Exeter, Truro, Cornwall, UK; Center on Aging and the Life Course (Dr Ferraro), Purdue University West Lafayette, Ind.; Center on Aging & Work/Workplace Flexibility (Dr Pitt-Catsouphes), Boston College Chestnut Hill, Mass.; and Department of Nursing (Dr Muntaner), University of Toronto, Toronto, Ontario, Canada.

Disclosure: The study was supported by National Institute of Occupational Safety and Health, 2R01OH003915 and 1F30AG040886-01 and by EU ERDF Funding (ECEHH). The authors declare no conflict of interest.

Address correspondence to: David J. Lee, PhD, Department of Epidemiology and Public Health, University of Miami Miller School of Medicine, 1120 NW 14th St, Rm 1530, Miami, FL 33136 (DLee@med.miami.edu).

DOI: 10.1097/JOM.0b013e318247a379

TABLE 1. Standard Occupational Classification Codes and Corresponding Health Occupations*

Health-diagnosing occupations	Physicians
	Dentists
	Veterinarians
	Optometrists
	Podiatrists
	Health diagnosing practitioners, not classified elsewhere
Health-assessing and treating occupations	Registered nurses
	Pharmacists
	Dietitians
	Respiratory therapists
	Occupational therapists
	Physical therapists
	Speech therapists
	Therapists, not classified elsewhere
	Physicians' assistants
Health technologist and technicians	Clinical laboratory technologists and technicians
	Dental hygienists
	Health record technologists and technicians
	Radiologic technicians
	Licensed practical nurses
	Health technologists and technicians, not classified elsewhere
Health service	Dental assistants
	Health aides, except nursing
	Nursing aides, orderlies and attendants

*From Chou and Johnson.[28] Reprinted with permission.

Statistical Analysis

Analyses were completed with adjustments for sample weights and design effects using SUDAAN and SAS to obtain standard errors (SUDAAN, Language Manual, release 9.0, Research Triange Institute, Research Triangle Park, NC; SAS version 9.2, SAS Institute, Inc., Cary, NC). The pooled analyses across the years 1997 to 2004 were performed in the four occupation groups for workers aged 45 to 59 years and 60 years and older ($n = 4149$), with adjustments for survey weights.[13,33] Chi-squared tests were performed to determine whether age-group specific morbidity risk estimates differed within occupational subgroups. Prevalence estimates for workers employed in the occupational subgroups were considered significantly different from the prevalence for all workers employed in the health care service sector if the corresponding subgroup's 95% confidence interval did not include the overall sector prevalence rate estimate.[34] Health and morbidity trends were examined from 1997 to 2009 via weighted linear regression models (including the intercept, occupational group, year, and the group-year interaction) and fit to the annual design-adjusted rates for the two collapsed health care occupational groups of 45 years of age and older ($n = 6509$). The weight used for each annual rate was the inverse of its variance. Respondents with missing information for a particular variable were excluded from these analyses.

RESULTS

Workforce Age Trend Analyses: 1997 to 2009

The average age of the US health care workforce aged 45 years and older significantly increased at an annual rate of 0.15 years among health-diagnosing/assessing/treating workers (SE, 0.05; $P = 0.005$) and 0.12 years among workers employed in the health technologist/technician and service occupations (SE, 0.05; $P = 0.021$). In 2009, the average age of workers aged 45 years and older in these two collapsed occupational categories was 54.1 and 54.9 years, respectively.

Demographic Characteristics of the US Health Care Workforce: 1997 to 2004

Compared with other workers in this sector, bivariate analyses reported in Table 2 reveal that those employed in the health-diagnosing occupations were much more likely to be men (81% vs 9% to 19%) and were more likely to be 60 years of age and older (26% vs 13% to 21%). The demographic characteristics of the health-assessing and treating occupations were similar to those employed in the health technologist/technician occupations, with the exception of a lower proportion of workers in this latter category with at least some college education (81% vs 97%). Compared with other workers in this sector, those employed in health service occupations were more likely to be women (92% vs 19% to 86%), report their race as black (28% vs 2% to 13%), have less than a high school education (21% vs 1%), and live below the federal poverty line (10% vs 1% to 2%).

Pooled Morbidity Analyses: 1997 to 2004

The prevalence of morbidity indicators was often greater among older than among younger health care workers, although differences varied as a function of employment within each of the four health care occupational groups (Table 3). For example, there was a nearly 2-fold difference in the prevalence of any functional limitation in older than in younger health-diagnosing professionals (22.6% vs 11.5%), with smaller age-group differences observed in the other worker groups. The prevalence of hearing impairment, cancer, and hypertension was two to three times greater in the health-diagnosing workers and among the health-assessing/treating workers aged 60 years and older than workers aged 45 to 59 years (all $P < 0.05$). Prevalence rate differences in older versus younger health technologist/technician workers were not as large. The prevalence of hypertension, however, and of having three or more functional limitations were significantly higher in older than in younger workers. Prevalence rates were significantly larger in older than in younger service workers for reports of any functional limitations, reported hearing impairment, and history of hypertension and coronary heart disease. However, rates of severe obesity were significantly lower in older than in younger health care service workers (8.5% vs 15.2%).

When making age-group specific comparisons across the occupational groups, health service workers were more likely to report functional limitations (up to a 3.3-fold difference), hypertension (up to a 2.6-fold difference), poor overall health (up to a 6.8-fold difference), and be obese (up to a 3.6-fold difference) than other health care worker groups. Rates of severe obesity were 19 times greater in younger health service workers relative to younger health-diagnosing workers (15.2% vs 0.8%, respectively). Health-diagnosing workers tended to report the lowest prevalence of health status and risk indicators, although workers aged 60 years and older reported the highest prevalence of hearing impairment (29.7%) and heart disease (14.7%) relative to all other subgroups.

Morbidity Trend Analyses: 1997 to 2009

As shown in Fig. 1a, health-diagnosing/assessing/treating occupations experienced a significant annual average increase in the prevalence of any functional limitation 0.46% (SE, 0.18; $P = 0.021$) from 1997 to 2009, but no increase was observed for health technologists/technicians and service workers (0.13%; SE, 0.20; $P = 0.513$). The prevalence of obesity and severe obesity varied between 1997 and 2009, with obesity rising for the health-diagnosing/assessing/treating occupations from 17% in 1997 to 27% in 2009, but none of these trends were significant at the $P < 0.05$ level (Fig. 1b). Figure 1c, however, shows significant

TABLE 2. Demographic Characteristics of the US Health Care Sector Workforce Aged 45 and Older: Pooled Data, 1997 to 2004 National Health Interview Surveys

Demographic Indicator	Health Diagnosing Occupations (*N*= 474), %* (SE)	Health Assessing and Treating Occupations (*N* = 1,621), %* (SE)	Health Technologist/ Technician Occupations (*N* = 699), %* (SE)	Health Service Occupations (*N* = 1,341), %* (SE)
Age group, yr				
45–59	73.8 (2.11)	87.3 (0.86)	86.9 (1.36)	79.2 (1.22)
≥60	26.2 (2.11)	12.7 (0.86)	13.1 (1.36)	20.8 (1.22)
Gender				
Men	80.6 (2.05)	13.9 (1.07)	19.3 (1.86)	8.5 (1.00)
Women	19.4 (2.05)	86.1 (1.07)	80.7 (1.86)	91.5 (1.00)
Race				
White	87.7 (1.88)	86.2 (0.91)	80.1 (1.77)	66.0 (1.54)
Black	2.4 (0.63)	9.4 (0.67)	12.6 (1.17)	28.1 (1.49)
Other	9.9 (1.81)	4.4 (0.68)	7.7 (1.45)	5.8 (0.73)
Ethnicity				
Hispanic	3.1 (0.88)	3.1 (0.45)	5.0 (0.83)	9.8 (0.87)
Non-Hispanic	96.9 (0.88)	97.0 (0.45)	95.0 (0.83)	90.2 (0.87)
Educational attainment				
Less than high school	0.5 (0.35)	0.5 (0.17)	1.3 (0.46)	21.1 (1.28)
High school/General Educational Development degree	0.9 (0.40)	2.8 (0.46)	17.8 (1.53)	42.4 (1.47)
Some college or higher	98.6 (0.53)	96.7 (0.50)	80.9 (1.60)	36.5 (1.62)
Poverty status†				
Not poor	97.0 (0.92)	97.5 (0.40)	93.5 (1.06)	65.5 (1.65)
Near poor	1.8 (0.69)	1.8 (0.32)	5.0 (0.93)	24.2 (1.43)
Poor	1.2 (0.62)	0.8 (0.25)	1.6 (0.60)	10.3 (0.95)

*Column totals for each demographic indicator do not always total 100% due to rounding error.

†Based on ratio of family income to census-derived poverty threshold: not poor = 200% or higher; near poor = 100% to less than 200%; poor = less than 100%.

average annual increases in the prevalence of reported hypertension for health-diagnosing/assessing/treating workers (0.89%; SE, 0.25; $P = 0.002$) but not for health technologists/technicians and service workers (0.42%; SE, 0.25; $P = 0.108$).

DISCUSSION

These findings provide evidence that the proportion of workers reporting any difficulty with one or more activities (such as walking, stooping, or bending) has significantly increased over time among health-diagnosing/assessing/treating workers aged 45 years and older. In addition, the proportion of diagnosing/assessing/treating workers who reported being hypertensive also rose significantly over time. These trends foreshadow important resource needs for health care workers in the coming decade.

Similar to the US workforce in general,[27] the prevalence of obesity was significantly different by occupational grouping; it was lowest among health-diagnosing occupations and highest among health service occupations. The proportion of older health service workers with severe obesity was significantly lower than in younger workers employed in the same sector (8.5% vs 15.2%). This age-group pattern is generally opposite that noted for other health status and risk indicators, irrespective of health care sector, and may be a reflection of work-selection processes because severe obesity is associated with early retirement in the US workforce (Table 3).[35] Given the documented association between mobility limitations and severe obesity levels in older adults,[36] it is likely that the job demands inherent in many health service occupations only increase the risk of early retirement. Employment growth in the health care service sector is projected to be the greatest among health service occupations (eg, home health aides and medical assistants),[4] yet as noted in Table 3, the health status of those employed in this sector is substantially worse than those employed in other health care sectors. These traditionally poorly paid occupations often have limited employee benefits and are characterized by high employee turnover, which adversely affects patient care. Work-related emotional strain also places an additional burden on many workers in this sector.[37]

As shown in Table 2, there is more demographic diversity among workers employed in the health service occupations. This diversity includes educational attainment from less than a high school education (21%) to some college or higher (37%). Such a range of educational levels can present challenges in the design and delivery of health education messages and targeted health promotion interventions in older populations.[38–40] In addition, 10% of this workforce resides in households living below the poverty line. Health promotion activities are even more challenging among those living with limited financial resources.[40] Although the research is limited, successful health promotion interventions for older workers in general,[41] and specifically among health service workers and other nursing personnel,[42,43] have been reported, yet most of these interventions have focused on improving physical fitness, teaching patient transfer skills, and use of lift-assist equipment,[42–44] with only one reported intervention designed to reduce stress levels.[45] This research reveals

TABLE 3. Prevalence of Health Status Indicators Within Health Care Occupations: Pooled Data, 1997–2004 National Health Interview Surveys

Health Status/Risk Indicator	Health Care Service Sector Occupations, % (95% CI)									
	All Health Care Sector Workers*		Health Diagnosing Occupations*†		Health Assessing and Treating Occupations*†		Health Technologist/ Technician Occupations*†		Health Service Occupations*†	
	45–59 yr (*N* = 3,347)	≥60 yr (*N* = 802)	45–59 yr (*N* = 343)	≥60 yr (*N* = 131)	45–59 yr (*N* = 1,382)	≥60 yr (*N* = 239)	45–59 yr (*N* = 590)	≥60 yr (*N* = 109)	45–59 years (*N* = 1,032)	≥60 yr (*N* = 323)
Any limited functioning	**28.9 (27.1–30.7)**	**38.1 (34.3–42.0)**	***11.5 (8.3–15.9)***	***22.6 (15.3–32.0)***	**26.6 (24.0–29.4)**	**35.0 (28.6–42.0)**	32.5 (28.2–37.2)	40.4 (29.7–52.1)	***37.9 (34.5–41.4)***	***49.3 (43.2–55.4)***
Limited functioning in ≥3 domains	**14.1 (12.9–15.5)**	**19.3 (16.3–22.6)**	***4.2 (2.5–7.2)***	**11.1 (5.9–19.9)**	*11.6 (9.9–13.5)*	14.5 (10.2–20.2)	**15.3 (12.5–18.7)**	**24.3 (16.1–35.0)**	*21.8 (18.9–25.0)*	*26.4 (21.2–32.4)*
BMI ≥30 kg/m^2	25.5 (23.6–27.5)	22.6 (19.3–26.3)	*10.0 (6.8–14.7)*	*9.2 (5.0–16.2)*	23.0 (20.3–25.8)	24.5 (18.6–31.5)	26.9 (22.9–31.3)	22.6 (15.1–32.5)	*35.8 (32.3–39.4)*	*29.1 (23.6–35.3)*
BMI ≥35 kg/m^2	**9.7 (8.6–11.0)**	**6.9 (5.0–9.4)**	*0.8 (0.2–2.9)*	*0.5 (0.1–3.1)*	8.4 (6.8–10.3)	8.0 (4.7–13.1)	11.0 (8.6–14.0)	10.2 (5.6–17.6)	***15.2 (12.8–17.9)***	**8.5 (5.3–13.4)**
Visual impairment	9.2 (8.1–10.4)	9.4 (7.5–11.7)	*3.5 (2.0–6.0)*	6.3 (3.2–11.7)	*7.3 (6.0–9.0)*	6.4 (3.7–11.0)	9.2 (7.0–12.0)	13.9 (8.2–22.8)	*14.7 (12.2–17.5)*	12.2 (8.8–16.6)
Hearing impairment	**13.2 (11.9–14.5)**	**21.9 (18.7–25.6)**	**15.6 (11.9–20.3)**	***29.7 (22.5–38.1)***	***10.7 (9.1–12.6)***	**19.7 (14.5–26.2)**	13.1 (10.3–16.6)	*11.6 (5.9–21.3)*	***16.0 (13.4–18.9)***	**23.2 (18.3–28.9)**
History of cancer	**7.0 (6.1–8.1)**	**12.1 (9.6–15.2)**	**7.2 (5.0–10.4)**	**16.1 (10.6–23.7)**	**7.1 (5.8–8.8)**	**16.6 (11.3–23.7)**	6.9 (5.0–9.4)	10.6 (6.1–18.0)	7.0 (5.3–9.1)	*6.3 (4.0–9.8)*
History of hypertension	**26.6 (24.8–28.4)**	**47.1 (42.7–51.5)**	***14.1 (10.8–18.3)***	**42.9 (33.7–52.6)**	***23.6 (21.1–26.4)***	**48.0 (39.9–56.2)**	**27.7 (23.9–31.9)**	**41.3 (30.8–52.6)**	***36.2 (32.9–39.6)***	**51.0 (44.6–57.4)**
History of coronary heart disease	**6.2 (5.4–7.2)**	**11.5 (9.1–14.4)**	**4.0 (2.1–7.5)**	**14.7 (9.3–22.6)**	6.8 (5.5–8.3)	11.1 (6.4–18.5)	6.9 (5.0–9.4)	10.7 (5.7–19.4)	**5.9 (4.4–8.0)**	**10.1 (6.7–14.9)**
History of asthma	**9.8 (8.6–11.2)**	**7.0 (5.3–9.2)**	7.6 (4.8–11.9)	6.4 (3.0–12.9)	**10.4 (8.7–12.4)**	**5.5 (3.1–9.5)**	10.1 (7.7–13.1)	8.5 (4.2–16.4)	9.7 (7.7–12.3)	8.2 (5.5–12.2)
Current fair/poor health rating	7.3 (6.3–8.4)	9.3 (7.3–11.8)	*2.3 (0.9–5.9)*	4.7 (1.7–12.4)	*3.9 (3.0–5.2)*	4.9 (2.5–9.3)	6.4 (4.4–9.2)	5.2 (2.3–11.5)	*15.6 (13.2–18.3)*	*17.7 (13.7–22.7)*

*Within occupational subgroup category bolded prevalence estimates for 40- to 59-year-old and 60-year-old or older workers are significantly different at the $P < 0.05$ level.
†Italicized health care service sector occupational subgroup prevalence estimates are significantly lower or higher than the age-group specific estimates for the entire health care service sector workforce ($P < 0.05$ level).
CI indicates confidence interval; BMI, body mass index (calculated as weight in kilograms divided by height in meters squared).

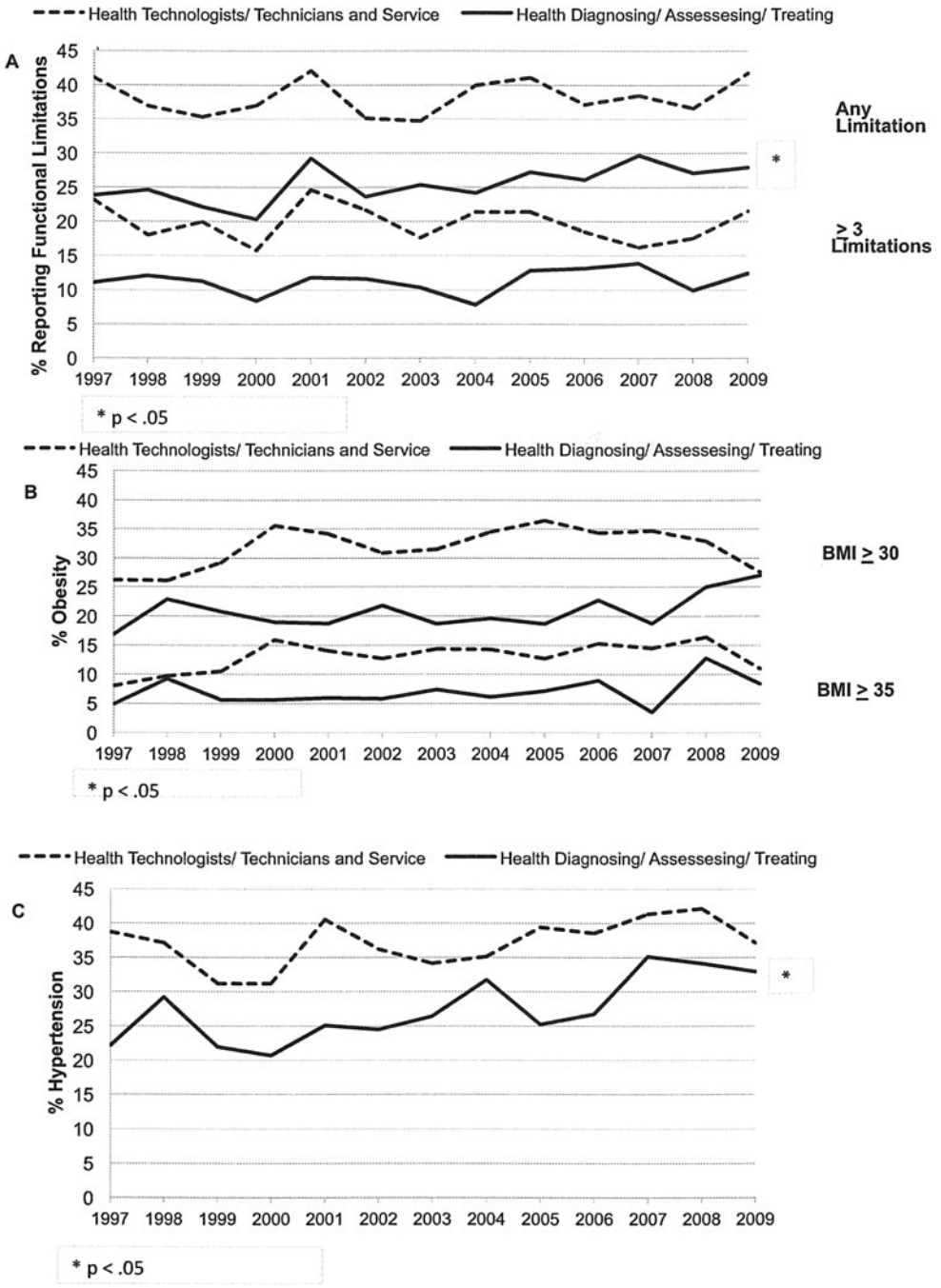

FIGURE 1. Trends in the prevalence of functional limitations in US health care workers aged 45 years and older: The 1997 to 2009 National Health Interview Surveys. Trends in the prevalence of obesity in US health care workers aged 45 years and older: The 1997 to 2009 National Health Interview Surveys. Trends in the prevalence of hypertension in US health care workers aged 45 years and older: The 1997–2009 National Health Interview Surveys.

the need for further development of a broad range of intervention strategies that can reach this diverse and important workforce.

LIMITATIONS

This analysis suffers from many of the limitations seen in large population-based studies including less than optimal response rates (pooled average, 71%)[5] and a limited selection of health indicators. For example, the NHIS does not include detailed questions about musculoskeletal injuries on an annual basis. The data are self-reported, and the degree of under- and overreporting may vary as a function of age, gender, and socioeconomic indicators.[46] Classification of occupation changed in 2005, which required us to collapse health care workers from four groups into two, possibly obscuring important differences in the changes in worker health in these two rather board categories. Sample sizes varied across the health care worker groups leading to differential power to detect statistically significant differences across these groups (Table 3). The strength of this study lies in the use of the NHIS, a nationally representative

sample of the entire US population, which yielded a pooled sample of more than 6500 older health care workers available for analysis.

RECOMMENDATIONS

In addition to improving overall working conditions and benefits, targeted and integrated efforts are needed to address the impact of obesity on worker health across the life course. Only 18% to 44% of employers have implemented programs to address older workers,[47] but interventions can begin early in the worker's career with a lasting impact on their lifestyle as they age.[48] Previous literature has emphasized that the physical and psychosocial work environments should be adjusted to improve the work ability of older workers.[49,50] Provision of workplace accommodations for health impairment has been shown to slow retirement, thus delaying social security payments.[51,52] Such efforts not only will serve to stabilize and grow a vital sector of the US health care workforce, but also may address the large health inequalities presently seen in the US workforce.[53]

REFERENCES

1. Wegman DH. Older workers. *Occup Med*. 1999;14:537–557.
2. Wegman DH, McGee JP. *Health and Safety Needs of Older Workers*. Washington, DC: The National Academies Press; 2004.
3. Bureau of Labor Statistics. *Occupational Outlook Handbook, 2010–2011 Edition*. 2011. Available at: http://www.bls.gov/oco/oco2003.htm. Accessed November 10, 2011.
4. Institute of Medicine. *Retooling for an Aging America: Building the Health Care Workforce*. Washington, DC: Institute of Medicine, The National Academies Press; 2008.
5. Fleming LE, Lee DJ, Martinez AJ, et al. The health behaviors of the older US worker. *Am J Ind Med.* 2007;50:427–437.
6. Silverstein M. Meeting the challenges of an aging workforce. *Am J Ind Med.* 2008;51:269–280.
7. Savinainen M, Nygard CH, Ilmarinen J. A 16-year follow-up study of physical capacity in relation to perceived workload among ageing employees. *Ergonomics*. 2004;47:1087–1102.
8. Virdis A, Bruno RM, Neves MF, Taddei S, Ghiadoni L. Hypertension in the elderly: an evidence-based review. *Curr Pharm Des.* 2011;17:3020–3031.
9. Pew RW, Van Hemel SB. National Research Council (U.S.), Steering Committee for the Workshop on Technology for Adaptive Aging, National Research Council (U.S.), Board on Behavioral Cognitive and Sensory Sciences. *Technology for Adaptive Aging*. Washington, DC: National Academies Press; 2004.
10. Centers for Disease Control and Prevention. Health care workers—NIOSH workplace safety and health topics. 2009. Available at: http://www.cdc.gov/niosh/topics/healthcare/. Accessed August 25, 2011.
11. Wunderlich GS, Sloan FA, Davis CK. Institute of Medicine (U.S.), Committee on the Adequacy of Nurse Staffing in Hospitals and Nursing Homes. *Nursing Staff in Hospitals and Nursing Homes: Is It Adequate?* Washington, DC: National AcademiesPress; 1996.
12. Bureau of Labor Statistics. WORK, 2010 non-fatal occupational injuries and illnesses requiring days away from work, 2010. 2011. Available at: http://www.bls.gov/news.release/pdf/osh2.pdf. Accessed November 10, 2011.
13. Botman SL, Moore TF, Moriarty CL, Parsons VL. Design and estimation for the National Health Interview Survey, 1995–2004. *Vital Health Stat 2*. 2000;June:1–31.
14. Division of Health Interview Statistics, National Center for Health Statistics, Hyattsville, MD; Centers for Disease Control and Prevention. U.S. Department of Health and Human Services. 2008 National Health Interview Survey (NHIS) Public Use Data Release. June 2009. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2008/srvydesc.pdf. Accessed October 19, 2009.
15. Division of Health Interview Statistics, National Center for Health Statistics, Hyattsville, MD; Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. 2007 National Health Interview Survey (NHIS) Public Use Data Release. June 2008. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2007/srvydesc.pdf. Accessed October 20, 2009.
16. Division of Health Interview Statistics; National Center for Health Statistics, Hyattsville, MD; Centers for Disease Control and Prevention; U.S. Department of Health and Human Services. 2006 National Health Interview Survey (NHIS) Public Use Data Release. June 2007. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2006/srvydesc.pdf. Accessed October 30, 2009.
17. Division of Health Interview Statistics, National Center for Health Statistics, Hyattsville, MD; Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. 2005 National Health Interview Survey (NHIS) Public Use Data Release. June 2006. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2005/srvydesc.pdf. Accessed October 20, 2009.
18. Division of Health Interview Statistics, National Center for Health Statistics Hyattsville, MD; Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. 2004 National Health Interview Survey (NHIS) Public Use Data Release. July 2005. Available at: http://www.cdc.gov/nchs/data/nhis/srvydesc.pdf. Accessed October 20, 2009.
19. Division of Health Interview Statistics, National Center for Health Statistics Hyattsville, MD; Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. 2003 National Health Interview Survey (NHIS) Public Use Data Release. December 2004. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2003/srvydesc.pdf. Accessed October 20, 2009.
20. Division of Health Interview Statistics, National Center for Health Statistics Hyattsville, MD; Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. 2002 National Health Interview Survey (NHIS) Public Use Data Release. December 2003. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2002/srvydesc.pdf. Accessed October 20, 2009.
21. Division of Health Interview Statistics, National Center for Health Statistics Hyattsville, MD; Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. 2001 National Health Interview Survey (NHIS) Public Use Data Release. January 2003. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2001/srvydesc.pdf. Accessed October 20, 2009.
22. Division of Health Interview Statistics, National Center for Health Statistics Hyattsville, MD; Centers for Disease Control and Prevention U.S. Department of Health and Human Services. 2000 National Health Interview Survey (NHIS) Public Use Data Release. March 2002. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2000/srvydesc.pdf. Accessed October 20, 2009.
23. Division of Health Interview Statistics, National Center for Health Statistics Hyattsville, MD; Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. 1999 National Health Interview Survey (NHIS) Public Use Data Release. February 2002. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/1999/srvydesc.pdf. Accessed October 20, 2009.
24. Division of Health Interview Statistics, National Center for Health Statistics, Hyattsville, MD; Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. 1998 National Health Interview Survey (NHIS) Public Use Data Release. October 2000. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/1998/srvydesc.pdf. Accessed October 20, 2009.
25. Division of Health Interview Statistics, National Center for Health Statistics, Hyattsville, MD; Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. 1997 National Health Interview Survey (NHIS) Public Use Data Release. February 2000. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/1997/srvydesc.pdf. Accessed October 20, 2009.
26. Division of Health Interview Statistics, National Center for Health Statistics, Hyattsville, MD; Centers for Disease Control and Prevention. U.S. Department of Health and Human Services. 2008 National Health Interview Survey (NHIS) Public Use Data Release 2008. June 2009. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2009/srvydesc.pdf. Accessed August 9, 2010.
27. Caban AJ, Lee DJ, Fleming LE, Gomez-Marin O, LeBlanc W, Pitman T. Obesity in US workers: the National Health Interview Survey, 1986 to 2002. *Am J Public Health*. 2005;95:1614–1622.
28. Chou CF, Johnson PJ. Health disparities among America's health care providers: evidence from the Integrated Health Interview Series, 1982 to 2004. *J Occup Environ Med*. 2008;50:696–704.
29. National Health Interview Survey .2005 NHIS Data Release. SOC Major Groups. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHIS/2005/SOC_Major_Groups05.pdf. Accessed November 1, 2009.
30. Scopp TS. *The Relationship Between the 1990 Census and Census 2000 Industry and Occupation Classification Systems*. Technical Paper 65: U.S. Census Bureau; 2003.
31. Davila EP, Caban-Martinez AJ, Muennig P, et al. Sensory impairment among older US workers. *Am J Public Health*. 2009;99:1378–1385.

32. Fleming LE, Pitman T, LeBlanc WG, et al. Interactive Monograph of Occupation, Disability, and Self-reported Health: The National Health Interview Survey (NHIS) 1986–1994. Available at: http://www.umiamiorg.com/publications/monograph/disability_monograph.htm. Accessed March 2, 2012.
33. Botman SL, Jack SS. Combining National Health Interview Survey Datasets: issues and approaches. *Stat Med*. 1995;14:669–677.
34. Rosner BA. *Fundamentals of Biostatistics*, 5th ed. Pacific Grove, CA: Duxbury; 2000.
35. Renna F, Thakur N. Direct and indirect effects of obesity on U.S. labor market outcomes of older working age adults. *Soc Sci Med*. 2010;71:405–413.
36. Vincent HK, Vincent KR, Lamb KM. Obesity and mobility disability in the older adult. *Obes Rev*. 2010;11:568–579.
37. Muntaner C, Li Y, Xue X, Thompson T, Chung H, O'Campo P. County and organizational predictors of depression symptoms among low-income nursing assistants in the USA. *Soc Sci Med*. 2006;63:1454–1465.
38. Institute of Medicine (U.S.). Committee on Communication for Behavior Change in the 21st Century: Improving the Health of Diverse Populations. *Speaking of Health: Assessing Health Communication Strategies For Diverse Populations*. Washington, DC: National Academies Press; 2002.
39. United States. Agency for Healthcare Research and Quality, Research Triangle Institute-University of North Carolina Evidence-based Practice Center. *Literacy and Health Outcomes*. Rockville, MD: The Agency; 2004.
40. Thompson SE, Smith BA, Bybee RF. Factors influencing participation in worksite wellness programs among minority and underserved populations. *Fam Community Health*. 2005;28:267–273.
41. Crawford JO, Graveling RA, Cowie HA, Dixon K. The health safety and health promotion needs of older workers. *Occup Med (Lond)*. 2010;60:184–192.
42. Dawson AP, McLennan SN, Schiller SD, Jull GA, Hodges PW, Stewart S. Interventions to prevent back pain and back injury in nurses: a systematic review. *Occup Environ Med*. 2007;64:642–650.
43. Skargren E, Oberg B. Effects of an exercise program on musculoskeletal symptoms and physical capacity among nursing staff. *Scand J Med Sci Sports*. 1996;6:122–130.
44. Evanoff B, Wolf L, Aton E, Canos J, Collins J. Reduction in injury rates in nursing personnel through introduction of mechanical lifts in the workplace. *Am J Ind Med*. 2003;44:451–457.
45. Horneij E, Hemborg B, Jensen I, Ekdahl C. No significant differences between intervention programmes on neck, shoulder and low back pain: a prospective randomized study among home-care personnel. *J Rehabil Med*. 2001;33:170–176.
46. Engstrom JL, Paterson SA, Doherty A, Trabulsi M, Speer KL. Accuracy of self-reported height and weight in women: an integrative review of the literature. *J Midwifery Womens Health*. 2003;48:338–345.
47. AARP. American business and older employees: a summary of findings. 2000; Available at: http://assets.aarp.org/rgcenter/econ/amer_bus_findings.pdf. Accessed November 11, 2011.
48. Capodaglio P. [Physical exercise in the prevention of musculoskeletal diseases in the elderly worker]. *Med Lav*. 2000;91:379–386.
49. Ilmarinen J, Rantanen J. Promotion of work ability during ageing. *Am J Ind Med*. 1999;suppl 1:21–23.
50. Ilmarinen J, Tuomi K, Klockars M. Changes in the work ability of active employees over an 11-year period. *Scand J Work Environ Health*. 1997;suppl 1:49–57.
51. Burkhauser RV, Butler JS, Kim YM. The impairment of employer accommodation on job duration of workers with disabilities: a hazard model approach. *Labor Economics*. 1995;3:1–22.
52. Burkhauser RV, Butler JS, Kim YM, Weathers RR. The importance of accommodation on the timing of male disability insurance application: results from the survey of disability and work and the health and retirement survey. *J Hum Resour* 1999;34:589–611.
53. Krieger N. Workers are people too: societal aspects of occupational health disparities—an ecosocial perspective. *Am J Ind Med*. 2010;53:104–115.

ERRATUM

Increases in the Use and Costs of Opioids to Treat Acute and Chronic Pain in Injured Workers, 1999 to 2009: Erratum

In an article published in the February 2012 issue of the *Journal of Occupational and Environmental Medicine*[1], the following table contained two errors. The correct data, highlighted in grey, appears below. The authors regret the error.

REFERENCE

1. Bernacki E, Yuspeh L, Lavin R, Tao X. Increases in the use and cost of opioids to treat acute and chronic pain in injured workers, 1999 to 2009. *J Occup Health*. 2012;54:216–223.

TABLE 3. Average Opioid Costs for Claims with Long Acting ± Short Acting and for Claims with Short Acting Only by Year

	0 Yr					1-7 Yr				
	Claims With SA Scripts Only		Claims With Any LA Scripts			Claims With SA Scripts Only		Claims With Any LA Scripts		
Script Year	*n*	Average Opioid Cost (SA)	*n*	Average Opioid Cost (LA+SA)	Opioid Cost Ratio: Claims (SA)/Claims (LA+SA)	*n*	Average Opioid Cost (SA)	*n*	Average Opioid Cost (LA+SA)	Opioid Cost Ratio: Claims (SA)/Claims (LA+SA)
1999	880	$62	30	$403	6.53	1617	$232	214	$1,337	5.77
2000	856	$61	36	$346	5.63	1538	$259	358	$1,666	6.44
2001	1290	$76	43	$537	7.11	1652	$275	354	$2,080	7.55
2002	1474	$79	23	$898	11.39	2135	$305	335	$2,421	7.93
2003	928	$95	25	$1,114	11.78	2071	$336	313	$2,764	8.23
2004	700	$95	16	$481	5.05	1732	$424	262	$3,532	8.32
2005	764	$72	13	$926	12.85	1574	$371	217	$3,339	9.00
2006	702	$66	27	$456	6.87	1327	$362	237	$2,091	5.78
2007	638	$61	21	$505	8.25	1089	$306	239	$2,486	8.12
2008	536	$66	17	$643	9.75	879	$271	189	$2,743	10.14
2009	428	$67	20	$774	11.57	842	$277	142	$2,717	9.81
Average	836	$74	25	$610	8.25	1496	$315	260	$2,426	7.71

LA, long acting; SA, short acting.

