HHS Public Access

Author manuscript

J Occup Environ Med. Author manuscript; available in PMC 2016 June 27.

Published in final edited form as:

J Occup Environ Med. 2016 April ; 58(4): 335–343. doi:10.1097/JOM.0000000000000670.

Prevalence of Injury in Occupation and Industry: Role of Obesity in the National Health Interview Survey 2004 to 2013

Ja K. Gu, MSPH, **Luenda E. Charles, PhD, MPH**, **Desta Fekedulegn, PhD**, **Claudia C. Ma, MPH**, **Michael E. Andrew, PhD**, and **Cecil M. Burchfiel, PhD, MPH**

Biostatistics and Epidemiology Branch, Health Effects Laboratory Division, National Health Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Morgantown, West Virginia

Abstract

Objectives—The aim of this study was to estimate prevalence of injury by occupation and industry and obesity's role.

Methods—Self-reported injuries were collected annually for US workers during 2004 to 2013. Prevalence ratios (PRs) and 95% confidence intervals (CIs) were obtained from fitted logistic regression models.

Results—Overall weighted injury prevalence during the previous three months was 77 per 10,000 workers. Age-adjusted injury prevalence was greatest for Construction and Extraction workers (169.7/10,000) followed by Production (160.6) among occupations, while workers in the Construction industry sector (147.9) had the highest injury prevalence followed by the Agriculture/Forestry/Fishing/Mining/Utilities sector (122.1). Overweight and obese workers were 26% to 45% more likely to experience injuries than normal-weight workers.

Conclusion—The prevalence of injury, highest for Construction workers, gradually increased as body mass index levels increased in most occupational and industry groups.

Work-site injury is a leading cause of morbidity and mortality worldwide. The International Labor Organization estimated that there are approximately 270 million injuries annually at a cost of $76 billion.[1] The Bureau of Labor Statistics (BLS) in the United States (US) reported nearly 3.6 million cases for nonfatal occupational injuries and an incidence rate of 3.5 cases per 100 equivalent full-time workers in 2012.[2] Certain occupational groups had a high incidence rate of injuries and illnesses. Among state or local government employees, the protective services (police and sheriff's patrol officers, correctional officers, and fire fighters) had a rate of 329/10,000 full-time workers, and among private employees, the transportation and material moving occupations had a rate of 278/10,000 full-time workers.[3] Agriculture/forestry/fisheries and construction were among the industry sectors reporting the highest injury risks for workers across all age groups.[4] These two industries have been

Address correspondence to: Ja K. Gu, MSPH, National Institute for Occupational Safety and Health, HELD/BEB, Mailstop L-4050, 1095 Willowdale Rd., Morgantown, WV 26505-2888 (GUM4@CDC.GOV).

Authors Gu, Charles, Fekedulegn, Ma, Andrew, and Burchfiel have no relationships/conditions/circumstances that present potential conflict of interest.

The JOEM editorial board and planners have no financial interest related to this research.

reported to be the most dangerous industries with regard to injuries. In the US construction industry, a study found that the total costs of fatal and nonfatal injuries were estimated at $11.5 billion ($27,000/case) in 2002.[5] A Finnish study discovered that the incidence rate of injury was 7.4/100 in 1996 and the total insurance cost was 23.5 million euros in 1999.[6] Results from a Canadian study showed that workers in the occupation of Manufacturing & Utilities had the highest risk of serious injury, followed by those in Trades, Transport, & Construction.[7]

Several factors are known to be associated with an increased prevalence of injuries and one of the most modifiable is obesity. Obesity among US adults is a major public health concern and the obesity prevalence among US workers is also alarming. In the US, the prevalence of obesity among workers has dramatically increased over the past three decades, from 10% in 1986 to 28% in 2011.[8,9] Employees in the protective services had an obesity prevalence of more than 40% and there was a 36% prevalence in community and social services.[10] Schulte et al[11] showed that obesity is related to increased health care costs and work-related conditions such as injury, cardiovascular disease, asthma, musculoskeletal disorders, stress, and cancer. Multiple studies have provided evidence that increased obesity is a risk factor for workplace injury.[12–15] Obesity was shown to be highly related to musculoskeletal injuries among firefighters.[16] Motor vehicle drivers who are obese tend to decrease seatbelt usage. Therefore, obesity may be associated with vehicular collision related injuries.[17,18]

At least one study has been published on the prevalence of obesity by occupational groups and the association between obesity and occupational injury characteristics (eg, site of injury, type of injury, external causes, treatment places, and missed work days).[13] However, studies investigating the prevalence of injury by occupational and industry groups and the relationship between obesity and work-site injury by occupational and industry groups are rare. Therefore, the aims of this study are to (1) estimate the prevalence of injury among US workers by occupational and industry groups, and (2) investigate the association between obesity and injury across occupational and industry groups using the National Health Interview Survey (NHIS) 2004 to 2013 data.

METHODS

Data

We used data from the NHIS to examine the prevalence of injury among US workers by industry and occupation. The NHIS was developed and administered by the National Center for Health Statistics (NCHS) in the US Centers for Disease Control and Prevention (CDC) to monitor trends in illness and disability and to track health status, health care access, and progress toward achieving national health objectives since 1957. Extensive details about the questionnaire, methodology, data, and documentation are available on the NHIS website.[19]

Data from the past 10 years 2004 to 2013 of the NHIS core questionnaires (Sample Adults, Family) were pooled for statistical analysis. Our sample included paid workers aged 18 years and older who were “working at a job or business” or “with a job or business but not at work” during the week before their interview. The total number of the combined 2004 to 2013 NHIS adults was 289,187 (an average response rate of 79.8%). From this population,

our study included 159,961 working adults, after excluding those who were nonworking, pregnant, or missing the body mass index (BMI) variable.

Occupational Injury

Information on participants' injuries was collected using the Injury and Poisoning questionnaire in the NHIS Family core questionnaire. For our study, injured workers were defined as those who answered that they were "working at a paid job" to the question, "What activity were you involved in at the time of the injury?" Before 2004, the surveys reported all injuries that occurred within four months of the interview. Beginning in 2004, NCHS decided to retain all injury episodes that reportedly occurred during the three months (91 days) before the date of the injury in question to reduce recall bias that may be associated with less serious injury.[19]

Occupational and Industry Groups

The NHIS Sample Adult data obtained verbatim responses from each participant regarding his/her occupation and industry. This information was subsequently reviewed by U.S. Census Bureau coding specialists, who assigned appropriate industry and occupation codes. These codes, developed by U.S. Census Bureau staff for use in noneconomic Federal surveys, are four-digit Census codes for industry and occupation consistent with the North American Industry Classification System (NAICS) and Standard Occupational Classification (SOC).[19] Although the Sample Adult File available for public use does not include the in-house Census codes, it does include an occupation recode with 23 simple categories, which were derived from the 93 SOC occupation groups. As some of 23 occupational groups did not have enough injured workers, we recategorized into 13 occupational groups for this study. For the industries, we also recategorized the 21 sectors to 11 sectors. We excluded participants who worked in the Military-specific occupational group or the Armed Forces industry group, as there were only a small number of injuries in the military occupation and industry.

Obesity

BMI is commonly used as an indicator of adiposity and it is highly correlated with body fat.[20] BMI was calculated as weight in kilograms divided by height in meters squared (kg/m^2). In the Sample Adults questionnaire, participants were asked their height in inches ("How tall are you without shoes?") and their weight in pounds ("How much do you weigh without shoes?") and the values were converted to meters and kilograms, respectively. We used BMI as both a continuous variable and a categorical variable (BMI: 18.5 to 24.9 kg/m^2 for normal weight, 25 to 29.9 kg/m^2 for overweight, 30+ kg/m^2 for obese). We excluded persons who were underweight (BMI <18.5 kg/m^2) because the number of injuries in that group was too small.

Covariates

The NHIS questionnaire collected information from participants on demographics (sex, age, race/ethnicity, marital status, education), lifestyle characteristics (smoking status, alcohol intake, physical activity, sleeping), and job characteristics (length of employment, work

hours, number of employees at work, second job). As several demographic variables may be related to injury and obesity, they were treated as potential confounders: age, sex, race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and all others), marital status (single, married, divorced), education (less than high school graduate, high school graduate or GED, some college or associate degree, and 4-year college or graduate). Sub-sequent models also included lifestyle characteristics and job characteristics, which are associated with both injury and BMI. Smoking status was categorized as never, former, and current. Alcohol intake was classified as never/former, current intake less of three drinks or less per week, and current intake of four or more drinks per week. Sleep duration was dichotomized as inadequate sleep (1 to 6 hours/day) and adequate sleep (7+ hours/day), based on the National Institute of Health recommendation.[21] Physical activity had three levels, inactive, insufficiently active, and sufficiently active. Inactive was defined as participating in no leisure-time aerobic activity that lasted at least 10 minutes; insufficiently active, as participating in moderate-intensity leisure-time aerobic activities for 10 minutes or more but less than 150 minutes per week; and sufficiently active, as participating in moderate-intensity leisure-time aerobic activity for 150 minutes or more per week, or in vigorous-intensity leisure-time aerobic activity 75 minutes or more per week, or an equivalent combination.[22] The number of employees at work was categorized as 1 to 9, 10 to 49, 50 to 249, and more than 250.

Data Analysis

All prevalence estimates (per 10,000 workers) were weighted using the NHIS individual sample adult record weight. Point estimates of injury with the relative standard error larger than 30% were considered unreliable and were identified by a symbol (†) in the tables.[23] The standard errors with complex multistage designs were estimated using Taylor series linearization. SUDAAN v11 was used in all data analysis to account for the complex sample survey design.[24] Age-adjusted prevalence estimates were based on the 2010 U.S. workers standard population by BLS, using five age groups: 18 to 34, 35 to 44, 45 to 54, 55 to 64, more than 65 years.

Associations were assessed for covariates with both injury and BMI using Chi-square and analysis of variance, respectively. Prevalence ratios (PRs), adjusted for covariates, were obtained from average marginal predictions in the fitted logistic regression models.[25] Adjustments were made for the following potential confounders: sex, age, race/ethnicity, marital status, education, smoking status, alcohol intake, sleep duration, physical activity, and number of employee at work. Within occupation and industry groups, PRs were calculated for associations between injury and BMI (using both continuous BMI and categorical BMI). The injury prevalence among overweight or obese workers was compared with that among the normal-weight group. The PRs between occupational and industry groups were also calculated using as the referent group “Professional” (for occupational group) and “Services” (for industry group). We also calculated mean values of BMI by demographic factors, lifestyle characteristics, and job characteristics. Effect modification (ie, interaction) was assessed for all of these variables in the association between obesity and injury but none were found to be significant ($P > 0.05$). Multivariable-adjusted PRs and 95%

confidence intervals (95% CIs) for the main associations were calculated. All reported P values were two-sided and a P value of less than 0.05 was considered statistically significant.

RESULTS

Table 1 summarizes the prevalence of injury and mean values of BMI by demographic, lifestyle, and job characteristics. In this sample of US workers, 54.9% was male and 14.1% was of Hispanic ethnicity. The mean (±SD) age of the sample was 41.4 (±0.07) years. Half of the workers earned less than $35K per year. Approximately 20% of the workers were current smokers. Thirty percent of the workers reported that they had less than 6 hours sleep a day and about two-thirds were overweight or obese. One-fifth of employees worked 50 hours or more per week and 8.8% reported that they had a second job.

The overall weighted prevalence of injury during the past three months was 77.0 per 10,000 workers. The highest prevalence of injury occurred in blacks (87.9/10,000), followed by whites and Hispanics, and the lowest prevalence was in “other” race/ethnicity (46.7). The prevalence of injury declined with age. Several measures of adverse lifestyle behaviors (current smoking, higher alcohol consumption, physical inactivity, short sleep duration, and obesity) were associated with an increased prevalence of work injury. Current smokers had the highest prevalence of injury (118.8), which was almost double that of the never smokers (59.7). Workers who were employed less than a year, worked long hours, or had a second job tended to have a higher prevalence of injury. The prevalence of injury (63.2/10,000) among workers in large industries (≥250 employees) was lower than that (96.4/10,000) in the medium size industries (50 to 249 employees).

The overall mean value of BMI for US workers was 27.6 kg/m^2. Male workers had a significantly higher mean BMI than female workers. Non-Hispanic black workers had the highest average BMI (29.2) of the racial/ethnic groups. Workers who reported more than 7 hours of sleep per day and sufficient physical activity had significantly lower mean BMI than the workers who reported shorter sleep duration and less physical activity. Participants who worked long hours (ie, more than 50 hours/week) had the highest mean BMI (28.3 kg/m^2) compared with those in the other groups.

Table 2 presents results of the prevalence of injury during the past three months across several occupational and industry groups. Among the occupational groups, the age-adjusted prevalence of injury was greatest for Construction and Extraction (166.0/10,000), followed by Production (162.6), Protective Services (135.9), and Installation/Maintenance/Repair (133.5). The occupations showing the lowest prevalence were Professional (28.3) and Office and Administrative Support (43.2). Among the industry categories, workers in the Construction sector (147.9) had the highest injury prevalence, followed by the Agriculture/Forestry/Fishery/Mining sector (122.1) and the Manufacturing sector (111.2). These results represent an estimated 142,000 workers in Construction, 32,000 workers in the Agriculture/Forestry/Fishery/Mining, and 150,000 workers in Manufacturing. The industries showing the lowest prevalence were Services (42.0) and Education (56.2).

Employees with the highest age-adjusted mean BMI were in Protective Service (29.1 kg/m^2) and in Transportation and Material Moving (28.8 kg/m^2) among occupation groups. Workers in the Transportation/Warehousing (28.7 kg/m^2) and the Public Administration (28.5 kg/m^2) had the highest age-adjusted BMI among industry groups. Those having the lowest mean BMI were in Education/Training/Library (26.8 kg/m^2) among occupation groups and in Education (27.0 kg/m^2) among industries.

Figures 1 and 2 show the scatter plots of the age-adjusted mean BMI and the prevalence of injury by occupations and industries, respectively. The employees in Protective Service ("Prtc" in Fig. 1) and Transportation and Material Moving ("Tran") had high mean values of BMI and relatively high injury prevalence. The workers in Construction ("Cnst" in Fig. 2) and in Agriculture/Forestry/Fishery/Mining ("Agrc") had a high prevalence of injury and moderately high mean BMI, while the workers in Transportation and Warehousing ('Tran') and in Public Administration ("Pblc") had high mean BMI and relatively high prevalence of injury. The Education and Services industry sectors both had low mean values of BMI and low prevalence of injury.

The age-adjusted prevalence of injury during the previous three months is reported by occupational and industry groups and BMI category in Table 3. Among occupational groups, the highest injury prevalence occurred among obese employees in Production (200.8/10,000), followed by Construction and Extraction (179.3) and Transportation and Material Moving (178.9). Among industry groups, obese workers in Agriculture/Forestry/Fishery/Mining (170.4/10,000) had the highest injury prevalence, followed by Construction (159.3) and Manufacturing (152.4). The prevalence of injury in most occupational and industry groups gradually increased as obesity levels increased. For example, the prevalence of injury in Management was 20.8 cases per 10,000 workers among those with normal weight, 43.5 among the overweight, and 77.3 among the obese. In the industry categories, the prevalence of injury in the Manufacturing sector was 80.5/10,000 among those with normal weight, 112.5 among the overweight, and 152.4 among the obese.

Table 4 summarizes the association between BMI and the prevalence of occupational injuries after controlling for sex, age, race/ethnicity, marital status, education, smoking status, alcohol intake, sleep duration, physical activity, and number of employees at work. Compared with normal-weight workers, those who were overweight or obese had significantly elevated prevalence of all occupational injuries combined; PR = 1.25 (95% CI 1.05 to 1.51) for overweight and PR = 1.45 (95% CI 1.20 to 1.74) for obese workers. For every one unit increase in BMI, the prevalence of injury increased by 2% (PR = 1.02, 95% CI 1.01 to 1.03). Among the occupational groups, BMI was significantly associated with occupational injury among those who worked in Management (PR = 1.05, 95% CI 1.02 to 1.09), Health care/Personal care/Community (PR = 1.05, 95% CI 1.02 to 1.07), and Transportation and Material Moving (PR = 1.05, 95% CI 1.01 to 1.08). Workers in the obese category in the previous three occupational groups had a prevalence of injury more than two times higher than those in the normal BMI category (PR = 2.70, 95% CI 1.22 to 6.00 for Management; PR = 2.34, 95% CI 1.42 to 3.84 for Health care/Personal Care/Community; PR = 2.51, 95% CI 1.21 to 5.21for Transportation and Material Moving). Among the industry groups, BMI was significantly related to injury among workers in Education (PR =

1.05, 95% CI 1.01 to 1.09). Compared with workers with a normal BMI, workers in Education and Health Care/Social Assistance who were obese had a higher prevalence of injury; PR = 2.18, 95% CI 1.03 to 4.61 and PR = 1.77, 95% CI 1.08 to 2.90, respectively.

In addition, we investigated injury prevalence among occupational groups (referent is Professional) and among industry groups (referent is Services). Compared with workers in the Professional group, workers in the Construction and Extraction were four and a half times more likely to have had an injury (PR = 4.51, 95% CI 2.92 to 6.96). This was followed by Protective Service (PR = 3.91, 95% CI 2.42 to 6.31), Production (PR = 3.88, 95% CI 2.54 to 5.87), and Installation/Maintenance/Repair (PR = 3.27, 95% CI 2.01 to 5.31). Among industry groups, workers in Construction were more than two and a half times as likely to have an injury compared with workers in Services (PR = 2.60, 95% CI 1.93 to 3.50). This was followed by Agriculture/Forestry/Fishing/Mining/Utilities (PR = 2.10, 95% CI 1.36 to 3.25), Public Administration (PR = 1.97, 95% CI 1.39 to 2.80), and Manufacturing (PR = 1.91, 95% CI 1.40 to 2.60).

DISCUSSION

In this study of the US adult working population, we used pooled data across the 10 most recent years of the NHIS survey (2004 to 2013) and investigated the prevalence of work-site injury by occupational and industrial groups and the association between BMI and injury across occupation and industry. The primary findings of this study were that the highest prevalence of injury occurred in the Construction and Extraction and Production (among the occupational groups) and in the Construction sector followed by the Agriculture/Forestry/Fishing/Mining/Utilities sector and Manufacturing sector (among the industry groups). Our findings are consistent with those of previous studies in the US and other countries. The US BLS reported that workers in the Protective Services, Building and Grounds Cleaning and Maintenance, and Transportation and Material Moving had the highest incidence rate for nonfatal occupational injuries.[3] The UN International Labor Organization also reported that the industrial sectors of Agriculture, Fishing, Mining, and Construction had the leading risk of injury, caused by machinery, falls, crashes, electrical hazards, chemicals, etc.[1] Our study showed that the majority (34%) of work-site injuries were in Construction and Extraction, Production, and Installation/Maintenance/Repair.

As we expected, all blue-collar workers—in Food Preparation and Serving, Building and Grounds Cleaning and Maintenance, Construction and Extraction, Installation/Maintenance/Repair, Production, Transportation and Material Moving—were more likely to have injuries than Professional workers. Workers in the Protective Service group were nearly four times more likely to experience injuries than workers in the Professional group. Protective services employees, mostly law enforcement officers and firefighters, work under dangerous conditions for the public's safety. Many law enforcement officers are frequently in a sedentary working environment. They experience high weight gain and frequently drive in severe weather and at high speeds.[26] Thirty-six percent of the law enforcement injuries were caused by motor-vehicle related incidents such as vehicle crashes or being struck by a vehicle while outside their patrol car,[26] and 45% of the firefighter injuries occurred during fire-fighting operations.[27]

With respect to the association between BMI and injury, in general, overweight and obese workers were more likely to experience injuries than normal-weight workers. The prevalence of injury in most occupational and industry groups tended to increase as BMI levels increased. However, only three occupations and one industry were found wherein obesity was associated with the prevalence of workplace injury: Management, Health Care/Personal Care/Community Service, Transportation and Material Moving, and the Education sector. Two studies of hospital employees found that obesity was associated with a higher risk of work-site injury.[13,28] In many US studies, vehicle drivers who are obese had a greater likelihood of a crash and fatality from traffic collision related injuries, and were less likely to wear seatbelts than nonobese drivers.[17,18,29,30] We observed that those in the Services and Education sector had a relatively lower prevalence of workplace injury 42.0/10,000 and 56.2/10,000, respectively, and lower mean BMI. The prevalence of workplace injury in the Management and Education sector was higher in the obese than in the normal-weight workers. On the contrary, the occupations with relatively high mean BMI and a high prevalence of injury—Protective Service, Production, Construction, and Installation/Maintenance/Repair—did not have a significant relationship between BMI and injury.

Although our study did not find an association between BMI and work-site injury in the Construction industry sector, Dong et al[31] found that obesity and overweight significantly increased the risk of work-related injury among construction workers. The differing results from the two studies are probably due to the sample sizes and the injury recall periods. Our study had a small number of injuries in the Construction sector with a relatively short recall period—only three months (166 injured workers among 10,800 total construction workers for 10 years), while the study by Dong et al[31] had a relatively large number of injuries with a long recall period—two years (545 injured among 5287 total construction workers for 13 years).

Limitations

There are some limitations in this study that should be considered when interpreting its findings.

First, this study takes into account acute injuries only that were self-reported and does not include fatal injuries; this may have led to an underestimation of injury. Small sample sizes prevented us from estimating the prevalence of work-site injury and the PR in some occupational and industrial groups by BMI level.

An additional limitation of this study is that our results are from a cross-sectional study, and the association between BMI and injury across occupational and industrial groups cannot provide evidence of causality or temporal sequence whether increase in BMI precedes the injury, or vice versa. BMI measurements in our study may have been underestimated because the NHIS survey used self-reported weight and height rather than objective measures for weight and height taken by trained research staff members using a standardized protocol. Shift work has been shown to be associated with an increased risk of workplace injury and workers' obesity.[32–36] Unfortunately, we were not able to control for shift work in our analysis because the variable was only available in the 2010 NHIS Occupational Health Supplement.

Strengths

Despite the limitations presented, the current study has a large sample size. Information was obtained from a nationally representative dataset that enabled estimates of occupational injury prevalence by demographic, lifestyle characteristics, job characteristics, and also by occupations and industries. Availability of a variety of relevant variables allowed adjustment for important confounders in the analysis of the association between BMI and injury.

In addition, the current study that reported injuries during the past three-month period may have minimized recall bias that could have decreased the potential for underestimating injury prevalence. There are many previous studies that have investigated injures in specific occupations or injuries by external causes and anatomical sites.[12,13,15,37] This study is unique in that we investigated the prevalence of injury by occupation and industry groups among U.S. workers and also the association between obesity and injury in these workers.

CONCLUSION

This study examined the prevalence of workplace injuries across occupations and industries during a 10-year period. The highest prevalence of injury was in Construction and Extraction. Compared with workers in the Professional group, workers in Construction and Extraction were four times more likely to report an injury. Overall, overweight and obese workers were 26% and 45%, respectively, more likely to experience injuries than normal-weight workers. Future prospective studies are warranted to determine risk of injury associated with elevated BMI and potential benefits that may result from reductions in BMI.

Acknowledgments

There is no funding for this study.

REFERENCES

1. Safety in Numbers. International Labor Organization, United Nations; Geneva, Switzerland: 2003. Available at: http://www.ilo.org/public/english/region/eurpro/moscow/areas/safety/docs/safety_in_numbers_en.pdf. Accessed October 9, 2014
2. Employer-reported Workplace Injuries and Illnesses: 2012. Bureau of Labor Statistics, News Release, USDL-13-2119, US Department of Labor. 2013. Available at: http://www.bls.gov/news.release/pdf/osh.pdf. Accessed October 13, 2014
3. Nonfatal Occupational Injuries and Illnesses Requiring Days Away From Work, 2012. News Release, USDL-13-2257. Bureau of Labor Statistics, US Department of Labor. 2013. Available at: http://www.bls.gov/news.release/pdf/osh2.pdf. Accessed October 9, 2014
4. Kachan D, Fleming LE, LeBlanc WG, et al. Worker populations at risk for work-related injuries across the life course. Am J Ind Med. 2012; 55:361–366. [PubMed: 22170632]
5. Waehrer GM, Dong XS, Miller T, et al. Costs of occupational injuries in construction in the United States. Accid Anal Prev. 2007; 39:1258–1266. [PubMed: 17920850]
6. Rautiainen RH, Ohsfeldt R, Sprince NL, et al. Cost of compensated injuries and occupational diseases in agriculture in Finland. J Agromed. 2005; 10:21–29.
7. Fan J, McLeod CB, Koehoorn M. Descriptive epidemiology of serious work-related injuries in British Columbia, Canada. PLoS One. 2012; 7:e38750. [PubMed: 22723884]
8. Caban AJ, Lee DJ, Fleming LE, et al. Obesity in US workers: the National Health Interview Survey, 1986 to 2002. Am J Public Health. 2005; 95:1614–1622. [PubMed: 16051934]

9. Gu JK, Charles LE, Bang KM, et al. Prevalence of obesity by occupation among US workers: the national health interview survey 2004–2011. J Occup Environ Med. 2014; 56:516–528. [PubMed: 24682108]
10. Luckhaupt SE, Cohen MA, Li J, et al. Prevalence of obesity among U.S. workers and associations with occupational factors. Am J Prev Med. 2014; 46:237–248. [PubMed: 24512862]
11. Schulte PA, Wagner GR, Ostry A, et al. Work, obesity, and occupational safety and health. Am J Public Health. 2007; 97:428–436. [PubMed: 17267711]
12. Janssen I, Bacon E, Pickett W. Obesity and its relationship with occupational injury in the Canadian workforce. J Obes. 2011; 2011:531403. [PubMed: 21773008]
13. Kouvonen A, Kivimaki M, Oksanen T, et al. Obesity and occupational injury: a prospective cohort study of 69,515 public sector employees. PLoS One. 2013; 8:e77178. [PubMed: 24146966]
14. Lombardi DA, Wirtz A, Willetts JL, et al. Independent effects of sleep duration and body mass index on the risk of a work-related injury: evidence from the US National Health Interview Survey (2004–2010). Chronobiol Int. 2012; 29:556–564. [PubMed: 22621351]
15. Pollack KM, Sorock GS, Slade MD, et al. Association between body mass index and acute traumatic workplace injury in hourly manufacturing employees. Am J Epidemiol. 2007; 166:204–211. [PubMed: 17485732]
16. Jahnke SA, Poston WS, Haddock CK, et al. Obesity and incident injury among career firefighters in the central United States. Obesity (Silver Spring). 2013; 21:1505–1508. [PubMed: 23512940]
17. Behzad B, King DM, Jacobson SH. Seatbelt usage: is there an association with obesity? Public Health. 2014; 128:799–803. [PubMed: 25183564]
18. Rice TM, Zhu M. Driver obesity and the risk of fatal injury during traffic collisions. Emerg Med J. 2014; 31:9–12. [PubMed: 23337422]
19. National Center for Health Statistics (NCHS). Center for Disease Control and Prevention, U.S. Department of Health and Human Services. National Health Interview Survey Public Use Data Release NHIS Survey Description. Available at: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_ Documentation/NHIS/2013/srvydesc.pdf. Accessed October 17, 2014
20. Adams TD, Heath EM, LaMonte MJ, et al. The relationship between body mass index and per cent body fat in the severely obese. Diabetes Obes Metab. 2007; 9:498–505. [PubMed: 17587392]
21. National Heart, Lung, and Blood Institute, National Institutes of Health. How Much Sleep is Enough?. 2014. Available at: http://www.nhlbi.nih.gov/health/health-topics/topics/sdd/howmuch.html. Accessed November 17, 2014
22. Blackwell DL, Clarks TC. Summary health statistics for US adults: National Health Interview Survey, 2012. Vital Health Stat. 2014; 10:260. LJ.
23. Klein RJ, Proctor SE, Boudreault MA, Turczyn KM. Healthy people 2010 criteria for data suppression. Healthy People 2010 Stat Notes. 2002:24.
24. Research Triangle Institute. SUDAAN Language Manual, Volumes 1 and 2, Release 11. Research Triangle Institute; Research Triangle Park, NC: 2012.
25. Bieler GS, Brown GG, Williams RL, et al. Estimating model-adjusted risks, risk differences, and risk ratios from complex survey data. Am J Epidemiol. 2010; 171:618–623. [PubMed: 20133516]
26. Tiesman, HM. Motor Vehicle Safety and Law Enforcement Officers. NIOSH Science Blog. 2014. Available at: http://blogs.cdc.gov/niosh-science-blog/2014/11/18/leo-motor-vehicle-safety/. Accessed May 04, 2015
27. Karter, MK. US Firefigher Injuries 2013. National Fire Protection Association. 2014. Available at: http://www.nfpa.org/research/reports-and-statistics/the-fire-service/fatalities-and-injuries/firefighter-injuries-in-the-united-states. Accessed May 4, 2015
28. Brown ND, Thomas NI. Exploring variables among medical center employees with injuries: developing interventions and strategies. AAOHN J. 2003; 11:470–481. [PubMed: 14651387]
29. Jehle D, Doshi C, Karagianis J, et al. Obesity and seatbelt use: a fatal relationship. Am J Emerg Med. 2014; 32:756–760. [PubMed: 24816062]
30. Anderson JE, Govada M, Steffen TK, et al. Obesity is associated with the future risk of heavy truck crashes among newly recruited commercial drivers. Accid Anal Prev. 2012; 49:378–384. [PubMed: 23036416]

31. Dong XS, Wang X, Largay JA. Occupational and non-occupational factors associated with work-related injuries among construction workers in the USA. Int J Occup Environ Health. 2015; 37:142–150. [PubMed: 25816923]

32. Wong IS, McLeod CB, Demers PA. Shift work trends and risk of work injury among Canadian workers. Scand J Work Environ Health. 2011; 37:54–61. [PubMed: 20890587]

33. Buss J. Associations between obesity and stress and shift work among nurses. Workplace Health Saf. 2012; 60:453–458. quiz 459. [PubMed: 23054165]

34. Kirsh V, Cotterchio M, McGlynn N. The association between shift work and obesity in Canada: a cross-sectional study using a novel exposure assessment tool. Occup Environ Med. 2014; 71(Suppl 1):A88.

35. Zhao I, Bogossian F, Turner C. The effects of shift work and interaction between shift work and overweight/obesity on low back pain in nurses: results from a longitudinal study. J Occup Environ Med. 2012; 54:820–825. [PubMed: 22796926]

36. Itani O, Kaneita Y, Murata A, et al. Association of onset of obesity with sleep duration and shift work among Japanese adults. Sleep Med. 2011; 12:341–345. [PubMed: 21377926]

37. Ren J, Waclawczyk A, Hartfield D, et al. Analysis of fall injuries by body mass index. South Med J. 2014; 107:294–300. [PubMed: 24937728]

Learning Objectives

- Discuss previous evidence suggesting obesity as an important modifiable risk factor for occupational injuries.
- Summarize the new findings on the association of overweight/obesity and injury across US occupational and industry groups.
- Discuss the implications for efforts addressing body weight to reduce the rate of injuries in specific occupations and industries.

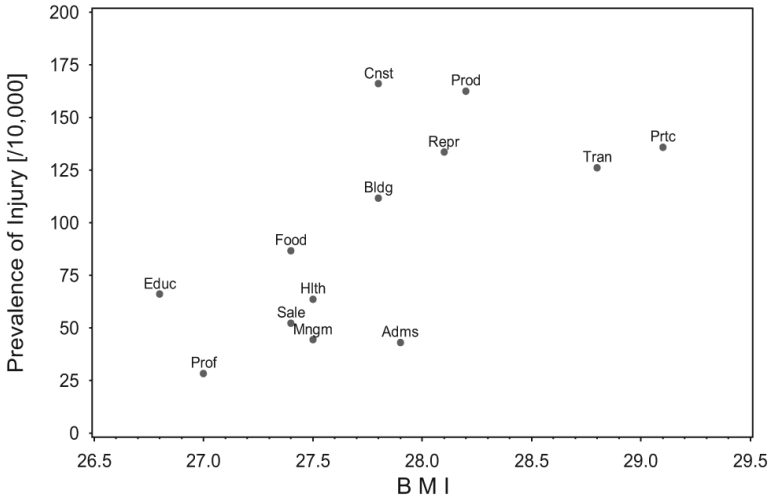

FIGURE 1.

Age-adjusted BMI and prevalence of injury by occupation. Adms, Office and Administrative Support; Bldg, Building and Grounds Clean & Maintenance; Cnst, Construction and Extraction; Educ, Educations, Training, Library; Food: Food Preparation & Serving; Hlth, Health care, Personal care, Community; Mngm, Management; Prod, Production; Prof, Professional; Prtc, Protective Service; Repr, Installation, Maintenance, and Repair; Sale, Sales and Related; Tran, Transportation and Material Moving.

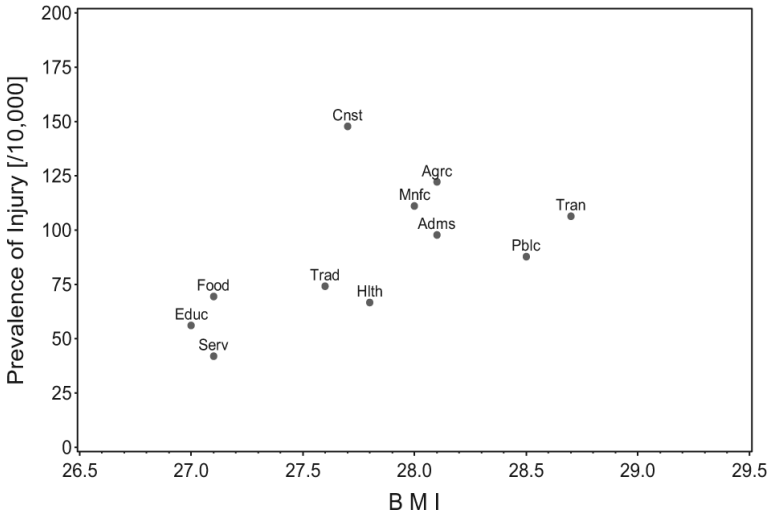

FIGURE 2.

Age-adjusted BMI and prevalence of injury by industry. Adms, Adm., Support, Waste Management; Agrc, Agr., Forestry, Fishing, Mining, Utilities; Cnst, Construction; Educ, Education; Food, Accommodation, Food; Hlth, Health Care, Social Assistance; Mnfc, Manufacturing; Pblc, Public Administration; Serv, Services; Trad, Trade (wholesale, retail); Tran, Transportation, Warehousing.

TABLE 1

Injury Prevalence During the Past Three Months and Mean BMI by Demographic, Lifestyle, and Job Characteristics

	All Workers			Injured Workers				BMI (kg/m^2) for All Workers	
	No. of Sample	Est. Pop.	%*	No. of Injured Workers	Est. No. of Injured Workers	Prev*±SE	P †	Mean*±SE	P †
All	**154,179**	**126,676,222**	**100.0**	**1258**	**974,926**	**77.0±2.7**		**27.6±0.02**	
Demographic characteristics									
Sex									
Men	18,312	69,531,297	54.9	746	662,503	95.3±4.5	<0.001	28.0±0.03	<0.001
Women	75,867	57,144,925	45.1	512	312,428	54.7±2.8		27.2±0.04	
Race/ethnicity									
White, non-Hispanic	94,021	87,684,735	69.2	784	686,251	78.3±3.6	0.001	27.4±0.03	<0.001
Black, non-Hispanic	22,311	14,200,926 17,843,676	11.2	197	124,771	87.9±7.5		29.2±0.06	
Hispanic	28,124	6,946,886	14.1	222	131,478	73.7±5.5		28.1±0.05	
All other, non-Hispanic	9,723		5.5	55	32,426	46.7±7.8		25.4±0.08	
Age (yrs)									
18–34	51,331	43,610,108	34.4	445	385,682	88.4±5.4	<0.001	26.7±0.03	<0.001
35–44	36,899	29,492,364	23.4	311	235,963	80.0±5.6		28.1±0.04	
40–49	35,349	30,406,155	24.0	286	220,510	72.5±5.1		28.2±0.04	
50–59	23,196	18,142,846	14.3	173	107,241	59.1±5.3		28.2±0.05	
60+	7,404	5,024,749	4.0	43	25,530	50.8±9.5		27.5±0.06	
Mean±SE	41.4±0.07								
Marital status									
Single	45,846	34,024,271	26.9	429	316,369	92.9±6.1	<0.001	26.9±0.4	<0.001
Married	73,265	72,487,701	57.4	467	445,612	61.5±3.3		27.8±0.3	
Divorced	34,683	19,894,775	15.7	361	210,529	105.8±6.8		28.0±0.5	
Education									
<12 yrs	16,936	12,404,828	9.8	177	138,779	105.2±9.2	<0.001	28.0±0.06	<0.001
High Grad/GED	38,220	32,331,930	25.7	375	312,438	92.7±5.9		28.2±0.04	
Some coll./Assoc. degr.	48,717	39,997,676	31.8	490	392,103	97.0±5.6		28.0±0.04	
Bachelor+	49,367	41,209,445	32.7	207	155,157	36.6±3.1		26.7±0.03	
Annual income									
<$35K	65,246	50,679,614	50.3	633	488,781	96.4±5.4	<0.001	27.6±0.04	<0.001
$35–65K	37,869	30,972,717	30.7	318	258,250	83.4±5.7		28.0±0.04	
$65K+	21,575	19,120,498	19.0	109	72,494	37.9±4.3		27.5±0.05	
Lifestyle characteristics									
Smoking status									
Never	93,414	76,144,982	60.2	596	454,914	59.7±3.1	<0.001	27.5±0.03	<0.001
Former	29,169	24,602,985	19.5	272	214,436	87.2±6.7		28.3±0.04	

	All Workers			Injured Workers				BMI (kg/m^2) for All Workers	
	No. of Sample	Est. Pop.	%*	No. of Injured Workers	Est. No. of Injured Workers	Prev*±SE	P †	Mean*±SE	P †
All	**154,179**	**126,676,222**	**100.0**	**1258**	**974,926**	**77.0±2.7**		**27.6±0.02**	
Current	31,342	25,716,637	20.3	390	305,576	118.8±8.0		27.2±0.04	
Alcohol									
Never/Former	43,399	34,232,025	27.4	337	246,587	72.0±4.8	0.001	27.9±0.04	<0.001
Current (≤3 drks/wk)	73,255	61,076,830	48.8	557	424,144	69.4±3.6		27.8±0.03	
Current (4+ drks/wk)	35,494	29,737,047	23.8	344	285,677	96.1±6.6		27.0±0.04	
Physical activity‡									
Inactive	46,187	36,317,172	28.9	390	300,335	82.7±5.1	0.141	28.2±0.04	<0.001
Insufficiently active	30,341	25,233,685	20.1	254	205,076	81.3±6.3		28.2±0.05	
Sufficiently active	76,617	64,302,932	51.0	595	455,222	70.8±3.9		27.1±0.03	
Sleep duration									
Inadequate (1–6 hrs/day)	48,325	38,911,475	30.9	531	405,262	104.1±5.6	<0.001	28.3±0.04	<0.001
Adequate (7+ hrs/day)	105,099	87,204,246	69.1	722	562,808	64.5±3.0		27.3±0.03	
Mean±SE	7.0±0.01								
BMI (kg/m^2)									
Normal (18.5–25)	55,617	45,692,263	36.1	359	267,401	58.5±3.9	<0.001	N/A	N/A
Overweight (25–30)	56,361	46,628,567	36.8	466	371,932	79.8±4.9			
Obese (30+)	42,201	34,355,392	27.1	433	335,592	97.7±5.5			
Job characteristics									
Length of employment (yrs)									
<1	24,842	20,637,774	16.4	285	231,540	112.2±9.0	<0.001	27.0±0.05	0.001
1–4	49,508	40,464,581	32.1	396	326,595	80.7±5.0		27.3±0.04	
5–9	31,433	25,385,060	20.1	235	169,964	67.0±5.2		27.8±0.04	
10+	47,606	39,609,937	31.4	339	244,812	61.8±4.1		28.2±0.03	
Mean±SE	7.9±0.04								
Work hours (hrs/week)									
<30	22,022	18,170,061	14.6	141	109,720	60.4±6.4	0.108	26.9±0.05	<0.001
30 to <50	100,372	81,512,443	65.7	779	603,418	74.0±3.5		27.7±0.03	
50+	28,925	24,474,865	19.7	254	198,875	79.2±6.3		28.0±0.04	
Mean±SE	40.3±0.05								
No. of employees at work									
1–9	38,579	31,581,702	27.1	270	204,615	64.8±4.7	<0.001	27.3±0.04	<0.001
10–49	38,979	32,475,005	27.9	335	264,655	81.5±5.7		27.5±0.04	
50–249	34,613	28,666,700	24.6	339	276,354	96.4±6.8		27.9±0.04	
250+	29,371	23,821,896	20.4	220	150,571	63.2±5.8		27.8±0.05	
Second job									
Yes	13,542	11,161,243	8.8	124	97,828	88.7±9.9	0.089	27.6±0.07	0.692
No	140,452	115,358,615	91.2	1,040	804,236	69.7±2.8		27.6±0.02	

"Inactive" is participating in no leisure-time aerobic activity that lasted at least 10 minutes.

"Insufficiently active" is participating in aerobic activities for 10 minutes or more but less than 150 minutes per week.

"Sufficiently active" is participating in moderate-intensity leisure-time physical activity 150 minutes or more per week, or in vigorous-intensity leisure-time physical activity 75 minutes or more per week, or an equivalent combination.

Reproduced from [22].

[*] Weighted value of column percent, and prevalence of injury weighted per 10,000 (=[estimated injury/estimated population]×10,000), and weighted mean of BMI.

[†] The levels (Inactive, Insufficiently active, Sufficiently active) of physical activity reflect the 2008 Physical Activity Guidelines for Americans (available at http:// www.health.gov/PAGuidelines/).

[‡] *P* value from Chi-square for injury, and *P* value from ANOVA for BMI.

TABLE 2

Age-Adjusted Prevalence of Injury During the Past Three Months and Mean of BMI by Occupational and Industry groups

	Injury						BMI (kg/m^2)	
	No. in Sample	Estimated Population	No. of Injured Workers	Estimated Injured Workers	Unadjusted Prevalence* of Injury	Age-adjusted Prevalence* of Injury	Unadjusted Mean of BMI	Age-adjusted Mean of BMI
	154,179	**126,676,222**	**1258**	**974,926**	**77.0±2.7**	**77.1±2.7**	**27.6±0.02**	**27.6±0.02**
Occupational groups†								
Management	14,000	12,185,727	74	57,256	47.0±6.6	44.4±6.7	27.7±0.06	27.5±0.06
Professional‡	21,015	17,328,298	74	49,633	28.1±4.2	28.3±4.3	27.0±0.05	27.0±0.05
Education, Training, Library	9804	8,077,577	65	52,307	64.8±9.8	66.0±10.0	26.9±0.08	26.8±0.08
Health care, Personal care, Community	20,926	15,953,681	159	101,225	63.4±6.4	63.6±6.5	27.5±0.06	27.5±0.06
Protective Service	3331	2,722,606	49	37,551	137.9±22.6	135.9±22.5	29.1±0.13	29.1±0.13
Food Preparation and Serving	8237	6,552,714	69	54,139	82.5±13.5	86.7±13.4	26.8±0.09	27.4±0.10
Building and Grounds Clean & Maintenance	7048	5,199,297	73	56,897	109.3±16.1	111.7±16.9	27.8±0.10	27.8±0.10
Sales and Related	15,710	13,389,587	83	69,907	52.1±6.6	52.3±6.5	27.3±0.06	27.4±0.06
Office and Administrative Support	20,901	16,558,580	104	71,897	43.1±5.3	43.2±5.1	27.8±0.06	27.9±0.06
Construction and Extraction	8856	7,653,431	150	129,843	169.7±17.6	166.0±17.6	27.8±0.07	27.8±0.07
Installation, Maintenance, and Repair	5400	4,914,955	75	64,934	132.1±19.9	133.5±20.5	28.2±0.09	28.1±0.09
Production	10,323	8,418,384	166	135,174	160.6±16.2	162.6±16.4	28.2±0.07	28.2±0.07
Transportation and Material Moving	9202	7,721,385	117	95,474	123.6±14.3	126.1±14.8	28.8±0.08	28.8±0.08
Industry groups§								
Agr., Forestry, Fishing, Mining, Utilities	3204	2,711,519	43	31,913	117.7±23.3	122.1±25.3	28.3±0.11	28.1±0.11
Construction	10,800	9,496,826	166	142,594	150.4±14.2	147.9±14.0	27.7±0.06	27.7±0.06
Manufacturing	16,366	14,046,321	181	150,299	107.0±10.2	111.2±10.8	28.1±0.05	28.0±0.06
Trade (wholesale, retail)	19,964	17,033,471	153	128,830	75.6±7.7	74.2±7.4	27.5±0.05	27.6±0.05
Transportation, Warehousing	6651	5,542,104	67	56,742	102.4±15.3	106.4±16.4	28.8±0.08	28.7±0.09
Services‖	35,644	29,524,507	162	122,587	41.7±4.0	42.0±4.1	27.2±0.04	27.1±0.04
Adm., Support, Waste Management	7025	5,413,065	68	54,391	100.5±15.5	97.9±15.2	28.0±0.09	28.1±0.09
Education	14,938	12,132,836	94	66,236	54.6±7.2	56.2±7.6	27.1±0.06	27.0±0.06
Health Care, Social Assistance	21,648	16,523,899	175	109,389	66.2±6.1	66.7±6.3	27.9±0.06	27.8±0.06
Accommodation, Food	9927	7,872,407	70	55,694	70.7±11.2	69.5±10.9	26.6±0.08	27.1±0.08
Public Administration	8185	6,511,635	79	56,251	86.6±11.6	87.9±11.9	28.6±0.08	28.5±0.09

[*] Prevalence of injury weighted per 10,000 [=(estimated injured workers/estimated population) × 10,000]. Age-adjusted prevalence estimates were based on the 2010 U.S. workers standard population by Bureau of Labor Statistics, using five groups: 18-34, 35-44, 45-54, 55-64, 65+.

[†] Occupational groups are simplified to 13 groups from 23 major groups, which are derived from the Standard Occupation Classification (SOC) Occupation Groups as determined by the US Census Bureau and the Bureau of Labor Statistics.

[‡] Professional includes business, financial, computer, mathematical, architecture, engineering, life/physical/social science, legal, arts/design/entertainment/sports/media.

[§] Industry groups are simplified to 11 groups from 21 major groups, which are derived from the North American Industrial Classification System (NAICS) Industry Sectors as identified by the US Census Bureau and the Bureau of Labor Statistics.

[//] Services include information, finance/insurance, real estate/rental/leasing, professional/scientific/technical services, management of companies/enterprises, arts/entertainment/ recreation, other services except public administration.

TABLE 3

Age-Adjusted Prevalence[*] of Injury During the Past Three Months by Occupation and Industry Groups and BMI Category

	Normal (BMI: 18.5–24.9)		Overweight (BMI: 25.0–29.9)		Obese (BMI: ≥ 30.0)	
	n	**Prev±SE**	**n**	**Prev±SE**	***n***	**Prev±SE**
	359	**57.7±3.8**	**466**	**80.6±5.1**	**433**	**99.6±5.8**
Occupational groups						
Management	13	20.8±6.5	31	43.5±9.7	30	77.3±20.8
Professional[†]	28	26.2±5.8	24	28.6±7.9	22	28.7±8.2
Education, Training, Library	21	44.1±11.3	23	80.0±21.6	21	95.3±25.8
Health care, Personal care, Community	45	40.8±7.2	45	57.8±11.5	69	105.6±17.5
Protective Service	10	125.8±48.0	22	154.6±37.8	17	127.8±35.9
Food Preparation and Serving	26	98.0±27.9	23	78.1±19.6	20	76.1±17.1
Building and Grounds Clean and Maintenance	21	97.9±26.5	28	107.2±29.6	24	127.4±29.8
Sales and Related	27	39.9±8.3	28	55.6±12.8	28	70.3±16.2
Office and Administrative Support	31	28.6±6.4	37	54.0±10.1	36	49.2±9.7
Construction and Extraction	41	138.8±29.3	66	180.2±29.1	43	179.3±33.2
Installation, Maintenance, and Repair	24	150.3±37.6	31	152.5±34.8	20	94.0±25.3
Production	46	162.3±32.4	65	139.6±21.1	55	200.8±33.9
Transportation and Material Moving	26	87.5±21.7	43	116.6±23.5	48	178.9±34.7
Industry groups						
Agr., Forestry, Fishing, Mining, Utilities	8	69.6±28.0	17	123.6±43.0[§]	18	170.4±65.8[§]
Construction	46	130.2±25.5	76	159.7±22.9	44	159.3±27.6
Manufacturing	44	80.5±15.0	73	112.5±19.4	64	152.4±24.3
Trade (wholesale, retail)	55	61.2± 11.0	49	75.8±13.8	49	93.2±16.8
Transportation, Warehousing	8	54.4±21.4	29	115.5±33.1	30	126.9±28.7
Services[‡]	63	42.9±6.6	53	38.4±6.5	46	45.9±8.1
Adm., Support, Waste Management	20	78.6±23.0	30	126.4±28.6	18	78.0±20.8
Education	28	32.6±7.3	32	66.2±15.6	34	97.7±23.6
Health Care, Social Assistance	46	47.0±7.9	56	63.0±10.8	73	98.2±15.1
Accommodation, Food	28	70.8±21.2	21	59.3±16.3	21	84.3±20.2
Public Administration	13	47.2±14.3	30	88.1±20.0	36	123.6±26.0

[*] Age-adjusted prevalence estimates were based on the 2010 U.S. workers standard population by Bureau of Labor Statistics, using five groups: 18-34, 35-44, 45-54, 55-64, 65+.

[†] Professional include business, financial, computer, mathematical, architecture, engineering, life/physical/social science, legal, arts/design/ entertainment/sports/media.

[‡] Services include information, finance/insurance, real estate/rental/leasing, professional/scientific/technical services, management of companies/ enterprises, arts/entertainment/ recreation, other services except public administration.

§The estimate of the prevalence is unreliable because the relative standard error of the estimate of injury prevalence in the referent level is larger than 30% (Klein et al[23]). Relative standard error is calculated by dividing the standard error of the estimate by the estimate itself, then multiplying that result by 100.

TABLE 4

Age-Adjusted Prevalence Ratio for Injury by BMI Levels and Occupational/Industry Groups

	BMI Levels				
	BMI Continuous	Normal (BMI: 18.5–24.9)	Overweight (BMI: 25.0–29.9)	Obese (BMI: ≥ 30.0)	
	PR* (95% CI)	PR* (referent)	PR* (95% CI)	PR* (95% CI)	Overall
	1.02 (1.01–1.03)	1 (referent)	1.26 (1.05–1.51)	1.45 (1.20–1.74)	PR* (95% CI)
Occupational groups					
Management	1.05 (1.01–1.09)	1 (referent)	1.96 (0.92–4.16)	2.70 (1.22–6.00)	1.51 (0.98–2.31)
Professional†	1.00 (0.96–1.04)	1 (referent)	1.07 (0.50–2.27)	1.19 (0.60–2.35)	1 (referent)
Education, Training, Library	1.01 (0.97–1.06)	1 (referent)	1.54 (0.73–3.24)	1.51 (0.67–3.43)	2.78 (1.73–4.46)
Health care, Personal care, Community	1.05 (1.02–1.07)	1 (referent)	1.24 (0.71–2.14)	2.34 (1.42–3.84)	2.15 (1.44–3.20)
Protective Service	1.00 (0.96–1.04)	1 (referent)	1.07 (0.61–1.86)§	1.06 (0.54–2.07)§	3.91 (2.42–6.31)
Food Preparation and Serving	0.98 (0.93–1.03)	1 (referent)	0.87 (0.41–1.84)	0.68 (0.35–1.34)	1.87 (1.15–3.06)
Building and Grounds Clean & Maintenance	1.01 (0.95–1.07)	1 (referent)	0.76 (0.35–1.64)	1.07 (0.53–2.16)	3.18 (2.00–5.03)
Sales and Related	1.00 (0.98–1.02)	1 (referent)	1.08 (0.74–1.57)	1.04 (0.72–1.51)	1.47 (0.96–2.23)
Office and Administrative Support	1.01 (0.98–1.04)	1 (referent)	2.11 (1.16–3.87)	1.60 (0.88–2.90)	1.17 (0.77–1.78)
Construction and Extraction	1.02 (0.98–1.06)	1 (referent)	1.55 (0.92–2.60)	1.66 (0.94–2.90)	4.51 (2.92–6.96)
Installation, Maintenance, and Repair	0.99 (0.94–1.04)	1 (referent)	1.02 (0.62–1.69)	0.81 (0.46–1.41)	3.27 (2.01–5.31)
Production	1.04 (1.00–1.08)	1 (referent)	0.70 (0.42–1.18)	1.02 (0.59–1.76)	3.88 (2.57–5.87)
Transportation and Material Moving	1.05 (1.01–1.08)	1 (referent)	1.50 (0.75–2.99)	2.51 (1.21–5.21)	2.69 (1.72–4.20)
Industry groups					
Agr., Forestry, Fishing, Mining, Utilities	1.02 (0.96–1.09)	1 (referent)	1.80 (0.63–5.15)§	1.89 (0.66–5.45)§	2.10 (1.36–3.25)
Construction	1.02 (0.98–1.07)	1 (referent)	1.38 (0.85–2.24)	1.41 (0.84–2.36)	2.60 (1.93–3.50)
Manufacturing	1.04 (1.00–1.08)	1 (referent)	1.04 (0.64–1.71)	1.49 (0.90–2.47)	1.91 (1.40–2.60)
Trade (wholesale, retail)	1.01 (0.98–1.04)	1 (referent)	1.44 (0.86–2.41)	1.46 (0.84–2.53)	1.31 (0.97–1.76)
Transportation, Warehousing	1.03 (0.98–1.07)	1 (referent)	2.45 (0.85–7.07)§	2.03 (0.68–6.09)§	1.54 (1.03–2.31)
Services‡	1.00 (0.97–1.04)	1 (referent)	0.81 (0.49–1.34)	0.99 (0.60–1.62)	1 (referent)
Adm., Support, Waste Management	1.00 (0.95–1.06)	1 (referent)	1.31 (0.56–3.02)	1.06 (0.51–2.20)	1.70 (1.16–2.48)
Education	1.05 (1.01–1.09)	1 (referent)	1.82 (0.93–3.57)	2.18 (1.03–4.61)	1.69 (1.20–2.39)
Health Care, Social Assistance	1.03 (1.00–1.06)	1 (referent)	1.25 (0.75–2.07)	1.77 (1.08–2.90)	1.61 (1.21–2.12)
Accommodation, Food	0.99 (0.94–1.04)	1 (referent)	0.83 (0.38–1.81)	0.92 (0.45–1.89)	1.04 (0.70–1.55)
Public Administration	1.00 (0.98–1.03)	1 (referent)	1.03 (0.65–1.66)	1.12 (0.70–1.79)	1.97 (1.39–2.80)

*PR: prevalence ratios with 95% confidence interval are adjusted for sex, age, race/ethnicity, marital status, education, smoking status, alcohol intake status, sleep duration, physical activity, and number of employee at work. Prevalence ratios are obtained from marginal predictions in the fitted logistic regression model (Bieler et al[25]).

†Professional include business, financial, computer, mathematical, architecture, engineering, life/physical/social science, legal, arts/design/entertainment/sports/media.

‡Services include information, finance/insurance, real estate/rental/leasing, professional/scientific/technical services, management of companies/ enterprises, arts/entertainment/ recreation, other services except public administration.

§The estimate of the prevalence ratio is unreliable because the relative standard error of the estimate of injury prevalence in the referent level is larger than 30% (Klein et al[23]).