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Prevalence of work-site injuries and relationship between obesity and injury among U.S. workers: NHIS 2004–2012☆,☆☆,★,★★

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ABSTRACT

Introduction: Studies have reported associations between obesity and injury in a single occupation or industry. Our study estimated the prevalence of work-site injuries and investigated the association between obesity and work-site injury in a nationally representative sample of U.S. workers. *Methods*: Self-reported weight, height, and injuries within the previous three months were collected annually for U.S. workers in the National Health Interview Survey (NHIS) from 2004–2012. Participants were categorized as normal weight (BMI: 18.5–24.9 kg/m^2), overweight (BMI: 25.0–29.9), obese I (BMI: 30.0–34.9), and obese II (BMI: 35+). The prevalence of injury and prevalence ratios from fitted logistic regression models was used to assess relationships between obesity and injury after adjusting for covariates. Sampling weights were incorporated using SUDAAN software. *Results*: During the 9-year study period from 2004 to 2012, 1120 workers (78 workers per 10,000) experienced a work-related injury during the previous three months. The anatomical sites with the highest prevalence of injury were the back (14.3/10,000 ± 1.2), fingers (11.5 ± 1.3), and knees (7.1 ± 0.8). The most common types of injuries were sprains/strains/twists (41.5% of all injuries), cuts (20.0%), and fractures (11.8%). Compared to normal weight workers, overweight and obese workers were more likely to experience work-site injuries [overweight: PR = 1.25 (95% CI = 1.04–1.52); obese I: 1.41 (1.14–1.74); obese II: 1.68 (1.32–2.14)]. These injuries were more likely to affect the lower extremities [overweight: PR = 1.48, (95% CI = 1.03–2.13); obese I: 1.70 (1.13–2.55); obese II: 2.91 (1.91–4.41)] and were more likely to be due to sprains/strains/twists [overweight: PR = 1.73 (95% CI = 1.29–2.31); obese I: PR = 2.24 (1.64–3.06); obese II: PR = 2.95 (2.04–4.26)]. *Conclusions*: Among NHIS participants, overweight and obese workers were 25% to 68% more likely to experience injuries than normal weight workers. *Practical applications*: Weight reduction policies and management programs may be effectively targeted towards overweight and obese groups to prevent or reduce work-site injuries.

1. Introduction

The prevalence of overweight (body mass index (BMI) 25.0–29.9 kg/m^2) and obesity (BMI 30.0+ kg/m^2) in the United States and in several developed countries has gradually increased since the beginning of the 1980s (Ogden & Carroll, 2012; Puska, Nishda, & Porter, 2003). Recent data from the National Health and Nutrition Examination Survey (NHANES) show that more than 78 million U.S. adults (35%) were obese in 2011–2012, with approximately 40% of middle-aged (40–59) adults and 56% of African-American women in the obese category (Ogden, Carroll, Kit, & Flegal, 2012). This increased prevalence of obesity and overweight is a major public health concern. Obesity is linked to an increased risk of a number of diseases including hypertension, metabolic syndrome, diabetes, coronary heart disease, stroke, sleep apnea, osteoarthritis, and some cancers (colon, breast, endometrial, and gallbladder; NHLBI, 2012). The prevalence of obesity has also

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escalated to one of the top workplace health concerns both in the United States and in other countries (Hertz, Unger, McDonald, Lustick, & Biddulph-Krentar, 2004; Kuehl et al., 2012; Østbye, Dement, & Krause, 2007; Pollack et al., 2007; Poston, Jitnarin, Haddock, Jahnke, & Tuley, 2011; Rodbard, Fox, & Grandy, 2009; Shuford & Restrepo, 2010). Workers' obesity levels could have work-related consequences such as injuries and disabilities (Pollack et al., 2007; Shuford & Restrepo, 2010), increased workers' compensation (Kuehl et al., 2012; Østbye et al., 2007), decreased work productivity (Rodbard et al., 2009), more absenteeism (Poston et al., 2011), and work limitations (Hertz et al., 2004).

In the National Health Interview Survey (NHIS) 1997–1999, work-related injuries comprised more than a quarter of all injuries. In one-third of men and one-fifth of women, the annual rate of work-related injuries was 4.3 per 100 U.S. workers (Smith, Sorock, Wellman, Courtney, & Pransky, 2006). Many studies have investigated the risk of injuries among workers who are obese (Hertz et al., 2004; Kuehl et al., 2012; Østbye et al., 2007; Pollack et al., 2007; Poston et al., 2011; Rodbard et al., 2009; Shuford & Restrepo, 2010). In a manufacturing company, the odds of workplace injury among obese workers were significantly higher than that among healthy workers (Pollack et al., 2007). This study also found that most injuries occurred to the hands/wrists and legs/knees among the obese workers. Truck drivers who are obese may be much more likely to be involved in traffic collision-related fatalities than non-obese occupants since many of these accidents are associated with seatbelt use, a practice that may be less prevalent among those with higher adiposity levels (Jehle, Doshi, Karagianis, Consiglio, & Jehle, 2014; Rice & Zhu, 2014). Obese workers in a Finnish hospital (Kouvonen et al., 2013) were reported to have a higher risk of bone fractures, dislocations, sprains and strains, and upper and lower extremities. Pollack and colleagues also reported a higher number of injuries to the back, hands/wrists, and legs/knees in the obese group. However, in a systematic review study, it was reported that although the risk of injury among obese persons was slightly increased, many of the estimates were not statistically significant (Pollack & Cheskin, 2007). Another study conducted among workers in Washington State indicated that obese women with occupational back injuries showed significant weight gain after one year of the occurrence (Keeney et al., 2013). The relationship between obesity and injury appears to be bidirectional, with one impacting the risk of the other.

Most of the previous studies that have reported associations between obesity and injury conducted their investigations in a single occupational or industrial site. There may be advantages to these single-site studies in that one can develop interventions that are specific to an occupation or industry. However, research incorporating a wide variety of occupations and industries is also useful in that they can provide general estimates of associations between obesity and injury on a national level. Even when studies were conducted on large samples, very few of those studies investigated associations among a nationally representative group of workers across all occupational groups. The objectives of this study, which was conducted among a nationally representative sample of U.S. workers, were to: (a) estimate the prevalence of work related injury by several factors: anatomical sites of injury, nature of injury, external causes, treatment location, number of nights in hospital, and days of work missed; and (b) examine the association between obesity and injury.

2. Materials and methods

2.1. Source of data

Injury was assessed using data from the National Health Interview Survey (NHIS), which was developed and administered by the National Center for Health Statistics (NCHS) in the U.S. Centers for Disease Control and Prevention (CDC) to track health status, health care access, and progress toward achieving national health objectives since 1957. The NHIS is a nationally representative cross-sectional survey of in-person household interviews conducted annually and is based on a multistage clustered area probability sample. Individuals who belong to racial/ethnic minority backgrounds (e.g., Blacks, Hispanics, and Asians) and adults aged ≥ 65 years are oversampled to allow for the precise estimation of health in minority populations and elders. Extensive details about the questionnaire, methodology, data and documentation are available on the NHIS website (NCHS, 2014).

Data from the NHIS core questionnaires (Sample Adults, Family) for 2004–2012 were analyzed for this study. Written informed consent was obtained from all subjects. All procedures in each NHIS were approved by the NCHS Research Ethics Review Board (NCHS, 2012a). We 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 prior to their interview. The total number of the combined 2004–2012 NHIS adults was 254,630 with average response rate of 79.8% (Table 1). From this population, our study included 141,235 working adults, after excluding those who were pregnant or missing the BMI variable.

The Sample Adults questionnaire in the NHIS elicited information from participants on demographics and socio-economic factors (age, sex, race/ethnicity, education, marital status, lifestyle, employment, income, occupation) and lifestyle characteristics (smoking status, alcohol intake, sleep duration, physical activity). The injury and poisoning questionnaire in the Family core questionnaire collected information on participants' injuries, medical care, external causes of injury, activity at time of injury, and the number of work days missed due to injury.

2.2. Body mass index (BMI)

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?"). Height was converted to meters and weight was converted to kilograms. BMI was used to assess obesity, and was calculated as weight in kilograms divided by height in meters squared. We used BMI as both a continuous variable and a categorical variable (BMI: 18.5–24.9 kg/m^2 for normal weight, 25.0–29.9 kg/m^2 for overweight, 30.0–34.9 kg/m^2 for obese I, and 35.0 + kg/m^2 for obese II). BMI was used as a continuous variable when assessing trends in injury prevalence with increasing BMI and was also categorized into commonly used groups when assessing whether injury-related characteristics were associated with obesity. We excluded persons who were underweight (BMI < 18.5 kg/m^2) because the number of injuries in that group was too small.

2.3. Work-site-injury

For our study, self-reported injury was collected during a limited period at the place of work. 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?" Beginning in 2004, NCHS decided to retain all injury episodes that reportedly occurred during the three months (91 days) prior to the date of the injury in question (NCHS, 2012b) to reduce the recall bias of less serious injury. The NHIS Injury file contains information about the external causes and the nature of the injury episode, what the person was doing at the time of the injury, where the person received medical advice and treatment, whether the person was hospitalized, and whether the person missed any days from work due to the injury, with the Ninth Revision of the International Classification of Diseases (ICD-9-CM) diagnostic codes and ICD-9-CM external cause codes. Each person with injury has been classified according to the nature of injury codes 800–909.2, 909.4, 909.9, 910–994.9, 995.5–995.59, and 995.80–995.85 in ICD-9-CM and one external cause of injury code of E800–E848, E850–E869.9, E880–E929.9, or E950–E999 (NCHS, 2012b). The nature of injuries was categorized on the questionnaire as fracture, sprain/