Clinically Significant Weight Gain 1 Year After Occupational Back Injury

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Objective: To examine the incidence of clinically significant weight gain 1 year after occupational back injury, and risk factors for that gain. **Methods:** A cohort of Washington State workers with wage-replacement benefits for back injuries completed baseline and 1-year follow-up telephone interviews. We obtained additional measures from claims and medical records. **Results:** Among 1263 workers, 174 (13.8%) reported clinically significant weight gain (≥7%) 1 year after occupational back injury. Women and workers who had more than 180 days on wage replacement at 1 year were twice as likely (adjusted odds ratio = 2.17, 95% confidence interval = 1.54 to 3.07; adjusted odds ratio = 2.40, 95% confidence interval = 1.63 to 3.53, respectively; both $P < 0.001$) to have clinically significant weight gain. **Conclusions:** Women and workers on wage replacement for more than 180 days may be susceptible to clinically significant weight gain after occupational back injury.

The dangers of obesity to general health and specific diseases are well-known. Obesity is strongly associated with a shorter life span, lower quality of life, higher rates of cardiovascular disease, various cancers, and type II diabetes.[1] In occupational settings, rates of back injury and increased workers' compensation costs are associated with obesity, as are overall rates of occupational injury, lower worker productivity, and reporting of noninjury back pain.[2–5] Being overweight or obese is associated with more workers' compensation claims, more lost workdays, higher medical claims costs, and higher indemnity claims costs.[4,6] Self-reported need for mental health services is associated with weight gain among injured workers.[7] Although much is known about obesity's impact on back injuries and workers' compensation, little is known about the extent of weight gain among injured workers or about the early predictors of weight gain after an injury.

We conducted an exploratory study, using a sample of workers with wage-replacement claims (at least 1 day of temporary total disability wage replacement) for work-related back injuries, to determine the incidence of clinically significant weight gain 1 year after occupational back injury. We expected that a subset of workers might gain a clinically significant amount of weight after injury (eg, due to decreased physical activity and more time at home engaged in sedentary activities). If risk factors for such weight gain could be identified early after injury and before weight gain, preventive interventions might be developed. Therefore, a second objective of the study was to identify early predictors of clinically significant weight gain and develop an exploratory multivariate predictive model for weight gain. Finally, we explored the association of clinically significant weight gain with receipt of wage-replacement (time-loss) benefits at 1 year after injury. We hypothesized that extended receipt of wage-replacement benefits would be associated positively with weight gain. On the basis of previous research, we hypothesized that the following baseline variables would predict clinically significant weight gain 1 year after occupational back injury: higher baseline body mass index (BMI), greater injury severity, higher baseline pain and disability levels, lower work physical demands, greater worker fear-avoidance and worse mental health, lower education attainment, poor overall health status, an opioid prescription within 6 weeks after seeing a provider for the back injury, not using tobacco, and not returning to work by the baseline interview.[1,3,4,7–10,12–24]

METHODS

Sample

We used the Washington State Workers' Compensation Disability Risk Identification Study Cohort (D-RISC)[9] data to examine the prevalence of overweight and obesity at the time of injury, the incidence of clinically significant weight gain in the year after injury, and early predictors of weight gain 1 year after occupational back injury. In D-RISC, potential risk factors for chronic disability were assessed in domains of interest that were used previously for occupational injury research.[8–11] Eight domains (sociodemographic, employment-related, pain and function, clinical, health care, administrative/legal, health behavior, and psychological)[8] were assessed in baseline telephone interviews with workers with recent back injuries.

The D-RISC was a prospective, population-based study that recruited Washington State Workers Compensation State Fund workers from June 2002 through April 2004 with accepted and provisional claims for occupational back injuries. Weekly claims review identified workers who missed at least 4 days from work and received wage-replacement benefits (temporary total disability). Approximately two-thirds of the nonfederal Washington workforce is covered by the State Fund. The remaining third are covered by large, self-insured companies and were not included because of insufficient administrative data.

From the State Fund claims database, 4354 workers were identified. Of those, 1178 (27.1%) could not be contacted, 909 (20.9%) declined enrollment, and 120 (2.8%) were ineligible.[9] The

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remaining 2147 (49.3%) were enrolled in D-RISC and completed baseline interviews. Persons were later excluded from the analysis sample if they were not eligible for wage-replacement benefits in the first year after claim submission ($n = 240$), were hospitalized for the injury ($n = 16$), were missing information on age ($n = 3$), or were not confirmed to have a back injury upon medical review ($n = 3$).[9] Hence, 1885 (43.3%) were included in D-RISC. Of the 1885, 1319 participants completed the follow-up interview approximately 1 year after claim receipt and 1269 participants (96.2%) reported their weight during both interviews.

Upon inspection of the data, 16 participants had very large weight changes after 1 year (≥50 lb). From additional administrative records, we were able to obtain data on weight for 3 of the 16 participants and used these data in the analyses. We excluded 6 of the 16 participants from analysis because of inconsistencies between self-report and clinical data that could not be reconciled. The self-reported and clinical data of the remaining 7 participants, among the 16 participants, were very similar and the original self-reported weights were retained in the data, creating a final analysis sample of 1263 participants.

The analysis sample was slightly older (mean age [standard deviation] = 40.3 [11.1] vs 37.5 [11.2] years, $P < 0.001$), had fewer workers of Hispanic ethnicity (14% vs 21%; $P = 0.008$), was more educated (less than high school 11% vs 19%; $P < 0.001$), was more likely to be married or living with a partner (68% vs 57%; $P < 0.001$), and contained more workers with general health insurance (72% vs 60%; $P < 0.001$), as compared with the 622 persons who did not complete the follow-up survey or were excluded because of problematic weight data.

Measures

Study participants completed structured telephone interviews at baseline and at 1 year. Workers were asked their current weight in both interviews. The baseline interview also asked for participant height, which was used to determine baseline BMI (weight in pounds divided by [height in inches^2 × 703]).[26] The baseline interviews were conducted a median of 18 days (interquartile range, 15 to 26 days) after claim submission. At the time of the baseline interview, the median number of days of wage-replacement compensation in the sample was 14 (interquartile range, 4 to 24 days). Among the participants, 94% had less than 6 weeks of wage-replacement compensation at the time of the baseline interview. Baseline measures for this study were a subset of those obtained in the larger study, with selection based on prior research pertaining to occupational injury, BMI, and weight and weight change. Additional data were obtained from the Washington State Department of Labor and Industries claims database, including the region of the worker's residence, the worker's type of industry, the specialty of the first provider seen for the injury, and the number of days between the injury and the first medical visit for the injury. In addition, medical record review by trained occupational nurses, with substantial interrater reliability, was used to determine injury severity.[11] (See Table 1 and the Supplemental Digital Content available at: http://links.lww.com/JOM/A115 for more information about the measures.)

A weight gain of at least 7% of baseline weight at 1 year was used as a measure of clinically significant weight change.[14,16–18] Definitions of clinically significant weight change are not consistent in the literature. Weight changes of any,[7] 3%,[27] and 5% have also been used,[12,13,28] but we chose the more conservative measure of a 7% gain.

To test our hypothesis that weight gain was associated with receiving wage-replacement benefits at 1 year after claim submission, we used a measure of wage-replacement receipt obtained from administrative records that corresponded to a similar timeline as our weight change measure: whether or not workers were receiving wage-replacement benefits 365 days after the date the claim was received by Department of Labor and Industries. In addition, we categorized the accumulated days on wage replacement by 1 year after claim receipt (1 to 29, 30 to 89, 90 to 179, 180+ days) to determine whether there was a dose–response relationship with clinically significant weight gain.

Statistical Analyses

We first conducted bivariate logistic regression analyses to examine associations between baseline variables of interest in each domain and clinically significant weight change, adjusted by age and sex. Missing, "don't know," and refusal responses for each variable were combined into one response and included in the analysis. Variables with the most missing data included time from the date of injury to the first medical visit ($n = 36$), region of worker residence ($n = 35$), paid bill for an opioid within 6 weeks of the first medical visit for the injury ($n = 33$), recovery expectations ($n = 29$), source of blame for the injury ($n = 26$), days of work missed due to non-back health problems in the previous year ($n = 23$), days of work missed due to back problems in the previous year ($n = 18$), worker self-report of whether his/her supervisor listens to work-related problems ($n = 17$), worker self-report of whether the employer had offered job accommodations to allow him/her to work ($n = 16$), worker self-report of number of previous worker's compensation claims ($n = 11$), and worker self-report of change in pain since the injury ($n = 11$).

Next, we created a multivariate logistic regression model predicting clinically significant weight gain (yes/no). We entered as independent variables all baseline variables with P values < 0.10 in the bivariate analysis, along with age and sex. A standard P value of 0.05 for determining statistical significance of bivariate associations may exclude variables that might be significant in a multivariate model.[29] Analyses were conducted with Stata Version 10 (College Station, TX).[30]

RESULTS

Sample Characteristics

The sample of workers ($N = 1263$) was mostly non-Hispanic white (73%; 14% Hispanic; 14% other) and male (69%). This sample seems to have fewer non-Hispanic whites and more male workers than the Washington State 2008 civilian labor force, which was approximately 85% non-Hispanic white, 8% Hispanic, 7% Other, and 54% male workers.[31] At the baseline interview, 29.7% of the study participants were of normal weight (BMI < 25), 40.0% were overweight (25 ≤ BMI ≤ 30), and 30.3% were obese (BMI > 30). At 1 year, 174 participants (13.8%) self-reported weight that represented clinically significant (7%) weight gain from baseline and 103 participants (8.2%) gained more than 10% of their baseline weight. Sixty-two participants went from normal to overweight status, 66 went from overweight to obese, and 1 participant went from normal weight to obese, for a total of 129 participants (10.2%) with an increase in BMI category by 1 year.

Baseline Predictors of Weight Gain in Bivariate Analyses

Table 1 shows the variables associated with clinically significant weight gain in the bivariate analyses. Six of 8 domains contained variables associated ($P < 0.10$) with weight gain. These included female sex (sociodemographic), having a fast-paced work environment prior to injury and not returning to work by the baseline interview (employment-related). The pain and function domain contained one predictor: activity interference due to pain was associated positively with weight gain. Worse current health, aside from injury, was the only predictor of weight gain in the clinical status domain. In the health care domain, weight gain was associated with the specialty of the first health care provider seen for the injury (occupational

TABLE 1. Baseline Variables Associated Bivariately ($P < 0.10$) With Clinically Significant Weight Gain (7%) 1 Year After Baseline Interview*

Domain and Variables	No Significant Weight Gain, $n = 1089$ (%)	Significant Weight Gain, $n = 174$ (%)	Odds Ratio†	95% CI	*P*
Sociodemographic					
Sex (ref = male)	775 (89.2)	94 (10.8)			<0.001
Female	314 (79.7)	80 (20.3)	2.10	1.52–2.91	
Employment-related					
Fast pace (ref = strongly disagree/disagree)	277 (89.9)	31 (10.1)			0.09
Agree	441 (86.5)	69 (13.5)	1.34	0.85–2.13	
Strongly agree	366 (83.2)	74 (16.8)	1.57	0.99–2.48	
Returned to paid work by baseline interview (ref = yes, same job)	365 (88.6)	47 (11.4)			0.02
Yes, light duty or different job	293 (88.0)	40 (12.0)	1.02	0.65–1.61	
No	431 (83.2)	87 (16.8)	1.61	1.09–2.37	
Pain and function					
Pain interference with daily activities, past week (0 = no interference, ref = 0–3)[43]	379 (88.8)	48 (11.2)			0.04
4–5	250 (88.3)	33 (11.7)	1.06	0.66–1.70	
6–7	188 (81.7)	42 (18.3)	1.75	1.11–2.76	
8–10	270 (84.6)	49 (15.4)	1.40	0.90–2.18	
Clinical status					
Current health aside from injury (ref = excellent)	219 (89.0)	27 (11.0)			0.01
Very good	424 (88.1)	57 (11.9)	1.08	0.66–1.76	
Good	336 (84.4)	62 (15.6)	1.45	0.89–2.37	
Fair/poor	110 (80.3)	27 (19.7)	1.90	1.06–3.43	
Health care					
Specialty, first provider seen for injury‡ (ref = primary care)	412 (88.2)	55 (11.8)			0.095
Occupational medicine	60 (78.9)	16 (21.1)	2.06	1.10–3.87	
Chiropractor	302 (84.6)	55 (15.4)	1.46	0.97–2.20	
Other	315 (86.8)	48 (13.2)	1.19	0.78–1.82	
Administrative/legal (no significant variables)					
Health behavior (no significant variables)					
Psychological					
Catastrophizing§ (ref = 0–1)	352 (89.1)	43 (10.9)			0.06
Low (>1–<2)	173 (85.2)	30 (14.8)	1.44	0.87–2.40	
Moderate (2–<3)	334 (87.4)	48 (12.6)	1.13	0.72–1.76	
High (3–4)	230 (81.3)	53 (18.7)	1.78	1.14–2.78	
Recovery expectations[42] (0–10 scale, 10 = extremely certain will be working in 6 mo, ref = 10)	651 (88.8)	82 (11.2)			0.01
High (7–9)	215 (83.3)	43 (16.7)	1.61	1.08–2.42	
Low (0–6)	198 (81.5)	45 (18.5)	1.84	1.23–2.76	
SF-36 v2 Mental Health‖ (ref = >50)[41]	449 (88.6)	58 (11.4)			0.07
41–50	275 (87.3)	40 (12.7)	1.09	0.70–1.68	
≤40	365 (82.8)	76 (17.2)	1.52	1.04–2.22	

*All measures were obtained from worker baseline interviews unless stated otherwise. Missing, "don't know," and refusal responses for each variable were combined into one response for each variable (results not shown).

†All odds ratios were adjusted for age and sex, except for sex.

‡From workers' compensation database.

§Mean of responses to three questions from the Pain Catastrophizing scale.[48]

‖Score from the Short Form–36 version 2 (SF-36v2) Mental Health scale; higher scores indicate better functioning.[40]

Ref indicates reference group.

CI, confidence interval.

medicine specialist relative to primary care provider). Three variables were identified in the psychological domain: greater catastrophizing, poorer 36-item short form health survey[41] Mental Health scale scores, and lower recovery expectations for the back injury were associated with weight gain. No factors from the administrative/legal or health behavior domains were associated with weight gain. Variables that were not associated with weight gain are listed in the Appendix (http://links.lww.com/EDE/A636); these include baseline BMI, injury severity, physical demands at work, fear-avoidance, education, opioid prescription for the injury, and tobacco use status.

Multivariate Model Predicting Weight Gain

Table 2 shows results from the multivariate model that included age and the 9 variables that were associated ($P < 0.10$) bivariately with clinically significant weight gain. Sex was the only significant predictor of clinically significant weight gain. Women had approximately twice the odds of weight gain, as compared with men (adjusted odds ratio [OR] = 2.17; 95% confidence interval [CI] = 1.54 to 3.07).

Association of Receiving Wage-Replacement Compensation With Weight Gain at 1 Year

Receipt of wage-replacement compensation at 1 year (189 of 1263 participants) was associated with clinically significant weight gain after adjustment for age and sex (adjusted OR for receipt of wage replacement vs no wage replacement at 1 year = 2.24, 95% CI = 1.51 to 3.33, $P < 0.001$; Table 3). Almost 25% of participants on wage replacement at 1 year after the injury had clinically significant weight gain, whereas 13.4% of those not receiving wage-replacement compensation at 1 year gained significant weight. In the analysis examining categories of days on wage replacement, adjusting for age and sex, only wage replacement for more than 180 days was associated with clinically significant weight gain, compared with 1 to 29 days (adjusted OR = 2.40, 95% CI = 1.63 to 3.53, overall $P < 0.001$).

DISCUSSION

To our knowledge, this is the first prospective study to examine the incidence and predictors of clinically significant weight gain after an occupational injury. Almost 14% of participants reported weight gain at 1 year of at least 7% of baseline weight. Female sex was the only significant early predictor. In addition, receiving wage-replacement benefits at 1 year was highly associated with clinically significant weight gain.

In this sample, accrued from 2002 to 2004, the baseline distribution of workers in different BMI categories (29.7% normal weight, 40.0% overweight, 30.3% obese) was fairly similar to that in the 2000 general US population (35.5%, 34%, and 30.5%, respectively).[32] The men in our sample had a slightly higher rate of obesity than the national sample (29.7% vs 27.7%), whereas the women were less likely to be obese (31.5% vs 34.0%).

The mean weight change of a 1.44 pound increase over 1 year in our sample was within the range of mean weight change in 1 year reported in previous studies of the American adult population (0.4 to 1.8 pound increases).[27,33–38] In one study of a racially and socioeconomically diverse sample, fewer than 10% of participants gained more than 3% of their body weight in 1 year, compared with 14% of participants gaining more than 7% of their body weight in our sample of injured workers.[27] In our data, men had an overall mean weight change of a 0.93-pound increase (SD = 13.52) whereas women had a mean increase of 1.78 pounds (SD = 14.4); these differences in weight change by sex were not statistically significant ($P = 0.31$). One other study reported mean weight change separately by men and women over 1 year; those authors also found no statistical differences.[27]

Female sex was the only predictor of clinically significant weight gain. Other studies have noted that women in the United States have a higher prevalence of obesity, overweight, lack of physical leisure activities, and weight gain than men.[27,50–52] Several studies have found that women, as compared with men, have more time off work after injury.[53] In one recent study, risk factors varied by sex for return-to-work determinants: working 40 or more hours weekly with dependents and nonawareness of workplace-based safety programs predicted slower return-to-work for females, whereas male factors included high perceived physical workload and higher job insecurity.[54] In our sample, there was no difference in time loss compensation days after the injury by sex (males, 86 days [SD = 127] vs females, 82 days [SD = 127], $P = 0.59$). Of note, we were unable to discern pregnancy status in our data.[55]

A low recovery expectation score (less certainty that he or she will be working in 6 months) at the baseline interview was associated with clinically significant weight gain in bivariate analyses but was not statistically significant in the multivariate model. Low recovery expectations have been previously shown in this sample and in other studies to predict several outcomes of occupational back injury, including slower claim closure, slower end of payment benefits, and being on disability leave after 6 months.[10,56] Recovery expectations may have been associated with weight gain in this study, at least in part, due to its association with being off work for a longer period of time, which we found to be strongly associated with weight gain.

Self-reported poor or fair health, apart from the back injury, was associated with weight gain in bivariate analyses, but not in the multivariate model. Worse self-reported health has been associated with high BMI scores and weight gain in multiple studies.[57–59] Worse overall health may be associated with less physical activity, which may lead to weight gain.[60] In addition, worse health may be associated with greater use of medications that may cause weight gain.[57,61] These associations warrant study in further research.

Weight gain may be part of a constellation of profound negative changes that occur when someone is off work for a prolonged period of time. These adverse effects can include activity limitations, social isolation, anxiety, relationship problems, and financial problems for workers and their families.[54,62–64] In addition, the loss of employment or not working may result in a decline of personal identity, self and family security, and perceptions of loss or humiliation.[65–67]

This work includes a number of limitations. First, our outcome of weight gain is based upon two self-reported weights. Self-reported weight may not be accurate. Nevertheless, in previous studies, participants seemed to misreport consistently, making multiple measures over time by an individual feasible to use in weight change research.[55,68–71] In addition, persons who are already overweight or obese may underreport their weight compared with persons of normal weight.[68,69] A model, including age, sex, and pregnancy status, has been suggested as a method to adjust for weight misreporting[55]; both age and sex were included in our multivariate model, but we were unable to discern pregnancy status in our data. We did not assess weight trends among our sample in years prior to the injury. Nevertheless, 7% weight gain is a marker for clinically significant weight change.[14,16–18] In addition, we were unable to include in our analysis some key known correlates of weight gain, such as diet, exercise, and social support status.[72,73] We may also have sample selection bias; people who did not report their weight and thus were excluded from the study ($n = 50$) may differ in important ways from those who reported their weight. If participants gained weight in the short period of time after the injury but before the baseline interview, we may be underestimating the proportion who gained clinically significant weight and thus underestimating some associations. Finally, 30.0%

TABLE 2. Multivariate Model Predicting Clinically Significant Weight Gain (7%) at 1 Year From Baseline Variables Associated Bivariately With Weight Gain*

Baseline Predictor	Adjusted OR†	95% CI	*P*
Age, y (ref = 35–44)			0.14
≤24	1.12	0.60–2.08	
25–34	1.41	0.91–2.19	
45–54	0.96	0.61–1.51	
≥55	0.59	0.29–1.21	
Sex (ref = male)			<0.001
Female	2.17	1.54–3.07	
Fast pace (ref = strongly disagree/disagree)			0.40
Agree	1.20	0.75–1.92	
Strongly agree	1.43	0.89–2.30	
Return to paid work by baseline interview (ref = Yes, same job)			0.30
Yes, light duty or different job	1.00	0.62–1.60	
No	1.35	0.87–2.10	
Pain interference with daily activities, past week (0 = no interference, ref = 0–3)[43]			0.58
4–5	0.92	0.55–1.53	
6–7	1.29	0.75–2.21	
8–10	0.93	0.53–1.64	
Current health aside from injury (ref = excellent)			0.14
Very good	1.12	0.67–1.85	
Good	1.45	0.87–2.40	
Fair/poor	1.86	1.00–3.45	
Specialty, first provider seen for injury‡ (ref = primary care)			0.15
Occupational medicine	1.85	0.97–3.53	
Chiropractor	1.43	0.94–2.18	
Other	1.08	0.70–1.67	
Catastrophizing§ (ref = 0–1)			0.38
Low (>1–<2)	1.29	0.76–2.21	
Moderate (2–<3)	0.92	0.56–1.51	
High (3–4)	1.29	0.76–2.22	
Recovery expectations[42] (0–10 scale, ref = 10, 10 = extremely certain will be working in 6 mo)			0.08
High (7–9)	1.45	0.92–2.28	
Low (0–6)	1.53	1.00–2.33	
SF-36 v2 Mental Health (ref = >50)[41]			0.86
41–50	0.89	0.56–1.42	
≤40	0.99	0.62–1.57	

*Each baseline variable included in this table was associated significantly ($P < 0.10$) in bivariate analyses with clinically significant weight gain by 1 year of initial occupational back injury. Age was included as an adjusting variable. Missing, "don't know," and refusal responses for each variable were combined into one response for each variable (results not shown).

†Adjusted for all other variables in the multivariate model.

‡From workers' compensation database.

§Mean of responses to three questions from the Pain Catastrophizing scale.[46]

Ref indicates reference group.

CI, confidence interval; OR, odds ratio.

of the D-RISC participants did not complete the 1-year follow-up interview and we do not know whether results would have differed had weight at 1 year been available for the entire sample. We emphasize the exploratory nature of the analyses and the need to replicate findings in other samples.

This study has several strengths. These include a large, prospective, population-based sample in Washington State. We utilized different data sources (two telephone surveys, administrative data, and medical record review) for our variables among eight domains of interest. This study is the first, to our knowledge, to explore variables associated with clinically significant weight gain in a cohort of workers with back injuries.

CONCLUSIONS

In sum, female workers with occupational back injuries were twice as likely as male workers to have clinically significant weight gain in the year after injury. In addition, receiving wage-replacement benefits 1 year after injury was associated with clinically significant weight gain. Approximately 10.8% of men and 20.3% of women in our sample gained a clinically significant amount of weight after

TABLE 3. Associations of Clinically Significant Weight Gain (7%) at 1 Year and Wage-Replacement Status by 1 Year After Occupational Back Injury, Adjusted for Age and Sex

Wage-Replacement Status	No. of Persons ($N = 1,263$)	Adjusted OR	95% CI	*P*
At 1 y				
No	1,070			<0.001
Yes	193	2.24	1.51–3.33	
By 1 y				
1–29 d	754			<0.001
30–89 d	163	1.17	0.69–1.98	
90–179 d	98	1.37	0.74–2.55	
>180 d	248	2.40	1.63–3.53	

CI, confidence interval; OR, odds ratio.

an occupational back injury, possibly resulting in decreased quality of life, increased susceptibility to weight-influenced medical conditions, and increased medical costs. Factors influencing weight gain and obesity are multifaceted and complex; weight gain may be part of a constellation of negative adverse effects of prolonged time off work after an injury and is an additional reason to develop and implement effective means of helping workers return to work as soon as possible after injuries involving some time off work.

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