

Are Hospital Workers Healthy?

A Study of Cardiometabolic, Behavioral, and Psychosocial Factors Associated With Obesity Among Hospital Workers

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Objective: This study evaluated the cardiometabolic, behavioral, and psychosocial factors associated with weight status among hospital employees. **Methods:** A total of $n=924$ employees across the six hospitals in Texas participated in this cross-sectional study, 2012 to 2013. Association between weight status and waist circumference, blood pressure, biomarkers, diet, physical activity, sedentary behaviors, and psychosocial factors was assessed. **Results:** About 78.1% of employees were overweight/obese. Obese participants (body mass index [BMI] $\geq 30.0 \text{ kg/m}^2$) had higher consumption of potatoes, fats, sugary beverages, and spent more time watching television, playing computer games, and sitting than those having normal weight. Being obese was positively associated with blood pressure, blood glucose, low-density lipoprotein, and negatively associated with high-density lipoprotein. Finally, 78.8% of workers were dissatisfied with their worksite wellness with dissatisfaction being higher among obese employees. Being overweight (BMI 25.0 to 29.9 kg/m^2) was positively associated with blood pressure, but not other variables. **Conclusion:** Understanding the risk profile of hospital workers is critical to developing effective interventions.

The burden of obesity continues to persist in the United States (U.S.) with 69% of adults classified as overweight or obese with a body mass index (BMI) more than 25.0 kg/m^2 .¹ Extreme obesity is on the rise, as the percentage of adults with BMI over 40 kg/m^2 increased by 70% between 2000 and 2010 and the prevalence of adults with BMI over 50 kg/m^2 increasing at an even faster rate.^{2,3} Furthermore, the prevalence of obesity is highest among the middle-age adults, aged 40 to 59 years with 39.5% classified as obese, as compared with their younger (30.5%) or older (35.4%) counterparts.¹

Obesity increases the risk for a plethora of chronic diseases and all-cause mortality.⁴ Obesity-related health care costs in the

U.S. are estimated to be \$190.2 billion annually, nearly 20.6% of all annual medical spending.⁵ People who are obese spend 42% more on health care costs than those at a normal weight.⁴ In addition, a number of studies have shown that costs associated with decreased work productivity such as absenteeism (number of days employees are absent from work due to obesity-associated medical conditions) and presenteeism (obesity-related loss of productivity on the days at work) are high.^{6,7} Increased health insurance costs, medical claims, workers compensation claims, and disability benefit payments are also higher among those who are obese.^{6,8-16} Obese workers experience the greatest work-related limitations especially with time needed to complete tasks and physical job demands,⁶ and are also more likely to have significantly more visits to their physician and emergency rooms, and higher hospitalizations than their normal-weight counterparts.^{15,17,18}

Specific industries and occupations are linked to risk of obesity among adults. Working more than 40 hours/week and a stressful work environment are associated with increased obesity prevalence.¹⁹ Also, working in the health care and social assistance sector is associated with a higher prevalence of obesity.¹⁹ Hospital employees, especially those engaged in lower-paying occupational categories, exhibit higher obesity rates than those in a higher-income category.²⁰ Hospitals are stressful environments challenged by round-the-clock staffing and shift workers. Studies have shown that health care workers working long work hours and shifts are more likely to be obese due to changes in body regulation, metabolism, and stress.^{21,22} Furthermore, the food and physical activity environment in hospitals could impact employees' weight status.²³ Despite this, little is known about the factors associated with obesity in a hospital employee population. The purpose of this study was to evaluate the cardiometabolic, behavioral, and psychosocial factors associated with obesity among hospital workers across six large hospitals in Texas.

METHODS

Study Design and Sample

This cross-sectional study was conducted as part of the baseline data for the Shape Up Houston (SUH) Texas Medical Center evaluation study. Recruitment of study participants and baseline data collection was conducted in Fall 2012. SUH, a 501c3 nonprofit organization, partnered with leading health care institutions in Houston, Texas, to implement a 6-month obesity prevention program. A convenience sample of six hospitals in Houston, each part of five separate hospital systems, was recruited to participate. The six hospitals collectively employ over 40,000 adults. SUH contacted the hospital leadership for their support on this study. Following this, the study team obtained approval from hospital Institutional Review Boards and the University of Texas Health Science Center Committee for Protection of Human Subjects, Committee for the Protection of Human Subjects.

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The authors declare no conflict of interest for this study.

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The Human Resources at each of the six hospitals sent mass emails to all their employees, which contained study information inviting them to participate in the study. Interested employees contacted research study staff who then determined eligibility and obtained informed consent. Inclusion criteria were participants who were employed 40 hours/week at the participating hospitals, and had the ability to read English at the 4th grade level. Participants were excluded if they were pregnant; on anti-coagulation therapy; had history of seizures, bleeding disorders such as hemophilia or low platelets; had suspected anemia, immune deficiency; or were previously diagnosed with HIV. Participants were given a \$20 gift card to a local retail store for their time. A total of $n=924$ employees across the six participating hospitals were recruited to participate in the study.

Data Collection Measures

Surveys in English were administered to employees by project staff. Trained project staff measured participant height, weight, blood pressure (BP), and waist circumference. Trained phlebotomists conducted venous blood draws on participants. All survey and health measurements were conducted onsite at the respective employee's hospitals.

Socio-demographics

Socio-demographic data including age, gender, race, ethnicity, education, income, and smoking status were collected using a self-reported survey with standard survey items.

Anthropometrics

Height and weight were measured by trained project staff using portable stadiometers (Perspective Enterprises Portable Adult Measuring Unit PE-AIM-101, Perspective Enterprises, Portage, MI), and digital platform scales with remote displays (Tanita Professional Digital Scales with Remote Display, BWB-800S, Tanita Corporation of America Inc., IL). These measurements were used to compute BMI using the standard equation [$BMI = \text{weight}/\text{height}^2$ (kg/m^2)]. These values were categorized using CDC's BMI range reference as a normal weight ($BMI \geq 18.5$ to ≤ 24.9), overweight ($BMI > 25.0$ to 29.9), and obese ($BMI \geq 30.0$).²⁴

Trained staff measured waist circumference to the nearest 0.5 cm, following standardized protocols. Waist circumference was coded as a dichotomous variable stratified by gender using cutoffs from the American Heart Association (AHA) of more than 35 inches for women and more than 40 inches for men.²⁵

Blood Pressure (BP)

Systolic and diastolic BP of the participants was collected using the BPM-200 (BpTRU Medical Devices, BC, Canada), an automated, noninvasive BP monitor, using standard protocols. A total of two measurements were recorded per participant and an average of the measures was used. BP was categorized as per guidelines from the AHA as "high hypertension risk" (systolic BP ≥ 140 mm Hg and diastolic BP ≥ 90 mm Hg), "at risk hypertension" (systolic BP 120 to 139 mm Hg and diastolic BP 80 to 89 mm Hg), and "no risk or normal" (systolic BP < 120 mm Hg and diastolic BP < 80 mm Hg).²⁶

Biomarkers

A certified phlebotomist collected 20 mL of nonfasting venous blood. Plasma lipids, including total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), triglycerides, and serum glucose levels, were measured using standard enzymatic methods, commercially available reagents, and CDC-provided internal standards on a Roche auto-analyzer. These analytes were measured in a Certified Laboratory Improvement Amendments and College of American Pathologists-certified laboratory.

Dietary Behaviors

Self-reported dietary behavior was measured using the validated Fruit and Vegetable Screener²⁷ and Fat Screener from the National Cancer Institute.^{28,29} Information regarding frequency and portion size for consumption of various fruits and vegetables (F&V) over the past month was obtained. Daily consumption of F&V in cup sizes was computed using an algorithm.³⁰ Participants were also asked to report frequency of consumption of fat in the past 6 months. On the basis of this, total daily fat intake in grams for an individual was computed using an algorithm.³¹

Physical Activity and Sedentary Behaviors

The long version of the validated International Physical Activity Questionnaire (IPAQ) was used to measure job-related, transportation, household/caring for family, leisure time activity, and sedentary behaviors of participants.^{32,33} For the purpose of this study, we evaluated job-related physical activity as measured by three items that assessed the number of days in the past 7 days that the participant engaged in walking, moderate activity, and vigorous activity for at least 10 minutes at their workplace. Responses from these questions were coded as ordinal variables with four response options ranging from "I don't do any of these activities" (coded as 0) to "3 hours or more per day" (coded as 3). Sedentary activity was measured using three questions: hours spent on the computer working/playing games; watching videos/DVDs, and watching television (TV). Responses ranged from "0 hours per day" (coded as 0) to "3 or more hours per day" (coded as 3). In addition, two questions measured the number of hours the participants spent sitting on weekdays and weekends in the last 7 days. These variables were coded as continuous variables.

Psychosocial Factors

Participants were asked about perceived diet quality (one item),³⁴ and their general satisfaction level of wellness offered through their workplace including quality and quantity of advice they received regarding nutrition and physical activity at their workplace in the past six months (three items).³⁵ Responses were self-reported on a Likert-type scale. Employees also reported if they were actively trying to lose weight (one item).

Statistical Analysis

The primary purpose of this study was to identify the cardiometabolic, behavioral, and psychosocial factors associated with weight status among participating hospital employees. All analyses were conducted using STATA 13.0 statistical software (STATA Corp, College Station, TX). Descriptive statistics including means, standard deviations, and frequencies were computed. Chi-square test and unpaired *t* test were used to determine differences in the socio-demographic characteristics by weight status. The cardiometabolic risk factors were treated as both continuous and categorical variables in determining their association with weight status. As per AHA recommendations for nonfasting values,³⁶ total cholesterol was dichotomized as "High" (≥ 200 mg/dL) and "Low" (< 200 mg/dL), HDL dichotomized as "High" (≥ 40 mg/dL) and "Low" (< 40 mg/dL), LDL dichotomized as "High" (≥ 130 mg/dL) and "Low" (< 130 mg/dL), and serum glucose was dichotomized as "High" (≥ 200 mg/dL) and "Low" (< 200 mg/dL).

Dummy variables were created for overweight and obese weight status to assess the risk for each weight status category separately. Independent logistic regression was computed to assess the association between being overweight or obese (with normal weight as the reference) and BP, total serum cholesterol, LDL, HDL, triglycerides, glucose, diet, physical activity, sedentary behaviors, and psychosocial factors. Odds ratios (ORs), adjusting for significant covariates including marital status, ethnicity and income level, 95% confidence intervals (95% CIs), and *P* values were computed.

Missing data were excluded from the analysis (<5%). Hosmer and Lemeshow’s goodness-of-fit test was used to assess model fit,³⁷ which indicated that the model fit the data well. Significance was set at $P < 0.05$.

RESULTS

Demographic Characteristics

A total of 924 employees, mostly administrators and technicians, from six hospitals in Houston, Texas, completed baseline measurements (Table 1). Of these, 78.2% were overweight or obese: 28.5% were overweight (BMI 25.0 to 29.9) and 49.7% were obese (BMI ≥30.0). For waist circumference, 43.6% of males had a waist circumference more than 40 inches, while 69.3% of females had a waist circumference more than 35 inches. The mean BMI was 30.8 ± 6.9, and the mean age of our participants was 43.6 years ± 11.1. Overall, the sample was 49.5% white, 34.7%

black, 8.6% Asian, and 7.2% categorized as “other.” Of the total sample, 85.5% were female, 78.5% non-Hispanic/Latino, and 58.7% were married. Most participants (87.4%) had completed some college, and 39.2% had income greater than \$75,000/year.

Overall, the prevalence of obesity was significantly higher among participants who were Latino (57.8% obese) or African-American (67.0% obese), not married (55.5% obese), did not have a college degree (55.5% obese), with annual income less than \$40,000 (59.9% obese), and reportedly had been diagnosed with high BP and high triglycerides. Among males, 36.1% were overweight and 44.4% were obese, whereas among females, 26.9% were overweight and 50.8% were obese.

Association Between Weight Status and Cardiometabolic Risk Factors

Both being overweight or obese were positively associated with hypertension (Overweight OR^{adjusted} = 1.75; 95% CI, 1.28 to

TABLE 1. Demographic Characteristics of Hospital Workers by Weight Status Across Six Hospitals in Houston, Texas ($n = 924$)

Variable Name	Total [†]		Weight Status [†]						X ²	P
	n	%	Normal		Overweight		Obese			
	n	%	n	%	n	%	n	%		
Weight status	920	100	201	21.8	262	28.5	457	49.7	—	—
Waist circumference										
Males										
≤40 inches	75	56.4	26	34.7	40	53.3	9	12.0	75.88	0.00
>40 inches	58	43.6	0	0	8	13.8	50	86.2		
Females										
≤35 inches	240	30.7	151	62.9	73	30.4	16	6.7	388.42	0.00
>35 inches	541	69.3	24	4.5	136	25.1	381	70.4		
Gender										
Male	133	14.5	26	19.6	48	36.1	59	44.4	4.79	0.09
Female	782	85.5	175	22.4	210	26.9	397	50.8		
Ethnicity										
Hispanic/Latino	192	21.5	30	15.6	51	26.6	111	57.8	8.58	0.01 ^a
Non-Hispanic/Latino	703	78.5	170	24.2	201	28.6	332	47.2		
Race										
White	415	49.5	121	29.2	119	28.7	175	42.2	89.11	<0.01 ^a
Black/African American	291	34.7	24	8.3	72	24.7	195	67.0		
Asian	72	8.6	33	45.8	25	34.7	14	19.4		
Others	60	7.2	14	23.3	15	25.0	31	51.7		
Marital status										
Married	527	58.7	133	25.2	153	29.0	241	45.7	10.78	0.01 ^a
Not married	371	41.3	64	17.3	101	27.2	206	55.5		
Education										
Completed college	786	87.4	192	24.4	222	28.2	372	47.3	17.92	<0.01 ^a
Not completed college	113	12.6	8	7.1	35	31.0	70	62.0		
Income										
<\$40,000	187	22.7	32	17.1	43	23.0	112	59.9	18.75	<0.01 ^a
40–75,000	313	38.1	59	18.9	86	27.5	168	53.7		
>75,000	322	39.2	85	26.4	103	32.0	134	41.6		
Smoking status										
No, never	695	78.5	160	23.0	199	28.6	336	48.3	2.42	0.66
No, but used to	159	18.0	35	22.0	42	26.4	82	51.6		
Yes	31	3.5	5	16.1	7	22.6	19	61.3		
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	F	P
Age	920	43.6 (11.1)	201	41.5 (11.6)	260	44.3 (11.3)	456	44.2 (10.7)	5.00*	<0.01 ^a
BMI	920	30.8 (6.9)	201	22.5 (1.7)	262	27.6 (1.4)	457	36.3 (5.3)	—	—

*ANOVA values reported.

[†]For “Total,” the overall column percentages are presented for the study sample. For “weight status,” the row percentages are presented stratified by weight status—normal weight, overweight, and obese.

^a $P < 0.05$.

TABLE 2. Differences in Cardiometabolic Risk Factors by Weight Status Among Hospital Workers Across Six Hospitals in Texas (n = 924)

Variable Name	Total [§] n (%)	Normal Weight n (%)	Overweight n (%)	Obese n (%)	Adjusted	
					Overweight OR (95% CI) P	Obese OR (95% CI) P
Blood pressure levels*						
Normal	430 (46.8)	135 (31.4)	114 (26.5)	181 (42.1)	1.75 (1.28–2.40); <0.01 ^a	2.21 (1.66–2.93); <0.01 ^a
At risk (hypertension)	344 (37.4)	51 (14.8)	114 (33.1)	179 (52.1)		
High (hypertension)	145 (15.8)	15 (10.3)	33 (22.8)	97 (66.9)		
Cholesterol [†]						
≤199 mg/dL	548 (64.2)	126 (23.0)	157 (28.6)	265 (48.4)	1.34 (0.86–2.09); 0.19	1.45 (0.97–2.18); 0.07
≥200 mg/dL	303 (35.8)	64 (21.1)	89 (29.4)	150 (49.5)		
LDL [†]						
≤129 mg/dL	659 (78.8)	157 (23.8)	189 (28.7)	313 (47.5)	1.57 (0.91–2.70); 0.10	1.79 (1.09–2.93); 0.02 ^a
≥130 mg/dL	177 (21.2)	32 (18.1)	52 (29.4)	93 (52.5)		
HDL [†]						
<40 mg/dL	64 (7.5)	6 (9.4)	17 (26.5)	41 (64.1)	0.30 (0.10–0.94); 0.04 ^a	0.21 (0.07–0.61); <0.01 ^a
≥40 mg/dL	787 (92.5)	184 (23.4)	229 (29.1)	374 (47.5)		
Glucose [‡]						
≤199 mg/dL	838 (98.5)	189 (22.6)	244 (29.1)	405 (48.3)	1.69 (0.15–18.97); 0.67	4.40 (0.53–36.44); 0.17
≥200 mg/dL	13 (1.5)	1 (7.7)	2 (15.4)	10 (76.9)		

95% CI, 95% confidence interval; HDL, high-density lipoprotein; LDL, low-density lipoprotein; OR, odds ratio.
 *“normal” Diastolic <80 mm Hg and systolic <120 mm Hg, At-risk hypertension: systolic: 120–139 mm Hg; diastolic: 80–89 mm Hg, High hypertension: systolic: 140 mm Hg or higher; diastolic: 90 mm Hg or higher (American Heart Association, 2014).²⁶
[†]As per AHA recommendations for nonfasting values, total cholesterol is dichotomized as “High” (≥200 mg/dL), “Normal” (<200 mg/dL), HDL dichotomized as “Recommended” (≥40 mg/dL), and “Low” (<40 mg/dL), LDL dichotomized as “High” (≥130 mg/dL), and “Normal” (<130 mg/dL).
[‡]Serum glucose was dichotomized as “High” (≥200 mg/dL) and “Normal” (<200 mg/dL).³⁶
[§]For “Total,” the overall column percentages are presented for the study sample. For “weight status,” the row percentages are presented stratified by weight status—normal weight, overweight, and obese.
^{||}Adjusted odds ratios, 95% confidence intervals, and P values computed for overweight (BMI = 25.0–29.9) and obese (BMI ≥30.0) category separately with normal weight (BMI = 18.5–24.9) was used as the reference category.
^aP < 0.05.

2.40; P = <0.01; Obese OR^{adjusted} = 2.21; 95% CI, 1.66 to 2.93; P = <0.01) (Table 2). Being obese was positively associated with LDL cholesterol (OR^{adjusted} = 1.79; 95% CI, 1.09 to 2.93; P = 0.02) and negatively associated with HDL cholesterol (OR^{adjusted} = 0.43; 95% CI, 0.07 to 0.61; P = <0.01). Although overweight and obesity were positively associated with total cholesterol and serum glucose, these results were not statistically significant. The direction and significance of these associations remained unchanged when glucose, total cholesterol, LDL, and HDL were treated as continuous variables instead of categorical variables.

Association Between Weight Status and Diet

Overall, participating employees were reportedly consuming on average 1.4 ± 1.7 cups of fruit and 1.4 ± 1.8 cups of vegetables per day (Table 3). There were no significant differences in the daily consumptions of F&V by weight status. However, obese participants had significantly higher daily consumption of French fries (OR^{adjusted} = 7.87; 95% CI, 2.20 to 28.10; P < 0.01), as well as other white potatoes (OR^{adjusted} = 39.43; 95% CI, 3.97 to 391.68; P < 0.01) than those of normal weight. Furthermore, obese participants also reportedly had almost a three times higher intake of regular fat food (versus reduced or low fat) (OR^{adjusted} = 2.82; 95% CI, 1.63 to 4.87; P < 0.01), and butter and margarine added to food (OR^{adjusted} = 2.67; 95% CI, 1.70 to 4.20; P < 0.01), and a significantly higher intake of sugary beverages (OR^{adjusted} = 1.64; 95% CI, 1.20 to 2.24; P < 0.00), than their normal-weight counterparts. There were no significant associations between being overweight and eating behaviors.

Association Between Weight Status, Physical Activity, and Sedentary Behaviors

Overall, 65.6% of the participants reported doing no days of vigorous physical activity and 48.4% reported no days of moderate physical activity in the previous week while at work (Table 3). Walking was more prevalent with 44% of the participants reporting walking 5 or more days a week as part of their job. However, 24% of the participants also reported 0 days of walking at work in the previous week. Being obese was negatively associated with frequency of job-related vigorous activity (OR^{adjusted} = 0.79; 95% CI, 0.65 to 0.96; P = 0.02). No significant associations were observed between overweight/obesity and job-related moderate activity or walking.

Overweight and obese participants also reportedly spent more time watching television (Overweight OR^{adjusted} = 1.75, 95% CI: 1.27 to 2.41; P ≤ 0.01; Obese OR^{adjusted} = 2.51, 95% CI: 1.86 to 3.38; P ≤ 0.01). Finally, obese participants spent significantly more time playing computer games (OR^{adjusted} = 1.27, 95% CI: 1.03 to 1.56; P = 0.02), and more number of hours sitting during the weekdays (OR^{adjusted} = 1.08, 95% CI: 1.01 to 1.15; P = 0.03) and weekend days (OR^{adjusted} = 1.16, 95% CI: 1.07 to 1.26; P ≤ 0.01) than those of normal weight.

Association Between Weight Status, Perceived Diet Quality, and Worksite Wellness Satisfaction

Participants’ perceptions of their own diet quality varied across weight status (Table 4). About 61.8% of the obese

TABLE 3. Differences in Dietary Behaviors and Job-Related Physical Activity by Weight Status Among Hospital Workers Across Six Hospitals in Houston, Texas (n = 924)

	Total [¶] N Mean (SD)	Weight Status [¶]			Adjusted [#]	
		Normal Weight N Mean (SD)	Overweight N Mean (SD)	Obese N Mean (SD)	Overweight OR (95% CI); P	Obese OR (95% CI); P
Dietary behavior: fruit and vegetable daily consumption (last month) in cups						
Fried potato (French fries)	672 0.2 (0.4)	132 0.2 (0.2)	191 0.2 (0.3)	348 0.3 (0.4)	1.52 (0.52–4.43); 0.44	7.87 (2.20–28.10); <0.01 ^a
Other potato	698 0.1 (0.1)	152 0.1 (0.1)	198 0.1 (0.1)	347 0.1 (0.2)	2.78 (0.27–28.41); 0.39	39.43 (3.97–391.68); <0.01 ^a
Total daily fruit consumption*	595 1.4 (1.7)	128 1.5 (1.2)	158 1.2 (1.4)	309 1.4 (1.9)	0.86 (0.71–1.04); 0.11	0.95 (0.84–1.07); 0.40
Daily vegetables consumption [†]	745 1.4 (1.8)	167 1.5 (1.5)	213 1.3 (1.3)	364 1.4 (2.1)	0.84 (0.71–0.99); 0.04	0.98 (0.88–1.08); 0.62
Total daily vegetable consumption [‡]	385 2.0 (1.7)	85 1.9 (1.4)	105 1.8 (1.3)	195 2.2 (2.0)	0.89 (0.70–1.14); 0.35	1.1 (0.93–1.31); 0.28
Total margarine and butter added to food [§]	786 0.5 (0.6)	172 0.4 (0.4)	226 0.5 (0.7)	387 0.7 (0.7)	1.74 (1.10–2.76); 0.02	2.67 (1.70–4.20); <0.01 ^a
Regular fat used	784 0.4 (0.6)	172 0.2 (0.3)	225 0.4 (0.6)	386 0.5 (0.6)	1.96 (1.10–3.46); 0.02	2.82 (1.63–4.87); <0.01 ^a
Sugar sweetened beverages (last month)	791 0.5 (1.0)	173 0.3 (0.7)	225 0.4 (0.7)	392 0.7 (1.1)	1.23 (0.88–1.71); 0.22	1.64 (1.20–2.24); <0.01 ^a
Physical Activity and Sedentary Behavior						
	n (%)	n (%)	n (%)	n (%)	OR (95% CI); P	OR (95% CI); P
Job-related vigorous physical activity						
0 days/week	481 (65.6)	106 (22.0)	129 (26.9)	246 (51.1)	0.93 (0.76–1.15); 0.51	0.79 (0.65–0.96); 0.02 ^a
1–2 days/week	81 (11.1)	17 (21.0)	21 (25.9)	43 (53.1)		
3–4 days/week	86 (11.7)	23 (26.7)	27 (31.4)	36 (41.9)		
5+ days/week	85 (11.6)	18 (21.2)	30 (35.3)	37 (43.5)		
Job-related moderate physical activity						
0 days/week	355 (48.4)	80 (22.5)	94 (26.5)	181 (51.0)	1.03 (0.84–1.26); 0.76	0.91 (0.75–1.10); 0.32
1–2 days/week	135 (18.4)	32 (23.7)	30 (22.2)	73 (54.1)		
3–4 days/week	135 (18.4)	31 (23.0)	44 (32.6)	60 (44.4)		
5+ days/week	108 (14.8)	21 (19.4)	40 (37.0)	47 (43.5)		
Job-related walking						
0 days/ week	179 (24.3)	31 (17.3)	51 (28.5)	97 (54.2)	0.93 (0.77–1.13); 0.48	0.87 (0.73–1.03); 0.11
1–2 days/week	91 (12.3)	22 (24.2)	17 (18.7)	52 (57.1)		
3–4 days/ week	143 (19.4)	42 (29.4)	42 (29.4)	59 (41.2)		
5+ days/week	324 (44.0)	68 (21.0)	99 (30.6)	157 (48.4)		
Watching video games per day						
I do not do any of these activities/day	653 (82.9)	150 (23.0)	188 (28.8)	315 (48.2)	1.15 (0.73–1.81); 0.56	1.48 (0.99–2.21); 0.05
<1 hour/ day	83 (10.5)	14 (16.9)	23 (27.7)	46 (55.4)		
1 or more hours/day	52 (6.6)	9 (17.3)	12 (23.1)	31 (59.6)		
Watching TV watching per day						
I do not do any of these activities/day	18 (2.3)	11 (61.1)	3 (16.7)	4 (22.2)	1.75 (1.27–2.41); <0.01 ^a	2.51 (1.86–3.38); <0.01 ^a
<1 hour/day	96 (12.2)	34 (35.4)	32 (33.3)	30 (31.3)		
1–2 hours/day	438 (55.6)	102 (23.3)	133 (30.4)	203 (46.3)		
3 hours or more/day	235 (29.9)	25 (10.6)	55 (23.4)	155 (66.0)		
Computer playing per day						
I do not do any of these activities/day	383 (48.6)	100 (26.1)	115 (30.0)	168 (43.9)	1.08 (0.86–1.36); 0.52	1.27 (1.03–1.56); 0.02 ^a
<1 hour/day	184 (23.4)	34 (18.5)	54 (29.4)	96 (52.2)		
1–2 hours/day	157 (20.0)	24 (25.3)	40 (25.5)	93 (59.2)		
3 hours or more/day	63 (8.0)	15 (23.8)	14 (22.2)	34 (54.0)		
Hours spent sitting on a week day	780 6.0 (3.0)	172 5.7 (2.8)	220 5.7 (3.0)	387 6.2 (3.0)	1.02 (0.95–1.10) 0.53	1.08 (1.01–1.15); 0.03 ^a
Hours spent sitting on a weekend day	785 4.7 (2.7)	171 4.1 (2.5)	223 4.3 (2.5)	390 5.1 (2.8)	1.02 (0.94–1.12); 0.59	1.16 (1.07–1.26); <0.01 ^a

95% CI, 95% confidence interval; OR, odds ratio.

*Total daily fruit consumption = 100% juice total daily consumption (cup) + Fruit total daily consumption(cup).³⁰

†Total daily vegetable consumption = lettuce salad total daily consumption (cup) + Other Vegetables total daily consumption (cup).³⁰

‡Total Daily Vegetable Consumption = Sum of all vegetable daily consumption listed exclude vegetable mixture (cup).³⁰

§Total Fat = sum(margarine on bread, margarine on veg, margarine on rice).

||Regular fat used = total fat * (Answer to “How often did you use reduced-fat margarine”): Didn’t use or almost never = total fat; About 1/4 of the time = total fat*0.75; About 1/2 of the time = total fat*0.50; About 3/4 of the time = total fat*0.25; Almost always or always = total fat*0.³⁰

[¶]For “Total,” the overall column percentages are presented for the study sample. For “weight status,” the row percentages are presented stratified by weight status—normal weight, overweight, and obese.

[#]Normal weight (BMI = 18.5–24.9) was used as the reference category.

^aP < 0.05.

TABLE 4. Differences in Psychosocial Factors Associated With Diet, Physical Activity, and Satisfaction With Worksite Wellness by Weight Status Among Hospital Workers Across Six Hospitals in Houston, Texas ($n = 924$)

Variable Name	Total [†] <i>n</i> (%)	Weight Status*			Adjusted [‡]	
		Normal Weight <i>n</i> (%)	Overweight <i>n</i> (%)	Obese <i>n</i> (%)	Overweight OR 95% CI; <i>P</i>	Obese OR 95% CI; <i>P</i>
Perceived diet quality						
Poor	79 (10.0)	3 (3.8)	9 (11.4)	67 (84.8)	0.58 (0.44–0.76); <0.01 ^a	0.34 (0.27–0.44); <0.01 ^a
Fair	264 (33.3)	31 (11.7)	57 (21.6)	176 (66.7)		
Good	298 (37.6)	67 (22.5)	114 (38.2)	117 (39.3)		
Very good	129 (16.2)	59 (45.7)	45 (34.9)	25 (19.4)		
Excellent	23 (2.9)	14 (60.9)	1 (4.3)	8 (34.8)		
Trying to lose weight						
Lose weight	681 (86.1)	93 (13.7)	203 (29.8)	385 (56.5)	0.19 (0.11–0.33); <0.01 ^a	0.03 (0.01–0.07); <0.01 ^a
Stay the same weight	87 (11.0)	63 (72.4)	19 (21.8)	5 (5.8)		
Gain weight	5 (0.6)	4 (80.0)	1 (20.0)	0 (0.0)		
I am not trying to do anything about my weight	18 (2.3)	13 (72.2)	3 (16.7)	2 (11.1)		
Satisfaction with general wellness care through work place						
Very satisfied	30 (3.9)	5 (16.7)	5 (16.7)	20 (66.6)	0.79 (0.57–1.08); 0.14	0.71 (0.54–0.93); 0.01 ^a
Satisfied	133 (17.3)	30 (22.6)	35 (26.3)	68 (51.1)		
Unsatisfied	455 (59.0)	93 (20.5)	138 (30.3)	224 (49.2)		
Very unsatisfied	153 (19.8)	45 (29.4)	39 (25.5)	69 (45.1)		
Amount of advice through your employer about nutrition and physical activity						
Too little	206 (31.2)	39 (18.9)	57 (27.7)	110 (53.4)	0.75 (0.46–1.23); 0.25	0.63 (0.41–0.97); 0.04 ^a
About right	441 (66.7)	110 (24.9)	129 (29.3)	202 (45.8)		
Too much	14 (2.1)	3 (21.4)	5 (35.7)	6 (42.9)		
Quality of advice for Nutrition and PA through employer						
Poor	70 (10.4)	13 (18.6)	14 (20.0)	43 (61.4)	0.99 (0.80–1.23); 0.96	1.01 (0.85–1.21); 0.89
Fair	110 (16.3)	29 (26.4)	36 (32.7)	45 (40.9)		
Good	274 (40.6)	60 (21.9)	90 (32.8)	124 (45.3)		
Very good	126 (18.6)	29 (23.0)	32 (25.4)	65 (51.6)		
Excellent	95 (14.1)	19 (20.0)	23 (24.2)	53 (55.8)		

95% CI, 95% confidence interval; OR, odds ratio.

[†]For “Total,” the overall column percentages are presented for the study sample. For “weight status,” the row percentages are presented stratified by weight status—normal weight, overweight, and obese.

[‡]Normal weight (BMI = 18.5–24.9) was used as the reference category.

^a $P < 0.05$.

participants considered their diet as “fair” or “poor” as compared with 29.2% of overweight, and 19.5% of normal-weight participants, and these differences were significant by weight status for those overweight or obese (Overweight OR^{adjusted} = 0.58, 95% CI: 0.44 to 0.76; $P < 0.01$; Obese OR^{adjusted} = 0.34, 95% CI: 0.27 to 0.44; $P < 0.01$). Also, overall, 86.1% of participants were actively trying to lose weight, of whom 56.5% were obese and 29.8% were overweight. Moreover, these differences were significant by weight status for those overweight or obese (Overweight OR^{adjusted} = 0.19, 95% CI: 0.11 to 0.33; $P < 0.01$; Obese OR^{adjusted} = 0.03, 95% CI: 0.01 to 0.07; $P < 0.01$).

Overall, 78.8% workers were “unsatisfied” or “very unsatisfied” with the general wellness provided to them at their worksite, and the lack of satisfaction was higher among those who were obese (OR^{adjusted} = 0.71; 95% CI: 0.54 to 0.93; $P = 0.01$). Furthermore, the dissatisfaction was higher among obese participants for both quality of advice through employer with regard to nutrition and physical activity. More obese participants reported receiving too little advice about nutrition and physical activity by employer between the groups (OR^{adjusted} = 0.63; 95% CI: 0.41 to 0.97; $P = 0.04$).

DISCUSSION

Our study showed that participating hospital employees had a higher prevalence of obesity than the national average and other

recently reported data on U.S. workers.¹⁹ Also, being obese was significantly associated with poor cardiometabolic outcomes, dietary intake, physical activity, and sedentary behaviors. Data from the 2013 NHANES show that 34.9% adults ages 20 years or older are obese,¹ as compared with 31.9% in Texas.³⁸ Data from U.S. workers, across different occupations, from the 2010 National Health Interview Survey showed that 27.7% of U.S. employees were obese.¹⁹ The estimates in our study were far larger, with 49.6% classified as obese. One reason for a higher prevalence of obesity seen in our study population could be due to volunteer bias. Participants who volunteered to be in the study might have done so to lose weight or to be healthier. This is indicated in our data, as a majority of the participants reported trying to actively lose weight at baseline. However, all employees were invited to participate in the study and the sample size was approximately equal across each of the six hospitals ($\sim n = 150$ workers/hospital), with five of the six hospitals being part of different hospital systems. Also, there were no significant differences between the six participating hospitals for any of the variables of interest, and the associations with weight status. These limitations notwithstanding, the high prevalence of obesity observed in our hospital employees is concerning and warrants further investigation.

Similar to previous studies, our results showed a significant positive association between weight status and BP, serum LDL, and serum glucose, and a significant negative association between

weight status and HDL. Obesity is a known risk factor for cardiovascular disease, type 2 diabetes, and hypertension,³⁹ the biomarkers for which were measured as part of our study. These results raise concerns about the ability of obese hospital employees to maintain health when faced with long work hours, shift work, and high job-related stress. Also, studies have also shown that the risk of injury is higher among overweight/obese hospital employees than those of normal weight.⁴⁰ Thus, medical and productivity costs of workers who are overweight/obese are higher.⁴¹ Our study population of hospital workers was middle-aged, with a mean age of 43.6 years with at least two decades of employment before reaching retirement age. Results of our study underscore the need for participating hospital worksites to invest in robust, evidence-based weight management strategies, coupled with a healthy environment to effectively address obesity among their employees.

Results of the dietary data showed that our participants were consuming less than three servings of F&V per day, which is less than recommended.⁴² Also, while there were no differences in F&V intake by weight status, participants who were obese were consuming a diet higher in French fries, white potatoes, butter or margarine, regular fat, and sugary beverages than those who were at a normal weight. These results concur with those of other studies who have found that consuming a diet high in fried foods, fats, and sugar-sweetened beverages increases the risk of obesity.⁴³ Our study did not find any association between weight status and intake of F&V, which concur with systematic reviews of the literature that have concluded a weak inverse relationship between F&V intake and obesity.⁴⁴ Also, a greater proportion of those who were obese perceived their diet quality to be poor than those who were at a normal weight. Thus, in addition to increasing intake of F&V, health promotion strategies could include substitution techniques to reduce intake of foods high in fat and sugars to effectively improve overall diet quality and weight status of the employees.

In evaluating physical activity and sedentary behaviors, overall, our study participants were engaging in low levels of job-related physical activity with 65% reporting 0 days/week of vigorous activity and 48% reporting 0 days/week of moderate activity. Less than half of the participants reporting walking 5 days/week while on their job. When stratified by weight status, obese participants spent a significantly greater amount of time sitting and engaging in screen time activities than their normal-weight counterparts. Increased time spent in sedentary behaviors and low levels of physical activity not only increases the risk for obesity but also has been associated with all-cause mortality in adults.^{45–47} Given that employees are spending a majority of their waking hours at work, worksite-based strategies to promote physical activity must be considered in future studies.

Overall, the majority of participating hospital employees were dissatisfied with the wellness programming received at their workplace, and there was higher dissatisfaction among those who were obese. The social-ecological framework suggests that individual level behavior change is guided by choices, which in turn is informed by perceptions and physical attributes of the environment.⁴⁸ Several studies have demonstrated healthy environments combined with individual strategies as being successful for obesity prevention^{23,49–56} of their hospital employees. Published literature has emphasized the role of health care workers and hospitals in primary prevention of obesity using evidence-based behavioral intervention focusing on healthy diet and physical activity.^{51,55,56} Results from our study, however, present a paradox that that although hospitals are inherently responsible for addressing the burden of obesity-related morbidities, the hospital workers in our study had high obesity rates and were dissatisfied with the wellness care at their workplaces. These results highlight the need for hospital employers to better understand, support, and nurture the health of their employees.

Strengths of our study include a relatively large sample size of an ethnically diverse group of hospital employees across six hospitals in Houston, Texas. Five of the six hospitals represent different hospital systems strengthening the external validity of the study. Other strengths include use of objective methods of data collection and validated surveys. Limitations include using a convenience sample of six hospitals resulting in a potential volunteer bias. However, technicians and hospital administrative staff in all six hospitals were invited to participate in the study. Moreover, the six hospitals represent five different health care systems collectively employing over 40,000 people. Our study did not collect data on energy intake, which should be considered in future studies. The biomarker data collected were nonfasting, which provide less useful CVD risk information and we were unable to compute a CVD risk profile of these participants, which is warranted in future studies.⁵⁷ Finally, the survey data were self-reported that could have social desirability bias and the cross-sectional nature of the study limits causality.

In conclusion, our study found a high prevalence of obesity in our hospital employee population, and being obese was associated with a significantly higher prevalence of several cardiometabolic risk factors, higher intake of French fries/white potatoes, fats, sugary beverages, and time spent in sedentary activities. Understanding the risk profile of hospital workers is beneficial to support the development of effective interventions in this population.

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