Evaluation of a Voluntary Work Site Weight Loss Program on Hypertension

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Objectives: The aim of this study was to examine the effect of a worksite weight loss program hypertension. **Methods:** Participants [$N = 5998$; body mass index (BMI) 34 ± 7 m/kg^2, 33% hypertensive] participating in a 10-week weight loss program were examined for hypertension prevalence within categories of (1) weight gain, or loss (2) less than 3%, (3) 3% to 5%, (4) 5% to 10%, and (5) more than 10% using general linear models or Chi-square analyses. **Results:** We observed a significant dose–response trend for the reduced prevalence of hypertension at follow-up (P-for-trend < 0.001). Baseline versus follow-up comparisons showed those gaining weight (28% vs 25%, *adjres.* $= 2.5$) or losing less than 3% (31% vs 25% *adjres.* $= 2.9$) were significantly more likely to present with hypertension at follow-up. Those losing 5% to 10% (33% vs 19%, *adjres.* $= -3.2$) or more than 10% (39% vs 17%, *adjres.* $= -3.2$) were significantly more likely to present without hypertension. **Conclusion:** Weight loss more than 5% significantly reduced workplace hypertension, while gaining weight increased its likelihood.

According to the evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8), hypertension is a risk factor for myocardial infarction, stroke, renal failure, and death and currently affects 34% of the United States population.[1] These statistics worsen in the presence of obesity. For example, Brummett et al[2] reported that 66% of those with hypertension are overweight [body mass index (BMI) > 25 kg/m^2], with an additional 36% meeting criteria for at least class I obesity (BMI > 25 kg/m^2). According to the 2015 update of Heart Disease and Stroke Statistics, 2011 estimates placed the direct and indirect costs for hypertension at $46.4 billion, a financial burden predicted to increase to $274 billion by 2030.[3] These costs have obvious trickle down implications in the form of productivity, absenteeism, presenteeism, disability, premature mortality, corresponding insurance payouts, and the general inflation of health care insurance costs in general.[4] While the cost implications of hypertension have been thoroughly reviewed elsewhere, it has also been shown that hypertension is highly treatable and positively affected by lifestyle interventions targeting weight loss, nutrition, and physical activity.[4] We recently examined the effects of voluntary worksite program on weight loss and metabolic syndrome, and found that those participating in a 10-week weight loss program demonstrated a significant reduction in weight (~5%) accompanied by a significant reduction in the presence of metabolic syndrome in both men and women.[5] A designate of 5% is important as this is synonymous with "clinically significant" weight loss.[6]

Given the recent change in the Joint National Committee Report on hypertension (JNC8), we examined the relationship between weight loss and the potential for a reduction in blood pressure and hypertension status in a voluntary worksite program. Thoroughly detailed in the JNC8 statement,[1] the fundamental changes for JNC8 include simplified reclassifications of the blood pressure cut-points[1] patients aged more than 60 years start blood pressure treatment at more than 150 mm Hg systolic or more than 90 mm Hg diastolic and[2] those patients aged less than 60 years initiate treatment at 140/90 mm Hg. The primary outcome for the study is change in hypertension status, whereby we hypothesize that a worksite wellness program affecting clinically significant weight loss will lead to substantial reductions in the prevalence of hypertension among employees. Secondary outcomes include categories of weight lost and associated cardiovascular disease risk factors.

METHODS

The methods of our study have been previously published elsewhere, and herein, the methods are resummarized for the readers' convenience.[5]

Participants

Our analysis is based on a convenience sample of 93 employers, composed of 5998 employees ranging in age from 20 to 65 years, presenting before and after participation to a voluntary, commercialized weight loss program offered within each company. Our study was reviewed by an ethics committee (Chesapeake IRB, Columbia, MD) and determined not to require IRB oversight according to the tenets of the US Department of Health and Human Services regulations at 45 CFR 46. Data were fully de-identified and did not contain the names of the employees, their respective places of employment, or the city/state of their residence, but did include age, gender, weight, and appropriate clinical laboratory measures, including blood work, waist circumference, and blood pressure.

Program

Employees volunteered to participate in a 10-week weight loss program composed of weekly lessons (Naturally Slim, Inc., Dallas, TX). Lessons included elements found in standard behavioral health programs such as self-monitoring, goal setting, stimulus control, modification of eating habits and problem solving, focusing on mindful, healthy eating, and understanding hunger signals. Participants are encouraged to partake in moderate intensity physical activity, primarily walking, according to NIH consensus development panel on physical activity.[7] While the program does not eliminate or focus on any specific food group or macronutrient, per se, it emphasized reducing carbohydrate and sugar intake, particularly refined sugar, and maintaining a protein intake of 25% to 30% of total calories. Lessons were delivered using a web-based distance-learning platform wherein participants can watch their lessons via the Internet. Each week focuses on one specific skill with a review of previous skills taught. Lessons are typically less than 1 hour and broken up into 3 to 6-minute segments,

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Dr Church serves as the Chief Medical Officer at ACAP Health and is responsible for the writing and editing of the paper.
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so the weekly lesson does not have to be watched all in one sitting. Each week, participants log their weight and physical activity, in addition to answering questions specific to building behavioral skills. There are counselors available to answer questions, but proactive outreach typically is limited to those participants who appear to have dropped out. Participants were informed of the program through in-house emails and flyers and subsequently applied for enrollment via the website. All participants performed a baseline risk factor screening. Due to the nature of worksite screening, the follow-up visits were not always immediately after the last class. For the purposes of this analysis, follow-up visits occurred within 20 weeks of the program start.

STATISTICS

We computed the arithmetic mean and standard deviation of each continuous variable. We then examined mean and change values using General Linear Models adjusted for age and respective baseline measures. The JNC8 position statement defined baseline and follow-up prevalence of hypertension[5] and tested using Chi-square tests. Pre to postcategorical differences were determined using adjusted residual values. To examine the potential benefit weight loss across different levels of weight change, categories were created to reflect (1) an increase in body mass, or cut points of weight loss defined as (2) less than 3% weight loss, (3) 2% to 3%, (4) 3% to 5%, (5) 5% to 10%, and (6) more than 10%. While we initially desired to create similar categories of weight gain, there were an insufficient number of participants to complete this analysis. Hypertension was defined as at least 150 mm Hg systolic and/or more than 90 mm Hg diastolic for those over 60 years of age ($n = 564$) and at least 140 and/or 90 mm Hg for those less than 60 years of age ($n = 5434$). The primary outcome for the study is change in hypertension status, whereby we hypothesize that worksite wellness program affecting clinically significant weight loss will lead to substantial reductions in the prevalence of hypertension amongst employees. Change in JNC8 hypertension status was performed by examining hypertension status from baseline to follow-up and further detailed as (1) No change from baseline, (2) Improvement from baseline, and (3) Worsening from baseline. There was no minimal level of participation to be included this analysis; thus, the potential range between baseline and follow-up testing was 1 to 20 weeks and the average time between baseline and follow-up examinations was 13.2 ± 2.8 weeks for women and 14.2 ± 3.2 weeks for the men. Due to this latter factor, we performed a sensitivity analysis by examining weight change across all weeks of follow-up, finding no differences in the magnitude of weight lost through 20 weeks ($P = 0.16$). Therefore, no adjustments were made in the analysis for length of follow-up. All reported P values are two-sided and performed using SPSS (v23; SPPS Inc., Armonk, NY). Significance was set at P value less than 0.05. All data are presented as mean ± SD, mean change ± 95% confidence intervals (95% CIs), and adjusted least squares as appropriate.

RESULTS

We have presented the baseline characteristics inclusive of anthropometric, lipid, and blood pressure characteristics for men in Table 1 and women in Table 2. Overall, our group presented at 46 ± 10 years, 67% female, and had a BMI of 34 ± 7 m/kg^2. Baseline systolic blood pressure averaged 126 ± 14 mm Hg; diastolic blood pressure was 81 ± 13 mm Hg; and 1947 (33%) of participants were hypertensive according to the JNC8 definition.

TABLE 1. Characteristics of Male Study Participants at Baseline and Follow-up

		All ($N = 1997$)		Gained Weight ($n = 303$)		Lost < 3% ($n = 389$)		Lost 3–5% ($n = 360$)		Lost 5–10% ($n = 655$)		Lost > 10% ($n = 290$)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Anthropometry													
Weight, kg[*,†,‡]	Baseline	105.32	20.67	105.40	23.77	104.40	21.60	105.87	19.96	104.82	19.94	106.93	18.33
	Follow-up	100.00	20.32	107.62	24.30	102.68	21.33	101.64	19.20	97.14	18.55	92.89	15.67
Waist, cm[*,†,‡]	Baseline	108.81	14.63	109.24	16.71	108.22	15.21	109.30	14.84	108.54	13.74	109.17	13.22
	Follow-up	103.76	15.09	109.25	17.77	105.63	15.59	105.06	14.19	101.76	13.78	98.43	12.67
BMI, kg/m^2[*,†,§]	Baseline	32.85	6.62	32.81	7.41	32.57	6.70	32.98	6.12	32.67	6.84	33.52	5.70
	Follow-up	31.16	6.63	33.31	7.76	32.11	6.75	31.84	6.04	30.14	6.50	29.05	5.03
Hematology													
Total-C, mg/dL[*,†]	Baseline	177.42	60.79	172.38	65.66	174.09	62.12	169.75	68.66	182.46	53.04	185.28	58.17
	Follow-Up	166.18	56.27	171.49	64.27	170.26	61.25	162.29	61.23	166.51	48.41	159.23	49.33
LDL-C, mg/dL[*,†]	Baseline	104.50	48.43	101.17	48.94	101.42	47.79	99.70	50.36	108.32	46.10	109.43	50.61
	Follow-up	98.68	47.86	99.57	48.79	99.78	49.04	93.91	48.31	101.74	48.28	95.28	43.24
HDL-C, mg/dL[*,†]	Baseline	40.27	12.91	40.38	13.56	40.72	11.70	40.67	17.04	40.16	11.39	39.33	10.90
	Follow-up	41.36	11.54	39.92	10.87	40.90	11.77	40.66	11.77	42.30	11.59	42.22	11.36
Triglycerides, mg/dL[*,†,§]	Baseline	171.61	106.10	175.03	102.70	172.99	114.57	169.02	110.22	166.92	88.62	179.98	126.88
	Follow-up	133.60	86.78	168.71	103.40	149.09	82.19	141.42	100.05	118.59	77.39	100.32	49.68
Glucose, mg/dL[*,†]	Baseline	105.08	29.30	109.23	40.17	108.81	30.30	104.73	31.97	102.82	24.14	101.26	18.92
	Follow-up	99.67	22.65	104.37	31.17	105.28	29.09	99.50	20.08	97.32	15.10	92.78	15.84
Hemodynamics													
Systolic BP, mm Hg[*,†]	Baseline	129.12	13.75	127.78	12.97	128.69	13.29	129.41	13.27	129.02	13.86	131.00	15.26
	Follow-up	124.67	13.07	126.97	13.16	126.41	13.43	125.84	12.50	123.16	12.87	121.90	12.80
Diastolic BP, mm Hg[*,†]	Baseline	82.69	9.33	81.55	9.44	82.09	9.17	82.98	9.46	82.73	9.09	84.26	9.63
	Follow-up	79.48	8.79	81.18	8.65	80.83	8.85	79.95	8.34	78.47	8.55	77.60	9.31

Conversions. mg/dL to mmol/L multiple respective values by triglycerides (0.0133), glucose (0.0555), and Total-C, HDL-C, and LDL-C by 0.0259.
BMI, body mass index; BP, blood pressure; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol.
[*]Significant trend across groups ($P < 0.001$).
[†]Significant difference between all groups ($P < 0.001$).
[‡]Significant within each category.
[§]Significant reduction for all weight loss groups.

TABLE 2. Characteristics of Female Study Participants at Baseline and Follow-up

		All ($N = 4001$)		Gained Weight ($n = 660$)		Lost < 3% ($n = 888$)		Lost 3–5% ($n = 753$)		Lost 5–10% ($n = 1311$)		Lost > 10% ($n = 389$)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Anthropometry													
Weight, kg*,†,‡	Baseline	91.85	21.16	91.75	22.19	92.57	21.86	93.01	22.27	91.02	20.16	90.99	18.71
	Follow-up	87.95	20.91	94.20	22.94	90.98	21.48	89.30	21.40	84.50	18.76	79.43	16.73
Waist, cm*,†,‡	Baseline	101.18	16.18	100.77	16.71	102.09	16.54	101.91	16.76	100.56	15.91	100.51	13.97
	Follow-up	96.01	15.99	99.96	16.53	98.53	16.09	97.32	16.54	93.45	14.80	89.62	14.20
BMI, kg/m^2*,†,‡	Baseline	33.62	7.95	33.78	8.01	34.16	8.13	34.08	8.04	33.05	7.90	33.08	7.21
	Follow-up	32.23	7.81	34.61	8.24	33.59	8.05	32.83	7.79	30.73	7.25	29.00	6.19
Hematology													
Total-C, mg/dL*,†	Baseline	184.73	55.11	184.78	56.99	182.21	58.62	182.39	55.59	185.96	50.91	190.80	55.96
	Follow-up	177.51	52.71	180.85	56.01	177.04	58.11	178.12	52.82	176.74	48.33	174.2	47.61
LDL-C, mg/dL*,†	Baseline	107.87	43.83	108.70	44.22	106.16	44.66	106.05	45.69	108.52	41.93	111.73	43.73
	Follow-up	103.60	41.53	105.11	41.49	103.88	44.35	102.52	41.88	103.93	39.49	101.37	41.05
HDL-C, mg/dL*,†	Baseline	50.91	14.69	51.04	14.87	51.27	14.77	50.59	15.45	51.02	14.37	50.13	13.77
	Follow-up	51.00	14.44	51.66	15.14	51.33	14.36	50.58	14.82	50.74	13.99	50.86	14.17
Triglycerides, mg/dL*,†,§	Baseline	143.51	79.88	140.34	73.45	146.63	87.95	143.14	81.18	141.91	76.55	147.83	79.40
	Follow-up	123.6	67.09	136.83	73.85	130.40	71.45	131.03	73.64	113.76	57.24	105.12	52.17
Glucose, mg/dL*,†	Baseline	100.27	26.36	101.82	31.36	101.32	24.32	101.66	29.09	98.56	23.78	98.37	23.86
	Follow-up	97.62	21.98	100.96	24.20	99.62	24.72	98.39	23.13	95.70	19.47	92.41	14.22
Hemodynamics													
Systolic BP, mm Hg*,†	Baseline	124.09	14.43	122.50	14.14	123.96	14.30	124.25	14.88	124.72	14.18	124.62	14.97
	Follow-up	120.39	13.62	121.40	14.32	121.35	13.94	120.89	13.06	119.62	13.51	118.15	12.71
Diastolic BP, mm Hg*,†	Baseline	79.58	15.08	78.51	9.30	79.51	9.73	80.67	28.72	79.48	9.02	79.82	10.13
	Follow-up	77.05	9.21	77.88	8.94	77.71	9.60	77.80	9.28	76.37	9.11	74.96	8.42

Conversions, mg/dL to mmol/L multiple respective values by triglycerides (0.0133), glucose (0.0555), and Total-C, HDL-C, and LDL-C by 0.0259.
BMI, body mass index; BP, blood pressure; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol.
*Significant trend across groups ($P < 0.001$).
†Significant difference between all groups ($P < 0.001$).
‡Significant within each category.
§Significant reduction for all weight loss groups.

Primary Outcomes

Anthropometry

When examining the pooled cohort, we observed significant trends for changes in weight, waist circumference, and BMI from baseline (*all*, *P*-for-trend, $P < 0.001$). Further analysis demonstrated significance for group (weight categories), gender, and the gender-by-group (weight category interactions (*all*, $P < 0.001$). Post-hoc analyses for each gender demonstrated that each weight category demonstrated significant weight changes within the parameters of that category with the exception of waist circumference (*all*, $P < 0.001$). Specifically, those in the weight gain category significantly increased weight and BMI, while those losing weight showed significant reductions for each parameter (Tables 1 and 2). Those losing weight demonstrated significant reductions in waist circumference within all weight loss categories ($P < 0.001$); however, those gaining weight did not exhibit a significant increase in waist circumference for men (Table 1) and demonstrated a significant reduction for women (Table 2, $P < 0.05$). Post-hoc comparisons between weight categories demonstrated that all weight categories were significantly different to one another for weight, BMI, and waist circumference.

Blood Pressure

We have presented baseline and follow-up blood pressure for men and women in Tables 1 and 2, respectively. Overall, regardless of weight category, we observed a significant trend for a reduction in blood pressure across groups (weight categories) for systolic and diastolic blood pressure for the pooled cohort (*P*-for-trend < 0.001, Fig. 1). Specifically, all weight categories reduced blood pressure to some extent. We also observed a significant effect for group (weight categories), but not for the gender-by-group (weight category) interaction (*both*, $P < 0.001$). Therefore, the following findings represent the pooled cohort results. Within our categorical analysis examining JNC8 blood pressure categorization, we found that a significant number of individuals (22%) moved to the normal blood pressure category ($P < 0.001$) at follow-up. When compared for weight category, however, those who gained weight were significantly more likely to worsen (*adjres* = 6.3) and significantly less likely to improve (*adjres* = −3.3). Those who lost less than 3% were also significantly more likely to worsen (*adjres* = 2.5) and less likely to improve (*adjres* = −4.1). No significant changes were observed for the 3% to 5% category. Those who lost 5% to 10% of baseline body weight were significantly likely to improve (*adjres* = 3.0) and significantly less likely to worsen (*adjres* = −3.9). Those losing more than 10% were also significantly more to improve (*adjres* = 5.9) and significantly less likely to worsen (*adjres* = −3.8). Between-category comparisons showed that those individuals demonstrating improvement were significant versus those gaining weight. Conversely, those individuals gaining weight significantly worsened versus those losing more than 10% weight (*both*, $P < 0.05$).

Hematology

Total and LDL Cholesterol

We observed an overall statistical trend for all hematological variables across weight categories (*P*-for-trend, *all*, $P < 0.001$). For total cholesterol and low-density lipoprotein-cholesterol (LDL-C), we observed a significant trend for a reduction in each parameter

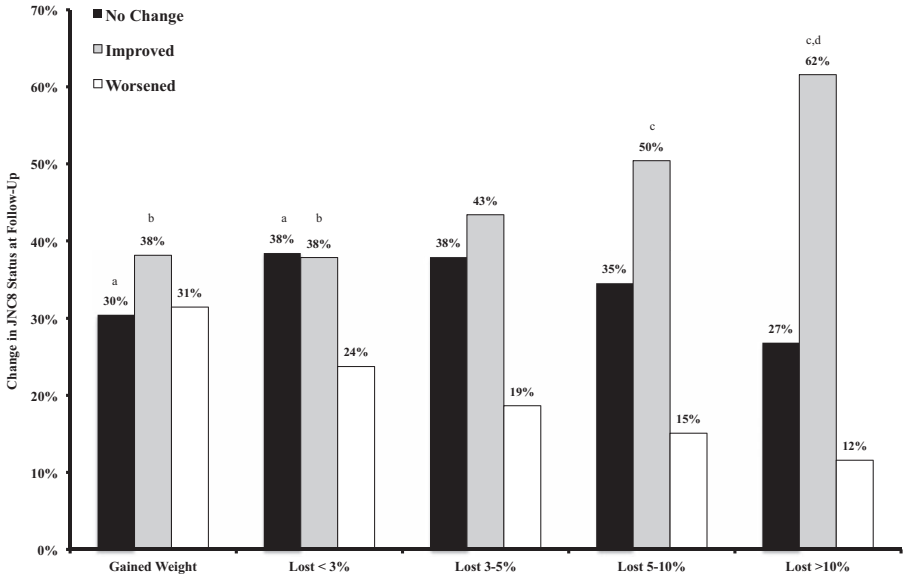

FIGURE 1. Data represent JNC 8 categorization for hypertension prevalence before and after the study intervention. Significance is denoted as (a) significantly unlikely to improve, (b) significantly likely to worsen, (c) significantly likely to improve, significantly different versus those gaining weight or losing less than 3% body mass. The notation (d) represents a significant difference between those gaining weight and those losing > 10% weight for improvement and worsening, respectively.

across weight categories with all categories showing some significant degree of reduction (*P*-for-trend, *all*, $P < 0.001$). Significant effects were also observed for gender and the gender-by-weight category interactions (*both*, $P < 0.001$). No significant differences were found between those gaining weight and those losing less than 3%. Similarly, no differences were observed between the less than 3% and 3% to 5% categories regardless of gender.

HDL-C

We observed a significant trend for group, gender, and the gender-by-weight category interaction for HDL-C (*all*, $P < 0.001$). For the pooled cohort, only the 5% to 10% and more than 10% weight loss categories demonstrated a significant increase in HDL-C, with both groups being significantly different than the weight gain and other weight loss categories ($P < 0.01$). For the pooled cohort, only those losing 5% to 10% or more than 10% experienced significant increase in high-density lipoprotein-cholesterol (HDL-C) ($P < 0.05$). Post-hoc analyses by gender demonstrated a significantly different pattern from one another. For men, those gaining weight or losing less than 3% or losing 3% to 5% demonstrated significant reductions in HDL-C, while those in the 5% to 10% and more than 10% weight loss categories showed no significant changes. Parenthetically, all women, regardless of weight category, demonstrated significant increases in HDL-C ($P < 0.05$).

Trigyclerides

We observed a significant overall trend for group (weight category), gender, and group-by-gender interactions (*all*, *P*-for-trend, $P < 0.001$). Pooled data showed that all weight loss groups reduced their triglyceride levels ($P < 0.05$), while those gaining weight had no significant changes. Post-hoc analyses demonstrated that all weight category groups were significant versus one (*all*, $P < 0.001$), except for the reductions between the less than 3% and 3% to 5% weight loss categories ($P = 0.50$). This pattern was consistent within each gender.

Glucose

We observed a significant overall trend for group (weight category), gender, and group-by-gender interactions (*all*, *P*-for-trend, $P < 0.001$) and gender-by-weight category interaction for glucose (*both*, $P < 0.001$). For the pooled cohort, significant reductions in glucose were observed within each weight category. Post-hoc assessments demonstrated no significant difference between those gaining weight and those losing less than 3% ($P = 0.74$). No differences were noted for the 3% to 5% versus 5% to 10% groups ($P = 0.12$). However, those losing more than 10% body mass were significantly different to all other groups ($P < 0.001$) and the 5% to 10% weight loss group was significantly different to all groups ($P < 0.001$) except the 5% to 10% group ($P = 0.20$). For gender, men gaining weight and those losing less than 3% demonstrated no significant reductions, while women showed significant glucose reductions for all weight loss categories, but not for those gaining weight.

DISCUSSION

We examined the relationship between weight loss and hypertension prevalence according to the recently revised JNC8 definitions before and after a 10-week corporate weight loss program. We also under took secondary analyses to examine categories of weight loss and associated cardiovascular disease (CVD) risk factors. Our overall findings demonstrate that gaining weight significantly worsens hypertension status and associated risk factors, whereas losing weight improves hypertension status in a stepwise fashion. Those losing 5% to 10% or at least 10% body weight demonstrated significant improvements and a reduced prevalence for JNC8 hypertension status. Of particular interest is that our analysis suggests that those gaining weight are significantly unlikely to improve and, more importantly, significantly likely to worsen. The opposite can be said for those losing 5% to 10% or at least 10% body weight. These improvements are confirmed by our assessment of weight, BMI, and systolic and diastolic blood pressure showing gradual and significant improvements accompanying weight loss as detailed by our post-hoc assessments showing significant differences between all weight loss groups for each parameter. These factors improved in a significant, stepwise pattern largely exhibited for most hematology risk factors. The health benefits associated with lesser degrees of weight loss are also clear, as the pattern for improvement was relatively consistent for most hematology variables (Tables 1 and 2). While this latter observation is intuitive, it is important for several reasons. Foremost, as program participants enroll into weight loss programs, the continued improvement surrounding weight loss can be used to highlight and reinforce participant success and compliance. Second, positive changes accompanying weight loss have practical implications for companies seeking to reduce their financial health care burden.

A discussion surrounding the health benefits of hypertension alone is challenging, as ''health'' is affected by multiple risk factors. In our current study, we observed an improvement in a number of risk factors that generally occurred in a step-wise fashion as weight loss progressed in magnitude. This is clinically important, as even small changes in weight are positively associated with improved cardiovascular risk. A meta-analysis by Tuck et al[8] showed that a weight reduction of 10% leads to an estimated reduction systolic blood pressure and diastolic blood pressure of ~15 and ~10 mm Hg, respectively. While our findings were not as robust, men in our study losing more than 10% body mass reduced systolic and diastolic blood pressure by an average of ~9 and ~7 mm Hg, respectively, while women in the same weight loss category decreased respective blood pressure values ~7 and ~5 mm Hg.

We would also emphasize that lesser degrees of weight loss or blood pressure responsiveness should not be ignored, but seen as a progression toward better health as weight loss or other healthy behaviors continue. For example, data from the Look AHEAD trial demonstrate a clear pattern for improved CVD risk concurrent to weight loss and decreased blood pressure in type II diabetic individuals.[9] In one example from this report, clinically meaningful changes in CVD risk for those losing weight and decreasing body mass were associated with a stepwise improvement in significant odds ratios of 1.24 (Lost 2% to 5%), 1.56 (Lost 5% to 10%), and 2.29 (Lost 10% to 15%) reductions in body mass and a 5-mm Hg reduction in systolic blood pressure regardless of the amount of weight lost. While Look Ahead examined individuals with diabetes, a systematic review and meta-analysis by Horvath et al[10] shows similar blood pressure changes associated with weight reduction regardless of whether the intervention was diet or pharmaceutically related. Also important to our discussion are the potential long-term effects of such programing. However, if weight loss is maintained, there is a reasonable expectation of maintain blood pressure status. For example, results from the Diabetes Prevention Program showed that after 1 year of follow-up, those individuals maintaining a 4.7% weight loss (95% CI, −5.0 to −4.4) also demonstrated significant reductions in systolic (−5 mm Hg, 95% CI, −7 to −3) and diastolic (−5 mm Hg, 95% CI, −6 to −4) blood pressure in individuals with impaired glucose tolerance.[11] Therefore, companies practicing proactive measures targeting weight loss, healthy lifestyle behaviors, and risk factor reduction with CVD have the potential to reduce the corporate health care burden of their employees.

Although we did not perform an actuarial examination of our current population, several brief points are worth noting regarding the potential financial benefits of such an intervention. Current estimates associated with comorbidities and CVD suggest that health care costs in the United States are estimated at ~$804 billion and projected to increase to ~$1200 billion by the year 2030.[3] Nichols and Moler[12] reported that that hypertension ($550), obesity ($366), low HLD-C ($363), and high triglycerides ($317) were all significantly associated with higher annual health costs. In a large multi-university based study examining 10,026 employees, obese employees were shown to have a 20% higher number of physician visits vs. normal weight employees (16%) and 26% more emergency rooms visits. Our study adds to the known literature by demonstrating that achieving > 5% weight loss not only improved the prevalence of hypertension, but also improved various lipid fractions glucose status, and waist circumference, while gaining weight eroded these values. Therefore, prophylactic interventions within the workplace have a great potential for reducing the financial health care burden.

Strengths and Limitations

A potential limitation to our study is the lack of a control group and lack of dietary records. However, numerous large behavioral and pharmaceutical weight loss studies have observed that control groups often demonstrate small amounts of weight loss (~2%). Due our large sample size, it is likely that our results would remain statistically significant. This study also represents a ''real world'' work environment. The short-term follow-up is also a concern, but given that these data were obtained from a number of individual work site initiatives, and not as part of formal research study, the duration of follow-up was out of our direct control. As such, we cannot generalize our findings beyond follow-up period. The short-term nature of the study and longer periods of follow-up may be a concern, as a recent report examining contestants from ''The Biggest Loser'' found that those with high BMI levels losing large amounts of weight are prone to regaining it due to issues surrounding metabolism.[13] Conversely, continued efforts supporting those losing large amounts of weight may assist in weight loss maintenance as evidenced by follow-up data from the Diabetes Prevention Program lasting 3.2 years.[14] Clearly, future investigations should examine the ''downstream'' effects relative to company health care economic benefits.

A major strength of our study is that we observed a significant dose–response between the magnitude weight lost and the prevalence of hypertension. Although a clear pattern exists for those gaining or losing more than 10% weight, improvements surrounding lesser degrees of weight loss are less clear, though the pattern for improvement is noticeable. These effects imply a considered health improvement accompanying weight loss that should be used to reinforce the benefits associated with weight loss once individuals begin losing weight. The primary benefit of such a program is that it can be adjusted on the basis of company needs. Utilizing a computer interface in addition to individual counseling also enhances the program features.

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