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Economic Evaluation of a Worksite Obesity Prevention and Intervention Trial among Hotel Workers in Hawaii

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Abstract

Objective—Economic evaluation of Work, Weight, and Wellness (3W), a two-year randomized trial of a weight loss program delivered through Hawaii hotel worksites.

Methods—Business case analysis from hotel perspective. Program resources were micro-costed (2008 dollars). Program benefits were reduced medical costs, fewer absences, and higher productivity. Primary outcome was discounted 24-month net present value (NPV).

Results—Control program cost $222K to implement over 24 months ($61 per participant), intervention program cost $1.12M ($334). Including overweight participants (body mass index > 25), discounted control NPV was −$217K; −$1.1M for intervention program. Presenteeism improvement of 50% combined with baseline 10% productivity shortfall required to generate positive 24-month intervention NPV.

Conclusions—3W's positive clinical outcomes did not translate into immediate economic benefit for participating hotels, although modest cost savings were observed in the trial's second year.

Keywords

Economics; worksite; weight loss; intervention; business case

Introduction

Together, overweight and obesity represent the second leading cause of preventable death in the US, and their prevalence is growing rapidly. At the worksite, physical inactivity and obesity lower productivity, increase absenteeism and workers' compensation claims[1–2], and raise medical care costs[3–6]. Worksite weight loss programs have the potential to improve employee risk profiles, lower health care costs[7], and generate a positive return on investment for employers.[8–9] The level of program benefits to both workers and employers from reducing obesity and improving nutrition and physical activity may well determine whether such programs are ultimately made available. However, data, particularly those on economic returns, are needed to evaluate whether worksite health promotion can actually achieve its objectives. Accurate estimates of the economic return of worksite health promotion are critical to establishing employee health as a strategic business objective and justifying further expenditures in these programs.

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Within the population of Hawaii, exceptional in its ethnic diversity, obesity rates vary widely across ethnic groups; the 20% of residents with Polynesian ancestry have one of the nation's highest obesity rates, while obesity is much less common among those of Japanese heritage. Tourism is Hawaii's largest industry; the island of Oahu alone has over 100 hotels. Hotel jobs often require little education or training, encouraging extensive hiring of immigrants and persons of low socioeconomic status (SES), which shows some association with excess weight, especially within the Honolulu area.[10] However, hotels in Hawaii and elsewhere commonly provide employees with a free meal during their shift in "employee-only" areas. These areas offer a work environment conducive to weight reduction and other behavior change programs. The Work, Weight, and Wellness (3W) study was a two-year randomized trial of a lifestyle change program targeting weight loss and delivered through hotel worksites. This paper presents an economic evaluation of the 3W program from the perspective of the implementing hotels. The basic evaluation format is a business case analysis that focuses on the program's net present value (NPV), the discounted sum of program benefits (lowered medical care costs, fewer absences, greater productivity, and reduced turnover) less discounted program costs. An employer should invest in a health program with a positive NPV, i.e., costs incurred over the short or intermediate term are expected to be offset by longer-term cost savings in some or all of the categories listed above.

Background

A full description of the 3W trial is provided elsewhere.[11] Briefly, 3W was a group-randomized clinical trial of a multi-component weight loss and obesity prevention program. It was conducted over two years at 31 Oahu hotels employing 11,559 persons. Prior to study entry, hotels were pair-matched on workforce size, luxury status, and union status, and randomly assigned to either a minimal (Level 1) or an intensive (Level 2) intervention. The primary trial outcome was annual rate of change in body mass index (BMI: weight (kg)/height $(m)^2$) and waist to height ratio over two years among overweight and obese (BMI > 25) employees of Level 1 versus Level 2 hotels. Secondary outcomes included intervention effects on ethnic and occupational subgroups, stage of change, and program return on investment (i.e., NPV).

Level 1 consisted of raising employees' awareness of their weight and health habits and the health-relevant features of their work environment during assessments. Measurement of employees' BMI increased awareness of their weight and health habits by giving them brief feedback about their actual weight relative to their ideal weight and a flyer about good health habits. For the environmental intervention, study staff invited hotel staff to accompany them to raise their awareness of the features of their work environment that could be improved to promote employee health.

Level 2 intervention components drew on a multi-component lifestyle approach used in the authors' prior research[12–14], and included two years of on-site weight management groups, and various environmental initiatives in addition to the same Level 1 feedback and advice. During the final intervention year, a dissemination component promoted post-study intervention adoption or maintenance. Intervention maintenance was assessed at a six-month follow-up.

Trial Results

After two years, obese and overweight employees at Level 2 hotels reduced both BMI ($p<.05$) and waist/height ratio ($p<.05$) compared to Level 1 employees. The Level 2:Level 1 overall two-year BMI change was 0.47 BMI units for males and 0.32 units for females. BMI reductions were strongly associated with race ($p<.0001$), with Filipinos and other Asian groups achieving the greatest weight change. Reductions in BMI at Level 2 compared to Level 1 hotels were detectable both in cross-sectional analyses (i.e., all persons assessed at each visit) and in the smaller cohort of persons examined serially across the three annual assessments. These results will be reported shortly in detail in an associated manuscript (Tom Vogt, personal communication).

Study Design

Analytic Framework

Because our primary interest was in identifying the financial effects of the worksite weight loss program on the implementing hotels, we adopted as our analytic framework the presentation method proposed by Nicholson and colleagues.[15] The Nicholson model assumes that a worksite healthcare quality improvement program such as 3W provides four potential benefits to employers: lower medical expenditures, fewer absences, better productivity (reflected in lower presenteeism), and lower turnover. Reducing health risks can lower presenteeism[16] and "indirect" costs of both absenteeism and presenteeism may actually exceed direct medical costs.17 In addition, the Nicholson model accounts for the fact that the benefit from reducing work absences is measurable and may be much more than the wage when absent workers are imperfectly substitutable, especially when combined with team production or penalties for below-goal output.

The Nicholson model focuses on the program's net present value (NPV), a metric that businesses commonly use to determine a potential investment's economic value. A program's NPV is the sum of its discounted dollar-valued benefits less the sum of its discounted dollar-valued costs. Benefits (and costs) in each future program year are discounted to the present using an appropriate interest rate such as the employer's opportunity cost of capital. If the NPV is positive (i.e., benefits exceed costs), investment is assumed appropriate because the program is expected to surpass investors' required returns. Investment is similarly appropriate if a program's return on investment (ROI = [NPV / PV of costs]) exceeds the employer's minimum acceptable rate of return, sometimes called the hurdle rate.

Cost Measurement

Program costs were those related to implementing and operating the intervention program over the 24-month trial period, and in most cases, were micro-costed—i.e., participant-level data were collected on the exact number and type of each resource consumed. Costs were measured from the perspective of the implementing hotel, and excluded research costs and participant investments of time or money. Project staff identified relevant intervention components, classified as labor or non-labor. Joint resources were shared evenly across study arms. Unit cost multipliers were applied to quantities consumed, and the results summed to obtain resource values. For example, the value of intervention staff time was the total intervention time of each staff member multiplied by the appropriate wage rate (including both fringe benefits and a 30% "burden" multiplier to account for vacations, sick leave, non-project meetings, and other "non-productive" employee activities for which the project is responsible). Such multipliers were obtained internally whenever possible. Other costs included equipment or printed materials. Cost data were collected from project staff, finance department staff, expense reports, or retrospective labor estimates. All costs are in 2008 dollars using the Prospective Payment System Input Price Index. We applied a 3% annual discount rate to costs and benefits accrued in the study's second year.

Program benefits related to the lowering of BMI are in three forms: reductions in employee medical care costs; reductions in self-reported absenteeism; and reductions in self-reported presenteeism. Medical care costs, whether in aggregate across the trial or incurred by a given hotel, are assumed to be a function of 1) the number of employees (all of whom are assumed to receive the intervention), 2) the proportion of those employees with a chronic condition (the recipients of the program's benefits), 3) the monthly rate of employee turnover (which attenuates the program's potential effect), and 4) the current medical care expenditure per employee. We used inflation-adjusted cost estimates from Wang et al. (2006) to serve as proxies for 1) current medical care expenditures and 2) the annualized dollar value of a unit change in BMI.18 To estimate the dollar value of absenteeism in terms of workdays missed, we multiplied the self-reported days missed per employee because of a health condition over the previous four weeks (annualized) by an appropriate Hawaii-based wage rate for a representative occupation.19 We estimated the value of presenteeism similarly, although in this instance the relevant metric was the proportion of work time for which self-reported productivity was below normal over the previous four weeks (annualized).20 A ten-point scale was used, with ten representing optimal work functioning and zero representing no work effort at all. A full work year was assumed to be 250 eight-hour days.

The baseline proportion of Hawaiian adults of working age with a chronic health condition was estimated as 40% based on 2009 data from the Hawaii Health Information Corporation.[21] The baseline average monthly employee turnover rate was estimated as 4.8% based on 2006 data for the leisure and hospitality industries within the Western region of the U.S., including Hawaii.[22]

Also, using data from over 800 manager interviews, Nicholson and colleagues found empirical support for the hypothesis that the cost associated with missed work varies across jobs according to the ease with which a manager can find an appropriate replacement worker.[23] In particular, in most instances the firm's cost of missed work in their data exceeded the wage rate by a "multiplier" greater than one. In Nicholson et al. (2006) the mean multiplier was 1.61 and the median was 1.28, i.e., for the median job the absence cost was 28% higher than the worker's wage. Multiplying an employee's wage by the multiplier for that (or a comparable) job yields higher, more accurate estimates of the financial return to health-related programs that reduce absences. To incorporate this multiplier, we mapped to the extent possible each 3W job category to one of 35 job categories in 12 industries listed in Nicholson et al. (2006). We then increased the estimated dollar-valued losses from absenteeism by that multiplier to reflect the influence of a given worker's absence on the productivity of his or her co-workers. We adopted a similar process to estimate losses from presenteeism by applying multipliers from a later study by Pauly et al.[24]

For each study arm, total intervention cost and discounted NPV was estimated. Univariate and multivariate sensitivity analyses addressed cost variation between different implementation settings, allowing appropriate analysis of parameter uncertainty.

Results

Table 1 lists component costs for the Level 1 (minimal) and Level 2 (intensive) programs; Table 2 summarizes the costs of both arms over the 24-month study period Joint investments of resources such as questionnaire development or assessment equipment were shared equally between study arms. The Level 2 program was roughly five times as expensive to implement and operate as the Level 1 program, largely because of the costs of the Level 2 onsite group sessions and the preparation time across all Level 2 hotels related to the environmental intervention. Program cost per participant over 24 months was $61 for Level 1 and $334 for Level 2. Note, however, that reported participant costs related to onsite sessions ($148K) are probably overstated because most sessions were held before or after the official workday to minimize the employer's subsidy of participation. We cannot say precisely how many employees attended a session on paid time; however, we strongly believe that no more than 25% of sessions were on paid time, which would lower the Level 2 program cost to approximately $1M ($300 per participant).

Table 3 presents baseline business case analyses for Levels 1 and 2 with all study participants across all hotels included. Over 24 months, both arms generated large financial losses; for Level 1, the loss is $342K, and for Level 2, $1.17M. These large deficits result simply from the lack of demonstrable benefits, whether in terms of BMI-related reductions in medical care costs or improvements in (self-reported) absenteeism or presenteeism. Level 2 performance was severely hindered by an increase over the first 12 months in self-reported days missed due to a health condition and workdays when performance was below normal (by 24 months, both parameters had improved). Table 4 presents analogous results, but focused on overweight and obese participants—those with a BMI of 25 or above. Again, both arms produced large financial losses, although they are somewhat less when non-overweight individuals are excluded; the Level 1 loss is $217K and $1.1M for Level 2. It should also be noted that over the second 12 months of the study, both arms generated relatively modest benefits; $82K in reduced presenteeism for Level 1, and $24K in total benefits for Level 2. These benefits were swamped, however, by the cost of the overall programs over 24 months.

We note here that the values for BMI change used in these models were unadjusted values for 12 and 24 months estimated separately for each year. Overall adjusted change in BMI over 24 months of .29 units (Level 1 vs. Level 2) was significantly associated with intervention group assignment (Tom Vogt, personal communication). This and other primary study outcomes will be reported shortly.

If a similar level of benefits among overweight employees could be expected in subsequent years, the average payback period for a Level 1 program would be 2.9 years, although this does not include ongoing annual program operational costs, which would lengthen payback. For Level 2, the average payback period would be closer to 46 years, again not including ongoing operational costs, and assuming that downstream financial benefits do not vary over that entire period.

Table 5 lists selected univariate and multivariate sensitivity analyses. Most parameters had little individual influence on the NPV results, especially for Level 2. In fact, a 50% improvement in presenteeism in the presence of a baseline 10% productivity shortfall would be required to generate economic returns sufficient to produce a positive Level 2 NPV over 24 months ($273K).

Discussion

After two years, the 3W program successfully lowered both BMI and waist/height ratio among overweight and obese employees at Level 2 hotels. The Level 2/Level 1 overall two-year BMI change was 0.47 BMI units for males and 0.32 units for females. Though this trend would confer an important population-level clinical benefit if it were maintained over several years, it did not come close to generating an economic return on the substantial program investment of resources over 24 months. Given published data on the relationship of BMI changes to cost, the changes produced by 3W were too limited in size and of too short a measured duration to influence the hotels' ongoing medical care expenditures in a meaningful way. In addition, based on available self-reported data, productivity benefits were centered in reductions of presenteeism over the second 12 months of the study. Yet, even these were partially offset by large *increases* in self-reported presenteeism during the first 12 months. Furthermore, no benefit from reduced absenteeism was reported at all.

If worksite programs such as 3W that target control of excess weight are deemed of potential value, then a highly useful area for future research would be to assess the relative contributions of a program's components. For example, the cost of preparation time for the Level 2 environmental intervention was approximately $357K, one-sixth of total program costs. It would be important to know whether the environmental component was sufficiently effective, and if so, whether the amount of preparation time is necessary. Efficiencies in this process would allow program costs to be reduced, perhaps substantially, without meaningful losses of clinical benefit. Also, once established, a program that produces sustainable productivity benefits over multiple years at limited cost would be expected to generate a more positive NPV over time than we have shown here.

The study was hampered by the significant loss to follow-up of participants at the second, and especially third and final, assessment. In particular, extensive losses of follow-up productivity data were observed, which likely contributed to the large variation in estimated presenteeism and absenteeism changes. There were no obviously significant differences between respondents and non-respondents in this regard, however. Furthermore, we do not believe the limited follow-up data affect our basic assessment of 3W's inability to generate a positive 24-month NPV.

We had also intended to explore the implications of the 3W program for changes in workers' compensation claims across the participating hotels. Yet, only about half of the hotels agreed to provide claims data at all, and the data submitted proved far too heterogeneous to be useful. Over the next year, however, we intend to examine 3W's effect on medical care utilization patterns pre- and post-intervention, focusing on the subset of participants across all hotels who were Kaiser Permanente members at the time of the study, and for whom electronic utilization and cost data would be available over a much longer period than that of 3W.

Conclusion

Despite generating clinical benefit among hotel workers, especially overweight and obese workers, in terms of reduced BMI and waist/height ratio, we were unable to demonstrate positive economic returns from the 3W worksite weight loss program. Future research should focus on identifying approaches of identifying and intervening directly with higher-risk subgroups, for which the economic return to employers may be more compelling.

Clinical significance: The current study illustrates the challenges of generating a rapid economic benefit to employers from the implementation of worksite weight loss programs delivered in a hotel setting, and evaluated using financial measures applicable to business decision making. At present, other criteria must be used to justify investment in such programs.

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TABLE 1

Intervention Cost Parameters (Level 1 "minimal" and Level 2 "intensive")

Number of participants	
Level 1	3,612
Level 2	3,346
Hotels per arm	15
Number of assessments per arm	45
Hours per assessment	
Session	27.6
Travel	1.5
Scheduling	2
Preparation	4
Number of assessors	3.46
Assessor wage rate	$25
Assessor training (hr)	15
Fringe rate	45%
Project coordinator wage rate	$40
Project coordinator data entry (min)	30
Travel (min)	40
Assessment (min)	45
Hotel coordinator (hr)	1
Hotel coordinator wage rate	$40
Number of trainers	1
Hours of training	13
Trainer wage rate	$30
Dissemination effort (hr)	373
Dissemination wage rate	$50
Dissemination materials cost	$58
Questionnaire development	$19,206
Printing costs	$12,191
Weight measurement equipment costs	$29,355
Environmental assessment wage rate	$50
Offsite session materials	$2,000
Environmental intervention materials	$415
Environmental intervention prep time (hr)	4,920
Participants in onsite sessions	15,800
Participants in offsite sessions	120
Offsite groups across all hotels	41
Study coaches	2
Onsite sessions	1,070
Offsite sessions (hr)	
Travel	1.5
Preparation	2

Coach session	2
Participant session	1.5
Participant fringe rate	25%
Participant onsite time (min)	45
Participant wage rate	$10

Table 2

Baseline 24-month intervention costs by study arm

Level 1 (minimal) intervention			
Labor	**$**		
Assessment training			
Trainer	566		
Assessors	544	**$1,110**	
Assessments			
Assessors		**101,695**	
Environmental assessment			
Project coordinator	5,003		
Hotel coordinator	2,610	**7,613**	
Questionnaire development		**19,206**	
Dissemination		**49,880**	
Total Labor			**$179,504**
Non-Labor			
Assessment equipment		**$29,355**	
Questionnaire printing		**12,191**	
Dissemination materials		**864**	
Total Non-Labor			**42,410**
			$221,914
Level 2 (intensive) intervention			
Labor	**$**		
Assessment training			
Trainer	566		
Assessors	544	**$1,110**	
Assessments			
Assessors		**108,563**	
Weekly onsite sessions		**341,330**	
Offsite sessions		**13,079**	
Participants--onsite sessions		**148,125**	
Environmental assessment			
Project coordinator	5,003		
Hotel coordinator	2,610	**7,613**	
Questionnaire development		**19,206**	
Dissemination		**49,880**	
Env. Interv.--prep time		**356,700**	
Total Labor			**$1,045,606**
Non-Labor			
Assessment equipment	**$29,355**		
Questionnaire printing	**12,191**		
Dissemination materials	**864**		

Offsite session materials	**30,000**	
Env. Interv.--materials	**415**	
Total Non-Labor		**72,825**
		$1,118,431

Table 3

3W Business case analysis

All participants	**Level 1 (minimal)**		**Level 2 (intensive)**	
Hotel employees	3,612		3,346	
% with a chronic condition	40		40	
% monthly employee turnover	4.8		4.8	
Median job class multiplier (based on Nicholson et al. 2006)	1.29		1.28	
Annual medical cost per employee	$4,621		$4,621	
Annual reduction in medical costs from one-unit BMI reduction (%	5		5	
Mean BMI change (12 mo.)	0.170		0.000	
Mean BMI change (24 mo.)	0.000		0.000	
% improvement in absenteeism (12 mo.)	−28		−25	
% improvement in absenteeism (24 mo.)	21		19	
% improvement in presenteeism (12 mo.)	−8		−6	
% improvement in presenteeism (24 mo.)	33		29	
% of workdays missed in last 4 weeks because of health condition	0.03		0.05	
% of work time productivity was below normal in last 4 weeks	1.00		1.00	
Average hourly wage	$15.86		$15.86	
Annual work hours	2,000		2,000	
	12 mos.	**24 mos.**	**12 mos.**	**24 mos.**
Program cost	−$141,888	−$80,026	−$585,749	−$532,682
Probability worker remains employed with original hotel (%)	100.0	55.4	100.0	55.4
Benefits				
Reduction in medical spending	−$32,332	$0	$0	$0
(among chronically ill)				
Reduction in absenteeism	−$2,829	$1,209	−$3,870	$1,094
Reduction in presenteeism	−$26,945	−$63,325	−$18,576	−$51,151
Total benefits	−$62,106	−$62,116	−$22,446	−$50,057
Net program value (annual)	−$203,994	−$142,142	−$608,195	−$582,739
Discounted program value (3%)	−$203,994	−$138,002	−$608,195	−$565,766
Cumulative net present value	−$203,994	**−$341,996**	−$608,195	**−$1,173,961**

Table 4

Business case analysis

Overweight (BMI > 25)	**Level 1 (minimal)**		**Level 2 (intensive)**	
Hotel employees	2,203		1,907	
% with a chronic condition	40		40	
% monthly employee turnover	4.8		4.8	
Median job class multiplier (based on Nicholson et al. 2006)	1.24		1.26	
Current medical cost per employee	$4,621		$4,621	
% reduction in medical costs from one-unit BMI reduction	5.00		5.00	
Mean BMI change (12 mo.)	0.003		−0.101	
Mean BMI change (24 mo.)	0.119		−0.284	
% improvement in absenteeism (12 mo.)	−2		−5	
% improvement in absenteeism (24 mo.)	0.009		36	
% improvement in presenteeism (12 mo.)	−35		−17	
% improvement in presenteeism (24 mo.)	73		6	
% of workdays missed because of health condition	0.03		0.05	
% of work time that productivity was below normal in last 4 weeks	1.00		1.00	
Average hourly wage	$15.86		$15.86	
Annual work hours	2,000		2,000	
	12 months	**24 months**	**12 months**	**24 months**
Program cost	−$141,888	−$80,026	−$585,749	−$532,682
Probability worker remains employed with original hotel (%)	100.0	55.4	100.0	55.4
Benefits				
Reduction in medical spending	−$348	−$7,864	$10,142	$16,247
(among chronically ill)				
Reduction in absenteeism	−$118	$0	−$434	$1,781
Reduction in presenteeism	−$69,113	$82,126	−$29,528	$5,937
Total benefits	−$69,580	$74,262	−$19,820	$23,965
Net program value (annual)	−$211,468	−$5,764	−$605,569	−$508,717
Discounted program value (3%)	−$211,468	−$5,596	−$605,569	−$493,900
Cumulative net present value	−$211,468	**−$217,064**	−$605,569	**−$1,099,469**

Table 5

Sensitivity analyses (overweight (BMI > 25)

Discounted net present value ($000s)			
	Parameter	**Level 1 (minimal)**	**Level 2 (intensive)**
% with a chronic condition	10%	−219	−1,102
% with a chronic condition	70%	−215	−1,097
% monthly employee turnover	2.4%	−186	−1,088
% monthly employee turnover	1.6%	−169	−1,083
Median job class multiplier	1.6	−214	−1,105
Current medical cost per employee	$2,000	−212	−1,114
% reduction in medical costs from one-unit BMI reduction	20%	−241	−1,022
Mean BMI change at 12 and 24 mo. (units)	−1.2	7	−938
Mean BMI change at 12 and 24 mo. (units)	−5	692	−345
% improvement in absenteeism at 12 and 24 mo.	15%	13	−898
Plus % of days missed because of health condition	5%		
% improvement in absenteeism at 12 and 24 mo.	36%	335	−615
Plus % of days missed because of health condition	5%		
% improvement in presenteeism at 12 and 24 mo.	50%	1,305	273
Plus % of work time productivity was below normal	10%		
% improvement in presenteeism at 12 and 24 mo.	20%	386	−536
Plus % of work time productivity was below normal	10%		
% improvement in absenteeism AND presenteeism at 12	50%	539	272
and 24 mo.	5%		