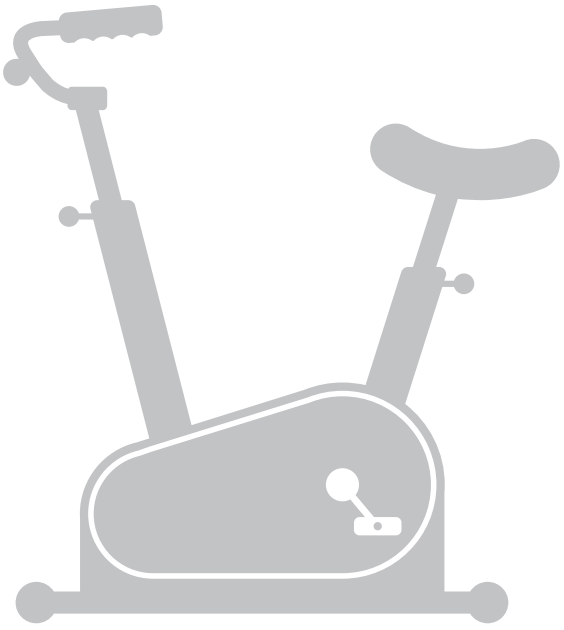
Chapter 7

Economic evaluation of an occupational health guideline for preventing weight gain among employees



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Abstract

Objective: This study evaluates the economic outcomes of an evidence-based guideline for occupational physicians (OPs) aimed at the prevention of weight gain.

Methods: We performed an economic evaluation alongside a cluster randomized controlled trial from both a societal and employer's perspective. The guideline consisted of a company-environment scan and an employee-directed intervention of up to five individual counseling sessions with an OP. Sixteen OPs randomized to the guideline (n=7) or usual care group (n=9) recruited 275 and 249 employees, respectively. Employees with unhealthy lifestyle behaviors or who were overweight were eligible to participate. Costs were collected using three-monthly retrospective questionnaires. Quality of life was measured with the EQ-5D, at baseline, 6, 12 and 18 months. Waist circumference and body weight were measured at baseline and 18 months.

Results: The occupational health care guideline resulted in less health effects but lower costs than usual care. Unfavorable differences were found between the guideline and usual care group on waist circumference (+1.6 cm, 95% CI 0.27;2.90) and weight (+1.1 kg, 95% CI 0.01;2.15); there was no difference in QALYs gained (-0.006, 95% CI -0.029;0.017). The mean cost-difference was €-99 (95% CI -2918;2772). Probabilities of cost-effectiveness were consistently below 55%. Net employer loss was €-158 (95% CI -2865;2672). Sensitivity analyses mostly showed unfavorable outcomes.

Conclusion: The occupational health care guideline for preventing weight gain among employees was not cost-effective compared with usual care. From a Dutch employer's viewpoint, no financial return from implementing the guideline was shown.

Trial Registration: ISRCTN/73545254 and NTR/1190.

Background

The global increase in overweight and obesity is widely acknowledged as a major public health problem.[1] Obesity is associated with high health care costs,[2] as well as increased sick leave, disability and productivity loss in the working population.[3] Occupational physicians (OPs) could play an important role in the prevention of overweight and obesity. In the Netherlands, about 44% of the population is employed and almost all of these employees have access to an OP. Therefore, an evidence-based occupational health guideline for the prevention of weight gain among employees was developed.[4]

Economic evaluations aid implementation decisions by giving insight in the trade-off between costs and benefits. In the Netherlands, employers are the major payers of occupational health care and prevention. They may be most interested in knowing their financial return from investments in preventive measures. Nevertheless, since health outcomes are not directly considered in financial return analyses and costs and benefits may also fall on other payers within society, cost-effectiveness analyses (CEA) and cost-utility analyses (CUA) from a societal perspective are also of importance.

The aims of the present study were to conduct a CEA with regard to weight related outcomes, a CUA from the societal perspective and a financial return analysis from the Dutch employer perspective, in which the care according to the occupational health guideline was compared with usual care.

Methods

Design of the study

An economic evaluation was conducted alongside the Balance@Work Study, a cluster randomized controlled trial carried out in the Netherlands from 2009 to 2011. The follow-up of the study was 18 months. Full details of the study design and the draft guideline have been published previously.[4] The study design and informed consent procedure were approved by the Medical Ethics Committee of the VU University Medical Center and all participants provided written informed consent.

Study population

OPs providing services to one or more companies with over 100 workers were recruited through a direct mailing by the Netherlands Society of Occupational Medicine (in Dutch, 'NVAB;). Twenty-eight OPs were randomized and requested to recruit at least 30 employees with unhealthy physical activity and/or dietary behavior, or who were overweight.[4] Employees were excluded when pregnant, in case a disease or condition was present which made physical activity impossible, when absent from work for 21 days or longer, or if they were unable to complete a questionnaire in Dutch. Between randomization and baseline measurements, 12 OPs withdrew because of lack of time (n = 3) or because the company they were servicing withdrew (n = 9). This left 7 OPs in the guideline and 9 in the usual care group.

Interventions

The intervention consisted of an environmental scan at baseline and after 6 months, judgment whether or not the company facilities were conducive to prevention of weight gain.[4] OPs discussed the results with the employer and workers' representative council. The guideline further consisted of five 20- to 30-minute individual counseling sessions with an OP, of which two sessions could be done by phone, to be completed within six months. OPs received training in behavioral change counseling techniques, i.e. motivational interviewing, aimed at physical activity and diet. Additionally, OPs and employees were provided with informational tools. At baseline employees received a waist circumference measure tape, a pedometer, information leaflets on physical activity and nutrition from the Netherlands Heart Foundations and Netherlands Nutrition Centre, and a diary to monitor daily physical activity and diet.

The control group received care as usual, consisting of health advice by the OP directed at the findings of the health risk assessment performed at baseline.

Study measures

Health-related outcomes

The primary outcome of the study was waist circumference with body weight as secondary outcome. Baseline body measurements were done during a health risk appraisal by the OPs or their assistants, who were trained and followed a standard protocol.[4] Waist circumference was measured midway the lower rib margin and the iliac crest to the nearest 0.1 cm, using a tape measure (Seca 201, Seca, Hamburg, Germany). Weight was measured to the nearest 0.5 kg with a scale available at the office of the OP. The EuroQol-5D (EQ-5D) was used to assess quality of life.[5] Health utilities were estimated with the Dutch tariff.[6] Quality adjusted life years (QALYs) were calculated by multiplying the utilities with the amount of time a participant spent in a particular health state. Transitions between health states were linearly interpolated. Measurements took place at baseline and after 6, 12 and 18 months.

Costs

Information on health care utilization, participant costs and productivity loss was obtained through six retrospective 3-month questionnaires.

Health care utilization consisted of primary health care (general practitioner, allied health care) and secondary health care (medical specialist, hospitalization) and was valued with Dutch standard costs.[7] When these were not available, prices reported by professional associations were used. Participants' costs concerned self-reported costs associated with improving physical activity, such as sports club memberships and sports equipment. Costs of productivity loss included absenteeism and presenteeism, i.e. lower performance while at work.

Absenteeism was assessed using an item of the PROductivity and DISease Questionnaire (PRODISQ), asking workers to report their total number of sick leave days during the past three months.[8] These were multiplied with the number of hours that an employee reported

to work per day. Labor costs associated with one hour sick leave were calculated per worker by dividing their yearly labor costs (self-reported net salary, with added taxes and benefits) by their total number of workable hours per year.[7] We used the Friction Cost Approach (FCA) with a friction period of 23 weeks (i.e. period needed to replace a sick worker) and an elasticity of 0.8. [7,9,10] An elasticity of 0.8 implies that full-time absenteeism corresponds to an 80% loss in productivity.[11]

Presenteeism was assessed using an item of the WHO Health and Work Performance Questionnaire (WHO-HPQ), asking workers to rate their overall work performance during the previous four weeks on a 11-point scale, ranging from "worst performance"(0) to "best performance"(10).[12] Assuming linearity, the average work performance during the 3 months' follow-up period (WPown) was calculated. A worker's level of presenteeism was calculated using the following formula:

Presenteeism Score = (10 – WPown)/10.

Presenteeism hours were calculated by multiplying a worker's Presenteeism Score by the number of hours worked in the previous three months, i.e. working hours minus sick leave. Presenteeism hours were valued with the employee's hourly labor cost. [13,14]

Prices were adjusted for the year 2009, the year of the first measurement, using consumer price indices.[15] No discounting was done for the costs in month 13 to 18 since this would have had little effect on the total costs. All prices used are given in Appendix 1.

Guideline costs

Bottom-up micro-costing was used to estimate the cost of using the guideline.[16] An estimated 488 OPs (22%) in the Netherlands are paid by companies to give lifestyle advice. [17-19] In the Netherlands, occupational guidelines are in general updated every five years. Costing was based on projections of the NVAB that 6% of the 448 OPs would start using the guideline in the first year, rising to 30% in the fifth year. OPs are expected to apply the counseling to 50 employees from three companies per year. Thus, in total 21,950 employees (0.3% of the Dutch workforce) would be counseled in five years' time.

Guideline costs consisted of fixed and variable costs. The fixed costs covered costs of the development of the guideline and printing of materials, training of the OPs, costs for selecting and inviting the participants, and both OP costs and employer time costs for the environmental scan. Printing of materials was valued using charges paid. Time investments were valued using labor costs. A second calculation was done to facilitate the financial return analyses from the employer's perspective, using commercial prices charged to companies for time invested by the OP. Total fixed costs per participant were €43.76 using labor costs and €100.24 using commercial prices.

Variable costs per participant depended on the number and duration of contacts that had been registered by the OP. Duration of the sessions, including administration, was estimated by the OPs at 30 minutes for the first session and 20 minutes for session 2-5. Costs included labor costs for the OP and labor costs for the employee. In the financial return analyses, OP time was valued with commercial prices. Guideline costs per employee consisted of the total of fixed and variable costs.

Statistical analyses

Multiple imputation

Intention-to-treat analyses were performed and missing data imputed using multiple imputation techniques. The imputation model included, among others, age, sex, educational level, baseline outcome values, available midpoint (6 and 12 months) and follow-up outcome values, number of counseling sessions attended, and available health care costs, participant costs, sick leave days and presenteeism at each cost measurement. Imputations were done separately for the intervention and control group. Because of the extreme skewed data and excess of zeros per cost component, resource use (except for number of counseling sessions, absenteeism and presenteeism) was imputed on an aggregated cost level. Ten different data sets were created in SPSS (version 17.0.2, Chicago, Ill) using Fully Conditional Specification and Predictive Mean Matching procedures.[20] These data sets were analyzed as specified below. The estimates were pooled with methods described by Rubin.[21] This method does not allow for an estimation of standard deviations, so the standard error of the mean (SEM) is presented to describe variability.

Cost-effectiveness and cost-utility analyses

Regression analysis was used to compare health-related outcomes between the intervention and control groups. Follow-up outcomes were adjusted for baseline values.[22] To compare costs between groups, confidence intervals around the mean differences in costs were estimated using the bias-corrected and accelerated bootstrap method with 2000 replications. Incremental cost-effectiveness (ICER) and cost-utility ratios (ICUR) were estimated by dividing the difference in total costs between the treatment groups by the difference in adjusted health-related outcomes. To graphically present uncertainty around the ratios cost-effectiveness planes (CE-planes) with 2000 bootstrapped cost-effectiveness pairs were plotted [23], and cost-effectiveness acceptability curves (CEACs) produced using the net health benefits approach.[24]

Financial return analyses

Using the costs and benefits of the program, three outcomes were calculated; 1) Net Benefits (NB), 2) Benefit Cost Ratio (BCR), and 3) Return On Investment (ROI).[25,26] Costs were defined as the costs of providing guideline-based care. Benefits were defined as the difference in monetized productivity loss (i.e. absenteeism and presenteeism costs) between both groups during follow-up. NB consisted of the guideline costs subtracted from its benefits. BCR was calculated by dividing the benefits by the costs. ROI was the division of NB by the costs, multiplied by 100. To quantify precision, 95% CIs around the NB were estimated by means of ABC intervals.[27] Financial returns are positive if the following criteria are met: NB>0, BCR>1, and ROI>0.

Sensitivity analyses

Sensitivity analyses were conducted to test the robustness of the results. First, analyses were performed using cases with complete data for both outcomes and costs, i.e. complete-cases (SA1). Second, productivity losses were estimated using standard mean labor costs of the Dutch population, i.e. €30.02 per hour [7] (SA2). Third, analyses were performed in which absenteeism costs were estimated using the Human Capital Approach (HCA) instead of the FCA (SA3). In the HCA, total sick leave days are neither "truncated" as in the FCA, nor is elasticity considered. Fourth, since overall consensus about whether or not to include presenteeism costs in economic evaluations does currently not exist, analyses were performed in which presenteeism costs were excluded (SA4).[28]

Results

Participants

The flow of OPs and employees can be found in Figure 1. After completion of the intervention period, three OPs were lost to follow-up, of whom one did not report on use of the intervention among his employees. Subsequently, the employees of these OPs were measured by the Balance@Work team. Six OPs had difficulties in performing follow-up measurements, resulting in missing data (Figure 1).

The OPs recruited 524 participants. After 18 months, 70 intervention employees (26%) and 54 control employees (22%) were lost to follow-up. Reasons for loss to follow-up were in majority loss of motivation or not reported. One participant was excluded because she wanted to gain weight. The baseline characteristics of the two groups are described in Table 1. Some differences were found between participants completing all cost and body measurements and participants with at least one of these measurements missing, especially in the intervention group (Table 1). These variables were included in the imputation model. Imputed data concerned 20% of the cost variables, 20% of utilities and 34% of the 18-month follow-up body measurements.

Effectiveness

Statistically significant differences in effects were found in favor of the control group. Compared with the control group, the intervention group gained 1.6 cm in waist circumference and 1.1 kg in weight (Table 2). There were no differences in QALYs gained.

Costs

Table 2 shows that presenteeism was statistically significant higher by 52 hours in the intervention group. Mean intervention costs were €218 using OP labor costs and €497 using OP charges. Total costs were similar, i.e., €25 565 for the intervention group and €25 664 for the control group.

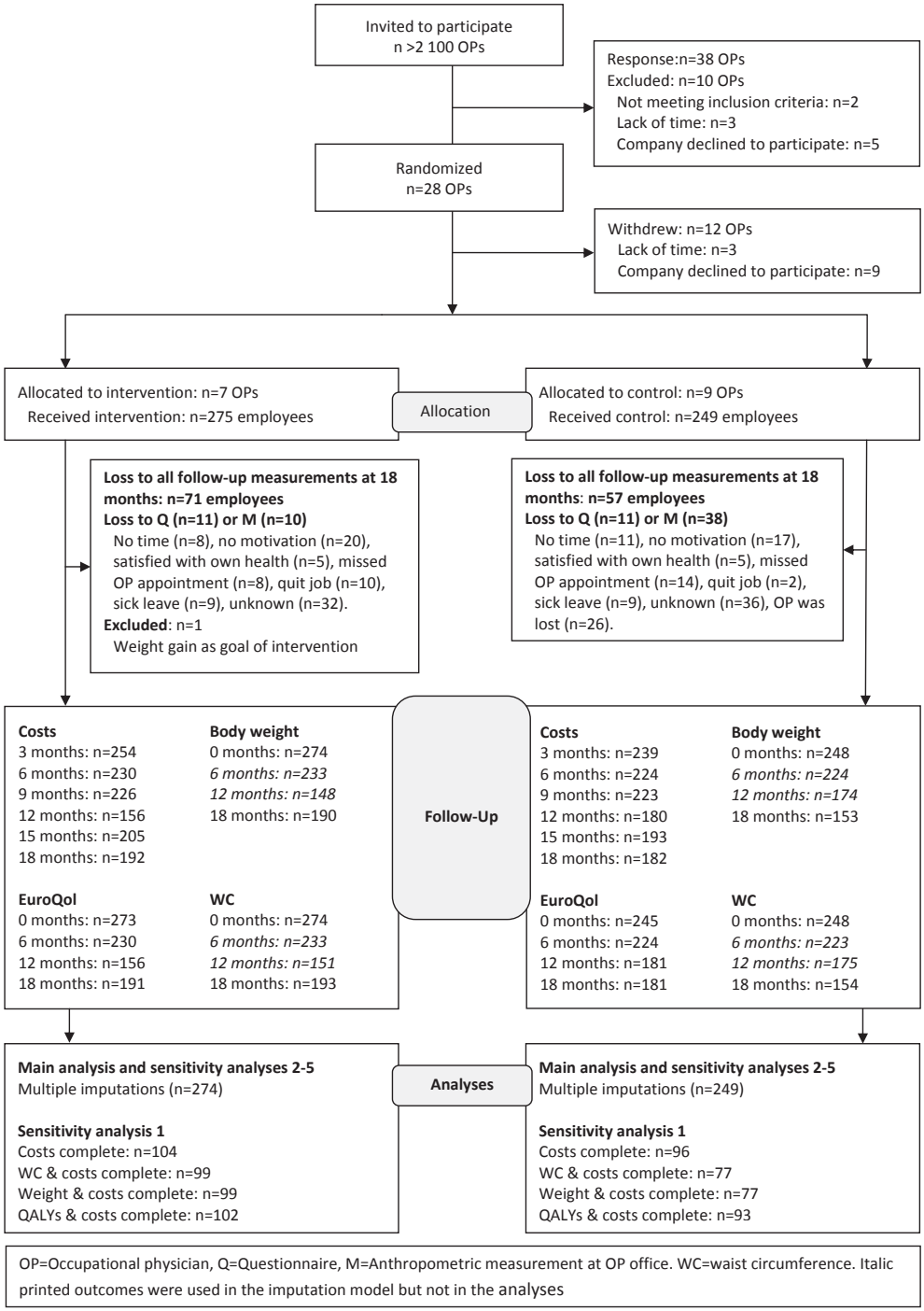


Figure 1. Participant flow

Table 1. Baseline characteristics of all randomized participants and of participants with complete data[a] and those with incomplete data

	Control group				Intervention group			
	All n=249	**Complete n=77**	**Incomplete n=172**	**Complete versus incomplete (95% CI)**	**All n=274**	**Complete n=99**	**Incomplete n=175**	**Complete versus incomplete (95% CI)**
Male, n (%)	162 (65)	57 (74)	105 (61)	+13%* (NA)	169 (62)	53 (54)	116 (66)	-12%* (NA)
Age, mean (SD), y	47 (8.7)	50 (7.5)	46 (9.0)	3.6** (1.3;5.9)	45 (7.8)	46 (8.0)	45 (7.8)	1.1 (-0.9;3.0)
Level of education: college or higher, n (%)	126 (51)	35 (46)	92 (53)	-8% (NA)	150 (55)	74 (74)	76 (44)	+30%*** (NA)
Irregular working hours, n (%)	73 (29)	26 (34)	47 (27)	+7% (NA)	53 (19)	5 (5)	48 (27)	-22%*** (NA)
White collar worker, n (%)	203 (83)	59 (78)	144 (86)	-8% (NA)	230 (86)	91 (95)	139 (80)	+15%** (NA)
Labor costs/hour, mean (SD), Euros, n=433	40 (14)	40 (14)	40 (15)	-0.8 (-3.3;4.9)	37(12)	39 (12)	36 (12)	3* (0.1;6.6)
Sickness absenteeism in previous 3 months, mean (SD) - working days - working hours	2.6 (8.1) 19.3 (60.0)	3.2 (9.7) 22.4 (68.1)	2.3 (7.4) 17.9 (56.1)	0.8 (-1.4;3.1) 4.5 (-11.7;20.8)	1.1 (3.9) 8.9 (31.1)	1.2 (4.7) 9.9 (37.6)	1.1 (3.4) 8.3 (26.9)	0.2 (-0.8;1.1) 1.6 (-6.1;9.4)
Presenteeism previous 3 months, mean (SD), (%)	23 (12)	23 (13)	23 (11)	0.0 (-0.03;0.04)	23 (12)	24 (12)	23 (12)	0.6 (-2.2;3.6)
Health utility, mean (SD)	0.89 (0.13)	0.92 (0.13)	0.88 (0.14)	0.04* (0.003;0.07)	0.88 (0.13)	0.90 (0.12)	0.87 (0.13)	0.03 (-0.01;0.06)

[a]Complete data: complete cost data (i.e. all six cost questionnaires, compliance to the intervention and data on number of working days and hours per week and salary were available) and complete body measurements (i.e. baseline and 18-month follow-up were available) Incomplete data: at least one of these measurements missing; *p<0.05, **p<0.01, ***p<0.001. Abbreviations: n, number; SD, standard deviation; CI, confidence interval; NA, not applicable

Table 2. Pooled outcomes at baseline and 18 month follow-up

Outcome	Intervention group n=249		Control group n=274		Intervention versus control
	Baseline mean (SEM)[b]	Follow-up mean (SEM)	Baseline mean (SEM)	Follow-up mean (SEM)	Mean difference (95% CI)
WC, cm	94.5 (0.79)	95.3 (0.91)	98.0 (0.86)	96.7 (0.84)	1.6* (0.27;2.90)
Body weight, kg	86.0 (1.05)	86.4 (1.03)	87.6 (1.07)	86.9 (1.09)	1.1* (0.01;2.15)
QALYs[a] achieved	-	1.37 (0.011)	-	1.38 (0.009)	-0.006 (-0.029;0.017)
Resource use					
Counseling sessions	-	4.2 (0.09)	-	-	-
Sickness absenteeism, FCA, hrs	-	89 (14)	-	94 (13)	-5 (-41;31)
Presenteeism, hrs	-	559 (14)	-	507 (13)	52** (15;89)
Costs per category					
Intervention	-	218 (4)	-	0 (0)	218 (NA)
Primary health care	-	398 (48)	-	390 (46)	8 (-122;140)
Secondary health care	-	410 (89)	-	381 (57)	29 (-161;248)
Participant	-	564 (44)	-	580 (48)	-16 (-144;107)
Absenteeism	-	3043 (540)	-	3524 (569)	-481 (-1852;972)
Presenteeism	-	20 932 (723)	-	20 789 (914)	143 (-2158;2416)
Total costs	-	*25 565 (908)*	-	*25 664 (1194)*	*-99 (-2918;2772)*

[a] The maximum amount of QALYs that can be achieved in 18 months is 1.5 units. *p<0.05, **p<0.05.
Abbreviations: n, number; WC, waist circumference; QALY, Quality Adjusted Life Year; SEM, standard error of the mean; CI, confidence interval; FCA, friction cost approach; NA, not applicable. Note: Costs are expressed in 2009 Euros

Cost-effectiveness

The ICER for waist circumference was -62, indicating a societal saving of €62 at the cost of a 1 cm increase in waist circumference with guideline care compared with usual care (Table 3). The ICER for body weight of -92 indicated a saving of €92 at a 1 kg increase in weight. The CE-plane for waist circumference (Figure 2a) shows substantial uncertainty. The CEACs show that for both outcomes the probability that the guideline is cost-effective was around 52% when society is not willing to pay at all. The probability decreased when willingness-to-pay increases (Figure 2b).

Figure 2a.

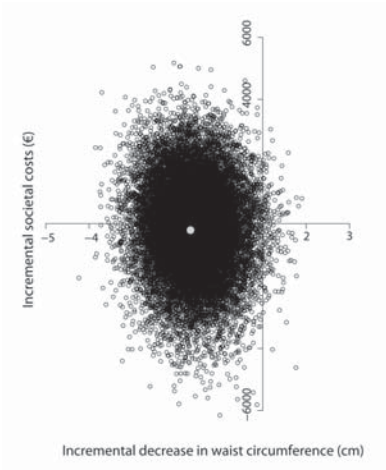
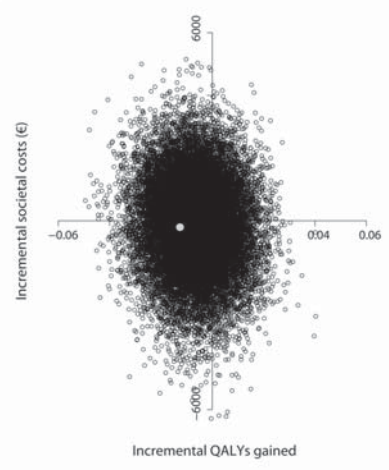


Figure 2c.



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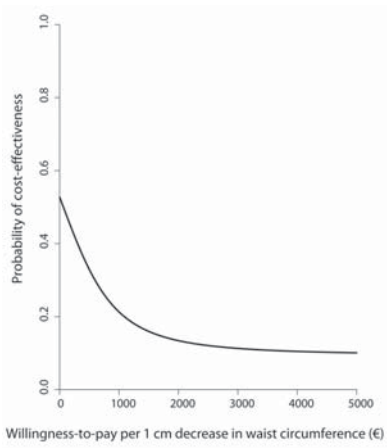

Figure 2d.

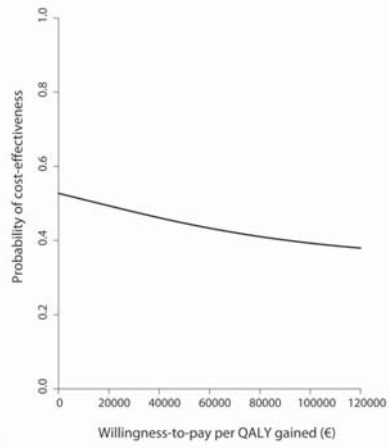

Figure 2a. Cost-effectiveness plane for waist circumference of the guideline group compared with usual care

Figure 2b. Cost-effectiveness acceptability curve for waist circumference of the guideline group compared with usual care

Figure 2c. Cost-effectiveness plane for QALYs gained in the guideline group compared with usual care

Figure 2d. Cost-effectiveness acceptability curve for QALYs gained in the guideline group compared with usual care

Table 3. Incremental cost-effectiveness ratios and distribution of the joint cost-effect pairs in the cost-effectiveness plane

Analysis[a]	Sample size per group		ΔC (95% CI)	ΔE (95% CI)		Distribution in CE plane (%)			
	Control	Intervention	Euros	Waist circumference, cm	ICER	NE[b]	SE[c]	SW[d]	NW[e]
Main analysis *Imputed datasets*	249	274	-99 (-2918;2772)	1.6* (0.27;2.90)	-62	0.4	0.5	52.0	47.1
SA1 *Complete cases*	77	99	651 (-3414;4097)	0.4 (-1.4;2.1)	1705	20.8	12.2	21.6	45.4
SA2 *Mean Dutch labor costs*	249	274	1653* (35;3286)	1.6* (0.27;2.90)	1041	0.7	0.0	2.2	97.0
SA3 *HCA*	249	274	22 (-3117;3013)	1.6* (0.27;2.90)	14	0.3	0.4	48.6	50.6
SA4 *Excluding presenteeism*	249	274	-242 (-1846;1385)	1.6* (0.27;2.90)	-153	0.2	0.5	61.8	37.4
	Control	**Intervention**	**Euros**	**Body weight, kg**	**ICER**	**NE[b]**	**SE[c]**	**SW[d]**	**NW[e]**
Main analysis *Imputed datasets*	249	274	-99 (-2918;2772)	1.1* (0.01;2.15)	-92	0.7	1.1	51.1	47.1
SA1 *Complete cases*	77	99	651 (-3414;4097)	0.7 (-0.6;1.9)	964	7.1	6.4	29.3	57.1
SA2 *Mean Dutch labor costs*	249	274	1653* (35;3286)	1.1* (0.01;2.15)	1529	1.7	0.1	2.2	96.0
SA3 *HCA*	249	274	22 (-3117;3013)	1.1* (0.01;2.15)	20	0.7	1.0	47.7	50.6
SA4 *Excluding presenteeism*	249	274	-242 (-1846;1385)	1.1* (0.01;2.15)	-224	0.6	1.2	60.7	37.5
	Control	**Intervention**	**Euros**	**QALY**	**ICUR**	**NE[b]**	**SE[c]**	**SW[d]**	**NW[e]**
Main analysis *Imputed datasets*	249	274	-99 (-2918;2772)	-0.006 (-0.029;0.017)	16 118	12.4	16.3	35.9	35.4
SA1 *Complete cases*	93	102	707 (-2745;4144)	0.006 (-0.022;0.035)	117 872	41.1	25.4	9.6	23.9
SA2 *Mean Dutch labor costs*	249	274	1653* (35;3286)	-0.006 (-0.029;0.017)	-269 097	28.3	1.4	0.9	69.4
SA3 *HCA*	249	274	22 (-3117;3013)	-0.006 (-0.029;0.017)	-3649	13.6	15.9	32.8	37.7
SA4 *Excluding presenteeism*	249	274	-242 (-1846;1385)	-0.006 (-0.029;0.017)	39 441	5.9	23.3	39.1	31.7

[a] In the analysis ΔC= mean difference in total costs of intervention vs. control, ΔE= mean difference in outcome, ICER (ICUR) is calculated as ΔC/ ΔE. In the intention to treat analysis missing data were multiply imputed. The complete cases analysis was restricted to participants with complete cost and effect data. [b] Northeast quadrant of the CE-plane: the intervention is more effective and more costly than usual care. [c] Southeast quadrant of the CE-plane: the intervention is more effective and less costly than usual care. [d] Southwest quadrant of the CE-plane: the intervention is less effective and less costly than usual care. [e] Northwest quadrant of the CE-plane: the intervention is less effective and more costly than usual care; *p<0.05. Abbreviations: CI, confidence interval; ICER (ICUR), Incremental Cost-Effectiveness (Utility) ratio; HCA, human capital approach.

Cost-utility

The ICUR showed that €30 193 was saved per QALY lost due to the guideline in comparison with usual care (Table 3). The CE-plane (Figure 3a) showed considerable uncertainty. The probability that the guideline is cost-effective for QALYs gained was 52% at a ceiling ratio of €0 and decreased with an increasing willingness to pay (Figure 3b).

Financial return

Table 4 shows a negative net employer benefit of €-158. The wide 95% confidence interval (-2865 ; 2672) showed that there was large uncertainty around this outcome. For each Euro invested, 0.68 Euros were retrieved, whereas the return on investment was -32%.

Sensitivity analyses

The sensitivity analyses revealed that the results found in the main analyses were not robust. When analyses were restricted to complete cases (SA1), cost differences were in favor of the control group (Table 3). The ICERs for weight loss and waist circumference represented losses in health at increased spending, whereas the ICUR showed QALYs gained at increased costs. The probability of cost-effectiveness remained below 40%, regardless of willingness-to-pay. The probability of cost-utility did not exceed 50%.

SA2 resulted in higher costs in the intervention group and probabilities of cost-effectiveness for all outcomes reduced to below 20% at any ceiling ratio. The other sensitivity analyses showed probabilities of cost-effectiveness below 62% for all outcomes.

The sensitivity analyses for financial return are presented in Table 5. All showed financial losses, with the NB ranging from €-15 to €-1910. The latter NB, based on the mean Dutch labor costs, was statistically significant.

Discussion

An occupational healthcare guideline to prevent weight gain among employees had unfavorable effects on weight-related outcomes, no significant effect on QALYs gained and a low probability of cost-effectiveness compared with usual care. From the perspective of a Dutch employer the guideline resulted in a financial loss.

In another Dutch study occupational nurses and some OPs provided face-to-face diet and physical activity counseling sessions to construction industry employees at increased risk for cardiovascular disease.[29] Counseling was more effective than no counseling. One year after baseline an ICER of -145 (€293/-2.0 kg) was found, with a probability of cost-effectiveness of 60% at €250/kg increasing to 90% at €2000/kg. However, employer's NB was also negative, €-254 (95% CI -1536; 1070). The differences between the studies may be explained by counseling by occupational nurses compared to counseling by physicians. A review found that allied health professionals and multidisciplinary teams produced better results than physicians only.[30]

Table 4. Intervention costs, benefits, net benefit (NB), benefit cost ratio (BCR), and return on investment (ROI) per employee

Analysis	Sample size		Costs	Benefits			Financial return		
	Control	Intervention	Intervention (Euros)	Absenteeism (95% CI)	Presenteeism (95% CI)	Total (95% CI)	NB[1] (95% CI)	BCR[2]	ROI (%)[3]
Main analysis *Imputed datasets*	249	274	497	481 (-972;1852)	-143 (-2416;2158)	338 (-2490;3058)	-158 (-2865;2672)	0.68	-32
SA1 *Complete cases*	96	104	536	804 (-200;2338))	-1275 (-4434;1923)	-471 (-3603;3120)	-1007 (-4340;2576)	-0.88	-187
SA2 *Mean Dutch labor costs*	249	274	497	147 (-939;1197)	-1561*** (-2631;-452)	-1413 (-2864;59)	-1910* (-3359;-440)	-2.84	-384
SA3 *HCA*	249	274	497	360 (-1652;1934)	-143 (-2416;2158)	217 (2950;3081)	-280 (-3261;2722)	0.44	-56
SA4 *Excluding presenteeism*	249	274	497	481 (-972;1852)	-	481 (-972;1852)	-15 (-1407;1426)	0.97	-3

[1] Indicates the amount of money returned after intervention costs are covered; [2] Indicates the amount of money returned per Euro invested in the intervention; [3] Indicates the percentage of profit per Euro invested in the intervention;*p<0.05, ***p<0.001. Abbreviations: CI, confidence interval; NB, net benefit; BCR, benefit cost ratio; ROI, return on investment; SA, sensitivity analysis; HCA, human capital approach; NA, not applicable. Note: Costs are expressed in 2009 Euros.

The cost differences proved to be very sensitive to different valuations of productivity loss. When productivity loss was valued using mean Dutch labor costs, the absenteeism cost difference decreased from €-481 to €-147, whereas the presenteeism cost difference increased from €143 to €1561 (see Table 5). This results from underlying interactions. The €-481 difference when labor cost were based on self-reported salary can be explained by lower absenteeism among higher income employees in the intervention group, i.e. an interaction between group and income. Post-hoc analyses (results not shown) seem to confirm this. Additionally, at baseline absenteeism was somewhat lower in the intervention group; this could have been carried through over the following months. In contrast, there was more presenteeism in the intervention group. Post-hoc analyses (results not shown) showed that in the main analysis this difference was ruled out because, equivalent to absenteeism, presenteeism was lower (i.e. the average work performance was better) among higher income employees. In conclusion, only small reductions in absenteeism costs are likely due to the guideline while increased presenteeism has an important and negative impact on the total cost differences when labor costs are equalized.

Limitations and strengths

A limitation is the amount of missing data. Despite meticulous pursuit, data were missing for up to 34% of the measurements, a common problem with this type of research in daily practice.[31] Furthermore, the self-report of all resource use may have led to underestimation of the costs. In particular absenteeism and presenteeism may have suffered from recall bias as the period on which to report was relatively long.[32]

A strength is the use of multiple imputation techniques, a recommended method to handle missing data.[21,33] Furthermore, we conducted an economic evaluation alongside a randomized controlled trial, which is the most valid design to evaluate effectiveness and allows for prospective data cost data collection.

Conclusion

Compared with usual care, care according to an occupational healthcare guideline to prevent weight gain among employees had a low probability of societal cost-effectiveness and cost-utility. From the viewpoint of a Dutch employer, using the guideline resulted in a financial loss. Implementation of the guideline in its current form is not advised.

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Appendix 1. Price weights used for valuation of resource use, per visit unless otherwise mentioned

Type of utilization	Price weight[a]
Direct healthcare costs	
Intervention: occupational physician	
Labor costs (h)	59.37
Charges paid by companies (h)	200
Primary care	
General practitioner	28[b]
Physiotherapist	36
Therapist (Cesar, Mensendieck)	35
Dietitian	27
Dentist	19.39
Psychologist	77[c]
Sports physician	79
Other primary care	22.60 – 100 [c, d]
Secondary care	
Clinic visit	72
Psychiatrist	103
Admission general hospital (d)	435
Admission academic hospital (d)	575
Outpatient	251
Emergency department	151
Direct patient costs	
Complementary therapists	50 - 135[c, d]
Sports & sports equipment	as reported by participant
Indirect productivity losses	
Sickness absenteeism and presenteeism (h)	based on salary as reported by participant

[a] Euros, corrected to the year 2009, [b] Price for consultation at the practice; [c] Range of the price weights for the different providers, [d] Price according to professional association