

## Summary



The prevalence of overweight and obesity has increased substantially in most Western countries, including the Netherlands. To counter the morbidity, mortality and economic consequences of overweight and obesity, there is a need to create interventions that are supportive for making healthy choices. **Chapter 1** describes that at the workplace, evidence-based practice guidelines could support occupational physicians (OPs) to play a key role in preventing weight gain. This thesis investigates the development, evaluation and implementation of a draft evidence-based practice guideline among occupational physicians and employees in the Netherlands.

### **Development of the guideline**

In **Chapter 2**, a meta-analytic review examines the effectiveness of primary and secondary prevention workplace interventions targeting physical activity and dietary behavior on body weight-related outcomes. Data from 22 studies published between January 1980 and November 2009 were extracted by two authors and assessed for methodological quality. The GRADE approach was used to determine the overall quality of evidence for each pooled outcome measure. Moderate quality of evidence was found that workplace physical activity and nutrition interventions significantly reduce body weight (pooled estimate -1.2 kg). Due to a limited number of studies, evidence could not be investigated for effects on waist circumference, sum of skinfolds and waist-hip ratio. Interventions containing an environmental component showed a greater reduction in body weight (pooled estimate -0.3 kg). For future interventions, we recommend workplace physical activity and dietary behavior interventions, including an environment component, in order to prevent weight gain as the clinical relevance of the pooled effects may be substantial on a population level.

In **chapter 3**, we outline the systematic development of the draft guideline, and the design for evaluation and implementation of the guideline. Control OPs were asked to provide usual care, which generally consisted of a health risk appraisal with anthropometric measurements and a subsequent health advice. Intervention OPs were asked to provide guideline-based care. Guideline-based care consisted of 1) providing advice to employers on how to assess and intervene on the obesogenic work environment, 2) conducting five behavioral change counseling sessions with employees during 6 months to improve their physical activity and dietary behavior, and 3) addressing evaluation and maintenance. The guideline was evaluated using a randomized controlled trial design over the course of 18 months among 16 OPs and 523 employees. The primary outcome measure was waist circumference. Secondary outcome measures were lifestyle behavior-related outcomes (physical activity, sedentary behavior and dietary behavior), body weight-related outcomes (body weight and BMI), health-related outcomes (blood pressure, cholesterol and quality of life) and work-related outcomes (sick leave and productivity).

### Evaluation of the guideline

**Chapter 4** evaluates the process of guideline-based care among intervention group participants. Quantitative data on seven process items were assessed and linked to effects on employees' waist circumference and body weight at 6 months follow-up. Among OPs, the environmental component was adequately conducted by only one out of seven intervention OPs. The behavioral change counseling was performed partly, but none of the OPs adequately addressed evaluation and maintenance of the guideline. Moreover, all OPs found it difficult to measure the waist circumference. Among employees, reach (86%), satisfaction (grade 7.1), and attendance rates (4.4 of out 5 sessions) were generally high. Furthermore, intervention employees with higher attendance and satisfaction rates significantly improved their waist circumference (-1.5 cm to -2.1 cm) and body weight (-0.9 kg to -1.4 kg). From these results we conclude the occupational health guideline is feasible, but the environmental component and behavioral change counseling need revisions before practical application.

**Chapter 5** presents the effectiveness of the draft guideline after 6 months on employees' lifestyle behavior-related outcomes (physical activity, sedentary behavior and dietary behavior measured by questionnaire) and body weight-related outcomes (body weight and BMI). Intervention employees were significantly younger (46 versus 48 years) and worked less often in irregular work hours (19% versus 29%) at baseline compared to control employees. To account for this bias, all results were adjusted for age and irregular work hours. During the 6-month intervention period, 53 subjects from both groups were lost-to-follow-up; 37 in the intervention group and 16 in the control group. Guideline-based care resulted in a reduction of the time spent sitting at work ( $\beta$  -28 min per day, 95% CI -2; -54) and increased fruit intake ( $\beta$  2.1 pieces per week; 95% CI 0.6; 3.6), but did not improve employees' physical activity or snack intake. Also, no significant difference was found between groups among employees who maintained or decreased their waist circumference and body weight (i.e. prevented weight gain) versus those who increased their waist circumference and body weight.

**Chapter 6** describes the effectiveness of the draft guideline during 18 months on employees' body weight-related outcomes (body weight and BMI) and health-related outcomes (blood pressure, cholesterol and quality of life). During this period 70 intervention employees (26%) and 54 control employees (22%) were lost to follow-up. Data were analyzed using multilevel analyses in order to adjust for the possible dependency of observations and unbalanced data. This procedure allows for all available data to be used in the analyses. Guideline-based care was neither more effective on body weight-related outcomes nor on health-related outcomes compared to usual care. The effect on increased fruit intake ( $\beta$  1.9 pieces per week; 95% CI 0.4; 3.4) was sustained at 18 months follow-up (*unpublished data*). Stratified analyses showed an increase in waist circumference among men ( $\beta$  2.5 cm, 95% CI 0.5; 4.5) and obese intervention participants ( $\beta$  2.7 cm, 95% CI 0.6; 4.7) compared to control participants. As blinding of OPs was not possible, additional control measurements were performed by independent researchers in a random sample of 141 employees during all measurements

(8%). Also, a total of 1,010 (80%) self-reported waist circumference measurements were assessed from employees during all follow-up measurements using a non-stretchable paper measuring tape (range 0-130 cm) and written measurement instructions. No differences were found between OP measured waist circumference and independent researcher measured waist circumference. However, compared to OPs, employees significantly under-reported their waist circumference by -1.4 cm (SD=3.9;  $p<0.01$ ). As employee measures tended to be less accurate, we conclude OP measured waist circumference remains the best of the two options.

**Chapter 7** describes the economic evaluation performed alongside the trial, from both societal and employer's perspective. 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. For the economic evaluation, missing data were imputed by multiple imputations. 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 (-0.01, 95% CI -0.03;0.02). The mean cost-difference was €-99 (95% CI -2918;2772). Probabilities of cost-effectiveness were consistently below 55%. Sensitivity analyses mostly showed unfavorable outcomes, leading us to conclude that the guideline was not cost-effective compared with usual care. From a Dutch employer's viewpoint, no financial return from implementing the guideline was shown. Net employer loss was €-158 (95% CI -2865;2672).

#### **Implementation of the guideline**

**Chapter 8** presents barriers and facilitators to implementation of the guideline, as mentioned by 14 OPs and employers during interviews. Data were analyzed following a systematic approach using Atlas-ti. Barriers and facilitators were related to the socio-political context, the organization, the OP, and the guideline. From this study we conclude that there is a broad societal basis and organizational support among OPs and employers for implementing the draft guideline, but that resources, structures and support for continuation are persistent barriers that need more attention. Presenting these factors in the guideline, including strategies how to overcome barriers and stimulate facilitators, could facilitate implementation of the final guideline in the Netherlands.

**Chapter 9** investigates the consequences of variability for clinical practice. Based on literature four gaps in knowledge were identified. First, the magnitude of measurement error is unclear. Second, the definition of clinically relevant change is unclear. We therefore caution clinicians and researchers when interpreting individual changes in waist circumference, as clinically relevant changes in waist circumference may not be distinguished from measurement error. Third, consensus is needed on adopting a uniform protocol. Fourth, there is a lack of knowledge on the effects of training. Considering these gaps in knowledge,

it is clear that there is a need for more good quality research and for action. Until then, we recommend consistently using one standard protocol, quality control as part of training and minimizing the number of observers, outsourcing measurements to well-trained clinicians and repeating measurements at least two, but preferably three times. By reducing measurement error, smaller changes in waist circumference may be detected by clinicians beyond measurement error, which is necessary for accurately monitoring changes in waist circumference of individual subjects over time.

In **chapter 10**, the results of this thesis are summarized and discussed. In addition, the relevance of the findings and recommendations for future research as well as practical implications are addressed. In conclusion, application of this systematically developed, well-appreciated but partly feasible draft guideline resulted in an improved sedentary behavior at the short-term and fruit intake at the short- and long-term, but did not result in overall improvements in behavioral outcomes, body weight-related outcomes or health-related outcomes. Also, the guideline was neither cost-effective nor cost-beneficial compared to usual care. Therefore, it cannot be recommended to implement the draft guideline in its current form. Several practical implications are given to provide direction when stepping into the future.