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The costs, effects and cost-effectiveness of counteracting overweight on a population level. A scientific base for policy targets for the Dutch national plan for action

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Abstract

Objectives. To gain insight in realistic policy targets for overweight at a population level and the accompanying costs. Therefore, the effect on overweight prevalence was estimated of large scale implementation of a community intervention (applied to 90% of general population) and an intensive lifestyle program (applied to 10% of overweight adults), and costs and cost-effectiveness were assessed.

Methods. Costs and effects were based on two Dutch projects and verified by similar international projects. A markov-type simulation model estimated long-term health benefits, health care costs and cost-effectiveness.

Results. Combined implementation of the interventions – at the above mentioned scale – reduces prevalence rates of overweight by approximately 3 percentage points and of physical inactivity by 2 percentage points after 5 years, at a cost of 7 euros per adult capita per year. The cost-effectiveness ratio of combined implementation amounts to €6000 per life-year gained and €5700 per QALY gained (including costs of unrelated diseases in life years gained). Sensitivity analyses showed that these ratios are quite robust.

Conclusions. A realistic policy target is a decrease in overweight prevalence of three percentage points, compared to a situation with no interventions. In reality, large scale implementation of the interventions may not counteract the expected upward trends in The Netherlands completely. Nonetheless, implementation of the interventions is cost-effective.

Keywords: Overweight; Cost-effectiveness analysis; Modelling; Behavioural interventions; Policy target; Physical activity

Introduction

The prevalence of overweight (body mass index (BMI) ≥ 25 kg/m^2) is increasing worldwide and curbing the trends is a primary public health target in many countries (World Health Organisation, 2000). It has become clear that this requires an integrative policy, consisting of measures affecting the individual, society and environment. Such a policy includes interventions targeted at changing behavior, namely reducing energy intake and stimulating physical activity (Mullis et al., 2004). These behavioral interventions can either aim at preventing overweight (primary prevention) or at treatment (secondary prevention). For achieving an optimal evidence based health policy more insight is needed in the effects, costs and cost-effectiveness of interventions (Aldana, 2001; Jain, 2004). This information may serve to develop a more realistic policy.

Two reviews (Kahn et al., 2002; McTigue et al., 2003) confirmed the long-term effects of two types of interventions, namely a community-based prevention approach and an intensive lifestyle program. A community-based approach aims at preventing overweight in the general population. Typically, it consists of communication strategies through mass media, combined with social support, such as self-help groups, risk

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factor screening and/or counseling in various settings (Kahn et al., 2002). An intensive lifestyle program, or multicomponent weight loss program, is targeted at individual overweight people and is usually implemented within a health care setting.

Since effectiveness of these two types of interventions is established we used them as the base for policy targets for the Dutch national plan for action on overweight/physical inactivity. The present article presents this research.

First, two Dutch projects were used for the cost-calculation and we estimated (population based) effects on overweight and physical activity after 5 years in case of large scale implementation. Thereafter, future effects on disease incidence/mortality and health care costs were estimated by using a markov-type simulation model, e.g. the RIVM chronic disease model (CDM), developed at the National Institute for Public Health (RIVM). Finally, cost-effectiveness was assessed in terms of costs per life year and quality adjusted life year (QALY) saved. (Avoided) costs were measured from the perspective of the health care system.

Methods

Effectiveness of interventions

Several community-based projects found positive effects on body weight and physical activity (Brownson et al., 1996; Goodman et al., 1995; Taylor et al., 1991), with a maximum of −0.7 kg after 6 years. Although other projects found no positive effects (Jeffery et al., 1995; Tudor-Smith et al., 1998), community-based approaches may decrease average bodyweight by 0.6% (Kahn et al., 2002) and are considered a promising strategy to increase physical activity (www.thecommunityguide.org). Assuming an average adult bodyweight of 75 kg (e.g. the Dutch situation) the decrease would be 0.45 kg or a BMI decrease of approximately 0.2 kg/m^2. Furthermore, community projects can decrease prevalence of inactivity, ranging from −7 percentage points to no effect at all. In The Netherlands, the community-based ‘Hartslag Limburg’ project started in 1997 and consisted of several initiatives organized in the southern part of the country. In the intervention region, average bodyweight was 0.2 kg lower and waist circumference 2 cm lower after 5 years, when compared to a control region (Schuit et al., 2006). The prevalence rate of inactivity reduced approximately by 2 percentage points.

With respect to the effects of ‘intensive lifestyle programs’, McTigue et al. reported a decrease in average bodyweight of 2 to 3 kg (McTigue et al., 2003). The Dutch “Study on Lifestyle intervention and Impaired glucose tolerance Maastricht (SLIM-project; 2000–2003)” is a 3-year multicomponent weight loss program targeted at persons with overweight and impaired glucose tolerance, decreased average bodyweight by 2.3 kg and BMI by 0.8 kg/m^2 and increased the VO_2^{max}, compared to the control group (Mensink et al., 2003).

Hence, the results of these two Dutch projects are in line with the effects of projects in other countries, and they were considered appropriate to use as a basis for the cost calculation.

The RIVM chronic disease model (CDM)

The RIVM Chronic Diseases Model (CDM), a dynamic Markov-type multi state transition model, was used to project future gains in life-years and QALYs in the population. Appendix 1 provides information about structure and input data for the present research and contains a list of previous articles with prior applications and information about mathematical details.

In short, the dynamic model forecasts the development over time of demography, risk factor prevalences, disease incidences and mortality in the Dutch population, and estimates the effects of (theoretical) scenarios. For each person several classes or ‘multiple states’ are defined, such as age, body weight (three classes: normal weight–moderate overweight (BMI 25–30 kg/m^2)–obesity (BMI ≥30 kg/m^2)) and physical activity (three classes: inactive–medium active–norm active). The model contains probabilities to change from one class to another, the so-called transition rates. The transition rate to the class ‘death’, which simulates that a person dies, is dependent on age, disease state and risk factor classes. At a given age, an overweight person has a higher probability to die (or get a related disease) than a person having a normal weight. Relevant CDM parameters (input data) were based on national data sources and scientific literature (Appendix 1). Relative risks of overweight and physical activity were assessed for different age categories. In general, disease risks of overweight and inactivity decline in older age and this needs to be taken into account when modeling public health impact (Flegal, 2005).

Modeling of scenarios

The CDM estimates the health gains, health care costs and cost effectiveness of interventions by comparing the outcome of an “intervention scenario” with a “reference scenario”. In the intervention scenario prevalence rates of overweight and inactivity decreased during a 5-year period (based on the intervention results). This was simulated by temporarily changing the transition rates in the RIVM-Chronic Diseases Model (CDM). After 5 years, the transition rates, for example the chance for an overweight person to become obese, were set back to their initial level (which means that the difference between intervention and reference scenario is sustained). In the reference scenario, the CDM parameters are not altered and this can be interpreted as the scenario without implementing the interventions.

Cost-effectiveness analysis

The health gains are calculated as the number of life years/QALYs lived in the intervention scenario minus the number of life years/QALYs lived in the reference intervention. The same procedure was followed for the health care costs. The cost-effectiveness ratio was calculated as the difference in total health care costs between the intervention and reference scenario plus the costs of implementing the interventions divided by the difference in life years or QALYs between the intervention and reference scenario. Costs and effects were discounted at a 4% annual rate. Direct health care costs in the CDM are based on the Dutch Costs of Illness study (Polder et al., 2002). The indirect costs of overweight and inactivity were not included, to make this information relevant for health care decision makers (Al et al., 2004). QALYs estimates account for the fact that quality of life generally decrease with age. QALYs were calculated by coupling disease prevalence rates to disability weights for those diseases (Mathers et al., 2001; Stouthard et al., 1997). Disability weights reflect the severity of a disease relative to death and optimal health and range from 0 (no disability) to 1 (death) (Murray, 1994). For diseases causally linked to BMI the CDM estimated future prevalence rates, and for the other diseases we used age and gender specific prevalence rates from the Dutch Burden of Disease Study and assumed them constant over time (Baal van et al., 2006; Melse et al., 2000).

The time horizon for assessing future health impact was 20 and 80 years. Health care costs in the life-years gained, in the intervention scenario, were included in the analyses. Sensitivity analyses were performed for variations in costs, effects, time horizon, and discount rates.

Intervention scenario: costs for large scale implementation

The intervention scenario simulates that a community-based approach is provided to 90% of the Dutch adult population and that 10% of the persons with overweight are offered an intensive lifestyle program. Hence, some people are exposed to both interventions and for them the effects and costs were assumed to be additive. The scale of implementation in this “intervention scenario” may be considered as a ‘realistic maximum’. Regarding the outcomes of the present article, the scale has effects on population-based effects and cost estimates, but has hardly any on the cost-effectiveness ratio (data not shown). The Dutch population consists of 13,270,000 adults and the prevalence of overweight is about 50%. Hence, the target population in the intervention scenario comprises 11,940,000 (=90%) persons for the community intervention and 650,000 persons for the intensive lifestyle program (=0.5*13,270,000* 10%) (numbers are rounded).

The costs of the intervention scenario were based on the two Dutch projects (in 2004 euros). The costs were estimates of real resource use and did not include productivity or start-up costs. For Hartslag Limburg the costs were about €500,000 (Ronckers et al., 2006). The project was targeted at 148,000 adults, so