Lifestyle interventions are cost-effective in people with different levels of diabetes risk: results from a modeling study

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The study compared two lifestyle interventions for individuals at different levels of diabetes risk. One intervention was a community-based programme of 5 years’ duration, which focused on nutrition and exercise and was targeted at the general population. The other was an intensive lifestyle intervention of 3 years’ duration, which focused on diet and exercise and was for adults with moderate risk of developing diabetes (i.e. obese adults aged 30 to 70 years), implemented in a health care setting.

These two interventions were compared with a reference scenario describing developments in the Dutch population when no interventions are applied.

Type of intervention
Primary prevention.

Economic study type
Cost-utility analysis.

Study population
The study population comprised either 20% or 100% of 12 million adults (aged 20 to 80 years) for the community intervention, and either 5% or 20% of 1 million obese adults (aged 30 to 70 years) for the health care intervention.

Setting
The study setting was the community. The economic study was carried out in the Netherlands.

Dates to which data relate
The effectiveness data were derived from studies published between 1991 and 2005. The cost and resource use data were derived from studies published between 2002 and 2006. The price year was 2005.

Source of effectiveness data
The effectiveness data for the interventions included the effects on body mass index and physical activity, which were translated into altered prevalence rates. The epidemiological data included the effect of body mass index (BMI) and physical inactivity on all-cause mortality, diabetes, cardiovascular diseases, musculoskeletal disorders and cancers.

Modelling
The authors used the National Institute for Public Health and the Environment (RIVM) chronic disease model (CDM) to explore the cost-effectiveness of the interventions under study. The CDM was a Markov dynamic population model describing the transitions between risk factors, chronic diseases and mortality (Hoogenveen et al. 2005, see ‘Other
Publications of Related Interest' for bibliographic details).

**Sources searched to identify primary studies**
The authors used the main structure of the CDM model (Hoogenveen et al. 2005), which contained epidemiological data on the risks of high BMI and physical inactivity derived from the international literature. Other model parameters such as prevalence, incidence, transition rates and mortality rates applied to a Dutch setting. The model was updated to include the effectiveness data of the interventions, which were estimated from published studies representative of the two interventions under study. The authors provided a full list of data sources in the online appendix to their article.

**Methods used to judge relevance and validity, and for extracting data**
A review of the literature was undertaken to identify effectiveness data for the two interventions under study. However, the authors did not report the methodology of the review. The results from the studies included in the review were reported within a range, reflecting the diversity of intervention effects found in the international literature.

**Measure of benefits used in the economic analysis**
The measure of benefit used was the quality-adjusted life-years (QALYs) gained. The QALYs were derived from the CDM model. However, it was unclear how the utility values were derived or how the QALYs were constructed because, in the full explanation of the CDM model, the authors reported how disability-adjusted life-years (DALYs) were calculated in the model rather than QALYs. Since the outcomes could be incurred over a long time, discounting was necessary and was performed at an annual rate of 1.5%, as recommended by Dutch guidelines.

**Direct costs**
The direct costs included in the analysis were those to the health care system in the Netherlands. These included costs for the community-based programme, the intensive lifestyle intervention, and the lifetime health care costs related to diseases linked to BMI or physical activity, and unrelated costs such as cancer and dementia. The costs for the community-based programme focused on nutrition and activities focusing on nutrition and physical activity. The costs for the intensive lifestyle intervention included the costs of equipment and personnel. The intervention costs were derived from two Dutch projects, while the future health care costs were derived from a cost of illness study in the Netherlands.

Since the costs could be incurred over the lifetime of an individual, discounting was relevant and was performed at an annual rate of 4%, as recommended by Dutch guidelines. The price year was 2005. The study reported the incremental costs (i.e. the difference between the intervention and no intervention costs). With the exception of the costs of the intensive lifestyle intervention programme, for which the authors provided a detailed overview in the online appendix, the resource quantities and the unit costs were not reported separately. The authors also calculated the costs of large-scale implementation of the two interventions under study in the Netherlands.

**Statistical analysis of costs**
The costs were treated as point estimates (i.e. the data were deterministic).

**Indirect Costs**
Productivity costs were not included.

**Currency**
Euros (EUR).

**Sensitivity analysis**
The authors carried out a series of one-way sensitivity analyses by varying the costs for the interventions and the discount rate.

**Estimated benefits used in the economic analysis**
The results were reported assuming a minimum intervention effect and a maximum intervention effect.

The discounted average QALYs gained with the community intervention were 0.006 when assuming a minimum effect and 0.039 when assuming maximum effect.

The discounted QALYs gained with the intensive lifestyle intervention ranged between 0.27 when assuming a minimum effect and 1.17 when assuming a maximum effect.

**Cost results**
The average intervention cost per patient was EUR 5.50 with the community intervention and EUR 675 with the intensive lifestyle intervention.

Compared with no intervention, the community intervention generated lifetime average discounted savings of EUR 10 and EUR 70 when assuming minimum and maximum intervention effects, respectively. However, in comparison with no intervention, it also generated incremental costs ranging from EUR 30 (minimum effects) to EUR 180 (maximum effects). Hence, the total incremental health care costs of the community intervention were between EUR 20 and EUR 110 when assuming minimum and maximum effects, respectively.

Compared with no intervention, the intensive lifestyle intervention generated lifetime average discounted savings of EUR 500 and EUR 1,700 when assuming minimum and maximum intervention effects, respectively. However, in comparison with no intervention, it also generated incremental costs ranging from EUR 1,300 (minimum effects) to EUR 5,600 (maximum effects). Hence, the total incremental health care costs of the intensive lifestyle intervention were between EUR 800 and EUR 3,900 when assuming minimum and maximum effects, respectively.

**Synthesis of costs and benefits**
The costs and benefits were combined using an incremental cost-utility ratio (i.e. the additional cost per QALY gained).

Compared with the no intervention strategy, the additional cost per QALY gained when using the community intervention was EUR 3,900 when assuming minimum intervention effects and EUR 3,100 when assuming maximum intervention effects. The corresponding costs per QALY gained with the intensive lifestyle intervention were EUR 5,500 (minimum effects) and EUR 3,900 (maximum effects), respectively.

The results of the sensitivity analyses showed that variations in the intervention costs and in the discount rate did not alter the cost-utility ratios significantly, with all ratios remaining under the EUR 20,000 per QALY gained threshold.

**Authors' conclusions**
The health care intervention for high-risk groups and community-lifestyle intervention targeted at the general population were both cost-effective ways of curbing the growing burden of diabetes.

**CRD COMMENTARY - Selection of comparators**
A justification was given for using the no intervention option as the comparator. It represented current practice in the Netherlands. You should decide if the comparator used represents current practice in your own settings.

**Validity of estimate of measure of effectiveness**
Many of the model parameters (e.g. incidence, prevalence, and relative risks of mortality for patients with diabetes or high BMI) were already included in the CDM model used by the authors. However, the authors undertook a review of
the literature in order to include the effects of the two interventions on BMI and physical activity. The authors reported that the international literature was searched for studies that were representative of the interventions under study. The potential intervention effects were then presented as a range, reflecting the potential impact of the two interventions, and the results for minimum and maximum effects were reported. It was unclear how exhaustive or systematic the review of the literature was.

Validity of estimate of measure of benefit
The estimation of health benefits (i.e. QALYs) was derived using a Markov model, which was appropriate for the study. However, it was unclear how the utility values were derived or how the QALYs were constructed as, in the full explanation of the CDM model, the authors reported how DALYs were calculated rather than QALYs.

Validity of estimate of costs
The analysis of the costs was performed from the perspective of the national health care system paying for the interventions. All the relevant categories of costs, and all relevant costs within these categories, appear to have been included in the analysis. The costs were derived from a national cost of illness study for lifetime medical costs, whereas the costs of the interventions were derived from data from two Dutch projects. Since the costs could be incurred over the lifetime of the patient, discounting was relevant and was appropriately performed. Only the intervention costs were varied in the authors' limited sensitivity analysis. The price year was reported, which will aid any future inflation exercises.

Other issues
The authors reported that literature on the cost-effectiveness of interventions aimed at the primary prevention of diabetes was scarce. In addition, they highlighted that it was difficult to generalise the results between countries because of variations in health care costs, diabetes prevalence and risk factor distributions. The authors do not appear to have reported their results selectively and their conclusions reflected the scope of the analysis. The authors did not report any further limitations to their study.

Implications of the study
The authors would appear to recommend that both the community-based programme and the intensive lifestyle intervention aimed at high risk patients should be implemented, as they were shown to be a cost-effective way to curb the growing burden of disease. However, the study limitations should be considered before following any recommendations.

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Other publications of related interest
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**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
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