Lifestyle intervention to prevent diabetes in men and women with impaired glucose tolerance is cost-effective


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 present study compared an intensive lifestyle intervention programme with no programme for preventing Type 2 diabetes mellitus in people with impaired glucose tolerance. The intervention programme included:

- yearly visits to the physician;
- seven visits to the nutritionists during the first year, and visits every third month thereafter; and
- participation in a circuit-type resistance training session for a group of 15 persons along with encouragement of individual exercise.

Details of similar prevention programmes used as a basis for the present study, such as the Finnish Diabetes Prevention Study (DPS), were described by Eriksson et al. (1999) and Tuomilehto et al. (2001), (see 'Other Publications of Related Interest' below for bibliographic details).

Type of intervention
Primary prevention.

Economic study type
Cost-utility analysis.

Study population
The hypothetical population comprised patients extracted from a screening study of a Swedish cohort of 60-year-old men and women recently screened who would be eligible for the intervention. Eligible patients were those with a body mass index of greater than 25, a fasting glucose greater than 6.1 mmol/L, and without a diagnosis of diabetes mellitus. The 60-year-old cohort consisted of a population-based random sample of one third of the 60-year-olds in the County of Stockholm. Details were provided elsewhere (Hellenius et al. 2000, see 'Other Publications of Related Interest' below for bibliographic details).

Setting
The setting for the study was outpatient care. The economic study was carried out in Sweden.

Dates to which data relate
The effectiveness data used in the model came from studies published between 1992 and 2004. The cost data were from 1995 to 2001. The price year was 2003.

Source of effectiveness data
The clinical and epidemiological data included:

- the risk of developing overt diabetes;
- the risk of suffering a myocardial infarction (MI) or stroke;
- mortality following MI and stroke;
- the relative risk of developing diabetes;
- a reduction in the relative risk of developing diabetes;
- a reduction in risk factors for cardiovascular disease; and
- the lasting effect of intervention after the discontinuation of treatment.

Microvascular complications were not explicitly incorporated into the model.

**Modelling**
The authors used a patient-level state-transition model. The baseline transition probabilities for each year were determined by risk functions. The patients were randomly selected from a sample of patients in a Swedish cohort study and the transition probabilities matched their characteristics. The relative risk reduction appeared to be fixed for every patient. A 6-year intervention horizon was assumed in the base-case, as this was the longest follow-up period in the original DPS.

**Sources searched to identify primary studies**
The risk of developing overt diabetes was taken from the placebo arm of the DPS (Tuomilehto et al. 2001). The risk of suffering an MI or stroke, relative risks and risk factors, and their reduction rates were taken from the UK Prospective Diabetes Study (UKPDS), Kothari et al. (2002) and Stevens et al. (2001), (see ‘Other Publications of Related Interest’ below for bibliographic details). Mortality following MI and stroke was estimated on the basis of Swedish statistics and cause of death statistics from the National Board of Health and Welfare.

**Methods used to judge relevance and validity, and for extracting data**
The process used to identify the data was not reported. No inclusion criteria for any of the parameters were specified. The method used to select the estimates was neither reported, nor discussed.

**Measure of benefits used in the economic analysis**
The authors used quality-adjusted life-years (QALYs) as a measure of benefit. The utility weights for diabetics have been estimated from the UKPDS (Clarke et al. 2002, see ‘Other Publications of Related Interest’ below for bibliographic details). No further details were provided. The authors also expressed their results as estimated survival years gained. The benefits were discounted at an annual rate of 3%.

**Direct costs**
Health-related direct costs included:

- intervention costs; costs for the first year after an MI or stroke and for the following years (including yearly visits to the physician, visits to the nutritionists, and group participation in circuit-type resistance training sessions);
- the costs of treatment of diabetes and microvascular complications; and
- a yearly cost based on the duration since the diagnosis of diabetes in patients without a stroke or MI.
The non-health related direct costs included costs for the patients associated with time and travel to physicians. The cost estimates associated with longer life were only included in a sensitivity analysis to facilitate the comparison of the base-case with other studies. The costs were appropriately discounted at an annual rate of 3%. The resource use data and unit costs came from government statistics, published literature, personal communications and authors’ opinions. The price year was 2003.

**Statistical analysis of costs**

The costs were treated deterministically.

**Indirect Costs**

Costs related to work absence in the model included costs for the first year after an MI or stroke and for the following years. Although indirect costs played a relatively small role given that the population was 60 years old and thus close to retirement, they were included because of the societal perspective adopted. The costs were appropriately discounted at an annual rate of 3%. The resource use data and unit costs were taken from published literature and authors’ opinion. The price year was 2003. No further details were provided.

**Currency**

Euro (EUR). The conversion rate from Swedish kroner (SEK) and US dollars ($) was EUR 1 = SEK 9.16 = $0.94 (2003 values).

**Sensitivity analysis**

First-year costs, costs associated with longer life, and the discounting rate were investigated in sensitivity analyses. Several scenarios were also evaluated, such as including costs in added years of life, sustained effect on diabetes prevention, no costs after the second year following events, and excluding a constant part of the predicted cost of microvascular complications. A probabilistic sensitivity analysis was also conducted.

**Estimated benefits used in the economic analysis**

Considering the two strategies for the base-case, the effectiveness results (mean QALYs with standard deviation, SD) for a 60-year old cohort with impaired glucose tolerance were 12.50 (SD=4.91) QALYs for the prevention strategy and 12.30 (SD=5.10) QALYs for the no intervention strategy.

The difference between the strategies was 0.20 QALYs gained for the prevention strategy.

The survival analysis (mean years with SD) results for the base-case were 14.01 (SD=5.39) years for the prevention strategy and 13.84 (SD=5.62) years for the no intervention strategy.

The difference between the strategies was 0.18 years gained for the prevention strategy.

**Cost results**

The mean cost of the intervention was EUR 2,614 (SD=673).

The mean total costs (2003 EUR) for the base-case, including direct, indirect and intervention costs, were EUR 18,212 (SD=18,082) for the prevention strategy and EUR 20,065 (SD=21,202) for the no intervention strategy.

The savings between the strategies was EUR 1,853 for the prevention strategy.

**Synthesis of costs and benefits**

In the comparison of the two strategies (lifestyle intervention versus no intervention), the gain in QALYs and the
associated overall savings showed dominance for the lifestyle intervention.

The only case that led to higher costs, and where an incremental cost-effectiveness ratio (ICER) was positive, was when costs in added years of life were included. In this case, the cost per QALY gained (lifestyle intervention versus no intervention) was EUR 2,363.

The results of the sensitivity analyses were also reported. The authors stated that assumptions had no major impact on the results.

Authors’ conclusions
A lifestyle intervention directed at a population at risk for developing diabetes mellitus was cost-saving for the health care payer and highly cost-effective for society. The results indicated that a lifestyle intervention programme focusing on diet and exercise to prevent Type 2 diabetes in a 60-year-old population at risk was costly, but that the potential health gains were impressive, and the net costs were negative. The results were stable to assumptions about costs and discounting. The intervention has been shown to be effective and also possible to implement in a primary care setting.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparator used, mainly because no intervention programme was in use in the authors’ setting. You should decide if the comparator represents current practice in your own setting.

Validity of estimate of measure of effectiveness
The authors combined data from existing models with data from several published studies of varying designs and a single personal communication reference. No systematic search for data was reported, so it was not clear whether the best available data were used. An important feature of the model was that treatment effects on risk factors and their longer term implications were applied to a locally representative Swedish cohort, making the results more locally valid.

Validity of estimate of measure of benefit
The estimation of health benefits (QALYs) was modelled using a Markov model. The methods used to estimate the utility weights were not described as they were taken from a published paper (Clarke et al. 2002). Survival analysis (years) results were also reported.

Validity of estimate of costs
Given the societal perspective adopted, all the relevant cost categories and their costs appear to have been taken into consideration. The resource use data and their unit costs were not reported separately, which would make it difficult to rework the analysis for other settings. The price year and the sources of resource use and unit costs were adequately reported. The costs were discounted at an annual rate of 3%, which would seem appropriate as the time horizon was greater than one year. Sensitivity analyses were conducted to assess the robustness of the cost estimates used.

Other issues
The authors compared their findings with those from other studies and their results were in agreement. The authors acknowledged the variation in patient population since all individuals were Caucasian and older than 60 years, but they did not evaluate the impact of this. In this regard it was difficult to assess whether the application of the UKPDS risk equations had led to an over- or underestimation of the risk of MI and stroke in Swedish patients. The authors’ conclusions would appear to be an accurate reflection of the scope of their analysis.

The authors acknowledged some limitations to their study, such as the cost data used and the fact that the study included all costs in patients with diabetes regardless of whether or not these costs were actually caused by the diabetes. However, the results from the sensitivity analysis indicated that these limitations were of little consequence. Another limitation was the data on quality of life, as the model incorporated less health states than were being used in the source model. This could mean that the potential quality of life gains were underestimated. In addition, patients with diabetes...
have higher mortality than those in the general population and also higher mortality than individuals with impaired glucose tolerance. Some of this excess mortality in diabetic patients is mediated through the higher risk of MI and stroke, which have high case fatalities. This finding, nevertheless, did not capture the entire increase in mortality and could lead to an underestimation of the benefits of the intervention and, hence, an overestimation of the cost-effectiveness ratios. The effects of the potential sources of bias all worked in the direction of overestimated cost-effectiveness ratios, with the possible exception of the applicability of the UKPDS equations to the Swedish sample. According to the authors, their estimate was thus most likely to be a conservative one.

Implications of the study
The authors state that the implementation of lifestyle intervention programmes for preventing diabetes in high-risk groups should be considered as a means to reduce the future burden of disease and costs to society.

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Bibliographic details

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Other publications of related interest
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