Cost-effectiveness of glycemic control and ophthalmological care in diabetic retinopathy
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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 use of glycaemic control and ophthalmological care in preventing the risk of visual impairment and blindness by diabetic retinopathy (DRP).

Type of intervention
Secondary prevention; screening.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised hypothetical patients with Type I and Type II diabetes mellitus (DM).

Setting
The setting was a medical centre. The economic study was carried out in Amsterdam, The Netherlands.

Dates to which data relate
Surgery recommendations and modelled treatment efficacy were obtained from reports published in 1981 and 1985 (Diabetic Retinopathy Study Research Group and the Early Treatment Diabetic Retinopathy Study Research Group). The dates for the remaining effectiveness data are associated with literature published between 1985 and 1998. The costs of glycaemic control and ophthalmological care were derived from medical charges in The Netherlands in 2003. The date to which the resources data related was not stated (correspondence with the author indicates it was in fact 1998).

Source of effectiveness data
The effectiveness data were derived from a review of published studies.

Modelling
Computer modelling was employed to estimate the costs and benefits of the two alternatives. The model, as described by Crijns et al. (see Other Publications of Related Interest), used continuous analysis to follow the progression of DRP.

Outcomes assessed in the review
The outcomes assessed in the review were the average glycohaemoglobin (HbA1c) value with current standard glycaemic control and the impact of intensive glycaemic control. The prevalence of DRP in Type I and Type II DM patients, the sensitivity of ophthalmological screening, and treatment efficacy were not reported in the study.
Study designs and other criteria for inclusion in the review
Not stated.

Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Not stated.

Number of primary studies included
Seven studies were included to evaluate the average HbA1c value. Two studies were included for the impact of intensive glycaemic control.

Methods of combining primary studies
It was not specified whether the studies were combined.

Investigation of differences between primary studies
Differences between the studies were not investigated.

Results of the review
Current standard glycaemic control in The Netherlands resulted in an average HbA1c value of 8.5% for both Type I and Type II DM patients.

In other countries, the reported values ranged from 7.6 to 9%.

According to published literature, intensive glycaemic control was supposed to reduce the average HbA1c value of 7%.

Measure of benefits used in the economic analysis
The measure of benefits was the number of years of sight gained. Quality of life was not assessed. For patients with Type I DM, the analysis performed 15 runs for one onset age (15 years), three HbA1c values (7, 8.5 and 10%), and five ophthalmological care scenarios depending on the frequency of screening and examinations. For patients with Type II DM, the analysis performed 45 runs for three onset ages (35, 50 and 65 years), three HbA1c values (7, 8.5 and 10%) and five scenarios of ophthalmological care. Each analysis for the onset ages of 15 and 35 years comprised a cohort of 1,000 male and 1,000 female patients who were all followed in time steps of 3 months, until the last patient had died. The cohorts with onset at 50 and 65 years of age included 5,000 male and 5,000 female patients. Age- and gender-specific mortality rates were adjusted to generate the life expectancy for Type I and II DM patients at the time of the study. Years of sight were discounted at 3%. It was not stated which particular method was used to estimate the benefits. The authors reported that the simulation model was not a Markov model, but a continuous simulation model.

Direct costs
The costs were restricted to the direct medical costs. The costs of glycaemic control and ophthalmological care related to the actual medical charges in The Netherlands. The authors reported that intensive glycaemic control required extra general physician and specialists’ visits, supplementary laboratory examinations, insulin treatment, self-control and...
materials. However, relevant details of the cost estimation for standard glycaemic control were not reported. The resource quantities and the costs were not reported separately. The costs were given from the perspective of health providers.

**Statistical analysis of costs**
No statistical analysis of the costs was reported.

**Indirect Costs**
No indirect costs were reported.

**Currency**
Euros.

**Sensitivity analysis**
A one-way sensitivity analysis was conducted on the discount rate (0 and 5%).

**Estimated benefits used in the economic analysis**
Numerous estimated benefits were reported. The authors reported the lifetime sight gained per 1,000 patients (3% annual discount rate) for standard (HbA1c 8.5%) and intensive (HbA1c 7%) glycaemic control, compared with minimal glycaemic control (HbA1c 10%), in each age of onset (15, 35, 50 and 65 years) and in the absence of ophthalmological care (s0). They also reported the lifetime sight gained per 1,000 patients (discount rate 3%) for four scenarios of ophthalmological care, compared with s0, in each age of onset and in combination with only minimal glycaemic control in Type I and II DM.

Standard glycaemic control was about half as effective as intensive control for all ages of onset. The effectiveness of intensive glycaemic control decreased between Type I and Type II DM patients. It also decreased as the age of onset of Type II DM rose. Intensive glycaemic control was more effective than ophthalmological care. For example, the duration of blindness for Type I DM patients was reduced by, on average, 0.76 years with intensive glycaemic control and by 0.53 years with intensive ophthalmological care.

**Cost results**
The cost results were not reported separately, but were included in the cost-effectiveness ratio (see "Synthesis of Costs and Benefits" section).

**Synthesis of costs and benefits**
Intensive glycaemic control was more cost-effective than standard glycaemic control for all ages of onset in comparison with minimal glycaemic control. For Type II DM patients, higher onset ages had higher average costs per year of sight gained. Ophthalmological care was more cost-effective than intensive glycaemic control. For example, in a Type I DM patient, one year of sight gained might cost Euro 1,126 with ophthalmological care versus Euro 50,479 with intensive glycaemic control. Sensitivity analyses on the discount rate led to similar conclusions.

**Authors’ conclusions**
Ophthalmological care appears to be more cost-effective in most analyses. However, it should not receive more emphasis than glycaemic control, as the latter is more effective. Both types of care are complementary and are required in postponing and preventing blindness among diabetes mellitus (DM) patients, apart from (possibly) ophthalmological care for patients developing Type II DM at older ages.
CRD COMMENTARY - Selection of comparators
The reason for the choice of the comparators was clear. Both alternatives were compared because they represented available visual impairment and blindness prevention strategies for patients with DM.

Validity of estimate of measure of effectiveness
The effectiveness data were obtained from what appear to be reliable sources. However, the estimates used in the model were not derived from a systematic review of the literature, at least none was reported, and as such it is not possible to rule out selection bias in the estimates. Sensitivity analyses on parameters used in the model were not undertaken, which weakens the validity of the results. It would have been useful to have reported more details in relation to these issues.

Validity of estimate of measure of benefit
The estimation of benefits (number of years of sight gained) was modelled. The model used to derive a measure of health benefit, a continuous simulation model, was not clearly described (correspondence with the author indicates that full details, however, are available elsewhere - see ‘other publications of related interest’ below). A measure of benefit taking into account the quality of life or the satisfaction of DM patients would possibly have been more informative. However, the authors reported that they deliberately excluded quality-adjusted life-years because of confidence intervals that would be far too large for a conservative simulation, which is a reasonable judgement for the patient/condition domain examined.

Validity of estimate of costs
The resource quantities were not reported. The authors reported only the average cost per year of sight gained. They also estimated the quotient of the total cost of standard glycaemic control and the number of years of sight gained compared with minimal glycaemic control. If minimal glycaemic control induced no cost, the quotient may be relevant, but it is likely that minimal glycaemic control did induce costs. The incremental costs should have been evaluated, and not the average costs. For example, if the total cost of minimal glycaemic control was above Euro 17,822,000, the final results would be altered. The authors pointed out that the costs were restricted to direct medical costs and although non-medical costs, financial benefits and disability savings must be important in any assessment of this disease, their potential impact was not addressed. (Correspondence with the author indicates that the results are based on incremental glycaemic control costs, and this point was not clearly reflected in the paper).

Other issues
The issue of generalisability to other settings was not addressed. The authors compared their findings with their earlier published analyses and with those from one other study. The authors claimed that the analysis underestimated the overall cost-effectiveness of glycaemic control, as glycaemic control is also effective in diminishing other secondary complications of DM, such as nephropathy and neuropathy.

Implications of the study
The authors recommend that their conclusions are incorporated in clinical guidelines and patient information systems, to enhance the compliance of patients and health care providers with ophthalmological care and metabolic interventions.

Source of funding
None stated.

Bibliographic details
Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Adult; Aged; Cohort Studies; Computer Simulation; Cost-Benefit Analysis; Diabetes Mellitus, Type 1 / complications / economics; Diabetes Mellitus, Type 2 / complications / economics; Diabetic Retinopathy / diagnosis / economics / prevention & control; Disease Progression; Hemoglobin A, Glycosylated / analysis; Humans; Hyperglycemia / complications / prevention & control; Markov Chains; Middle Aged; National Health Programs; Netherlands; Ophthalmoscopy / economics / utilization; Patient Compliance; Quality-Adjusted Life Years

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