A comparison of cost per case detected of screening strategies for Type 2 diabetes and impaired glucose regulation: modelling study

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.

CRD summary
This study evaluated multiple screening strategies for type 2 diabetes mellitus and impaired glucose regulation to find low cost-per-case detected screening strategies by probabilistic modelling. The authors concluded that non-invasive risk stratification before blood testing improved the cost-effectiveness with little effect on screening efficacy. The study scope was limited to evaluating the screening yield and cost. The data sources and the authors’ conclusions appear appropriate.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The study evaluated 212 screening strategies for type 2 diabetes mellitus and impaired glucose regulation to find the three or four lowest cost per case detected screening strategies.

Interventions
Multi-stage screening strategies were evaluated. The screening tests used to detect type 2 diabetes mellitus and impaired glucose regulation were fasting plasma glucose and/or glycated haemoglobin blood tests, and two forms of non-invasive risk stratification (participant assessed risk surveys, and practice database generated risk scores). Screening strategies involved one or two screening tests followed by confirmatory oral glucose tolerance tests. Fasting plasma glucose and glycated haemoglobin could be tested in a single stage. Alternative strategies were variations of these screening strategies with different thresholds defined for positive tests for diabetes and impaired glucose regulation.

Location/setting
UK/outpatient

Methods
Analytical approach:
A probabilistic decision tree was created in Win BUGS to model the cost-effectiveness of 212 alternative screening strategies for type 2 diabetes mellitus and impaired glucose regulation using cross-sectional data from a large UK study. The alternative strategies used different thresholds for diabetes and impaired glucose regulation.

Effectiveness data:
The primary efficacy measures were sensitivity and specificity of the screening strategies. The effectiveness data were from the ADDITION-Leicester trial (Webb et al. 2010 see Other Publications of Related Interest), a cross-sectional 5,794 participant study containing a random sample from 20 Leicestershire practices. Oral glucose tolerance testing was the reference standard by which the specificity and sensitivity of the different screening tests were measured.

The model assumed an average two-week interval between fasting plasma glucose test and the confirmatory oral glucose tolerance test. The model also assumed 60% compliance at stage one of screening, 80% at stage two, and where a third stage was incorporated 90% compliance was assumed. Compliance assumptions were based on comparisons with other studies and were tested in sensitivity analyses.

Monetary benefit and utility valuations:
Measure of benefit:
The measure of benefit was the number of cases detected of type 2 diabetes mellitus and impaired glucose regulation.

Cost data:
Costs came from a number of published UK sources including the Department of Health, the National Health Service (NHS) Information Centre, and Personal and Social Service Research Unit (PSSRU) costs. Costs included healthcare assistant labour time, laboratory tests, and administrative costs for performing the screening. The price year was 2009. Costs that were not in 2009 £, were reflated using PSSRU indices.

Analysis of uncertainty:
Uncertainty was incorporated into the model by using probabilistic distributions to generate 95% confidence intervals around the generated point estimates. Subgroup analysis was conducted for south Asian participants, a large ethnic group in Leicester.

Results
Eighteen of the 212 alternative screening strategies had sensitivities for type 2 diabetes mellitus of approximately 80% (range 67% to 91%). Only five of these consisted of a blood test at stage one; the remaining 13 had non-invasive risk stratification at stage one.

The four lowest costing strategies used practice database risk stratification at stage one, followed by a single blood test at stage two. The cost per diabetes case detected of these four strategies ranged from £457 to £523 per case. The four strategies had diabetes detection sensitivities that ranged from 67.1% to 82.4%.

In comparison, the four most expensive strategies had a cost per diabetes case detected between £1,487 and £1,639, with sensitivities that ranged from 68.8% and 83.7%. All these strategies used a combination of two blood tests at the first stage, followed by confirmation using oral glucose tolerance tests.

In all 18 of the screening strategies, the cost per case detected was lower when screening for impaired glucose regulation was included, as this increased the number of detectable cases. For all tests, costs were lower in south Asian participants.

Authors' conclusions
The authors concluded that at a population level, universal screening for type 2 diabetes mellitus using a single blood test as a first line strategy led to higher costs per case detected; offering two blood tests simultaneously had little diagnostic improvement but greatly increased the cost. The authors concluded that screening for diabetes and impaired glucose regulation was more cost-effective than screening for diabetes alone, and that screening should focus on identifying people with any form of abnormal glucose tolerance.

CRD commentary
Interventions:
The interventions were well reported and represented a wide variety of screening approaches. Given that 212 different screening strategies were included, it appeared that there was a good chance that the most relevant strategies were included.

Effectiveness/benefits:
The screening accuracy was evaluated from a large, representative UK study that measured all of the interventions considered as potential elements in screening strategies. Only the sensitivity and specificity of the full strategies were reported for most screening strategies, so it was unclear how the tests performed individually. The accuracy of the reference test was unclear.

The number of cases detected per screening strategy was evaluated, which was useful information, but the health benefits associated with the screening strategies were not evaluated, so the real value was unknown.
Costs:
The model only evaluated the costs involved in screening, so potential cost savings and additional costs that resulted from detecting diabetes or impaired glucose regulation were not included in the model. The authors appropriately acknowledged this as a limitation and referenced other studies that had evaluated future costs. The screening costs were all incurred within a short time span, so no discounting was necessary.

The costs in the model came from UK government and publication sources and appeared valid. The cost data were broken down into specific items which would be useful for a decision-maker when assessing the data for their setting.

Analysis and results:
The choice of a decision tree was an appropriate choice for short term, cross-sectional data. The authors thoroughly discussed strengths and limitations of the model and gave appropriate consideration to how the model applied to other settings.

The cost per case detected was reported. This was interesting information, but the strategy with the lowest cost per case detected may not be chosen to maximise health outcomes. The most likely decision rule would be choosing the most effective strategy that had a cost which the decision-maker would be willing to pay. This was given by the incremental cost-effectiveness ratio (the difference in costs divided by the difference in benefits).

The authors alluded to a sensitivity analysis on compliance levels, but no results were reported for this sensitivity analysis. Using ethnic subgroup analysis would allow the potential application of the results in areas with different demographics, which would increase generalisability of the study.

The distributions used to generate primary effectiveness data were generally not reported, and the number of simulations used to generate confidence intervals around the point estimates was not reported.

The authors' conclusions appear appropriate given the results.

Concluding remarks:
The study scope was limited to evaluating the screening yield and cost. The data sources and the authors' conclusions appear appropriate.

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