Screening for type 2 diabetes mellitus: update of 2003 systematic evidence review for the U.S. Preventive Services Task Force
Norris SL, Kansagara D, Bougatsos C, Nygren P, Fu R

CRD summary
The authors concluded that there was no direct evidence on the effectiveness of screening for type 2 or pre-diabetes, but lifestyle and pharmacotherapy interventions could reduce the progression of type 2 diabetes in patients with pre-diabetes. The authors’ conclusions reflected the limited evidence, but should be interpreted with caution given the poor study quality and potential review bias.

Authors’ objectives
To provide an updated review assessing the effects of screening programmes for type 2 diabetes mellitus and pre-diabetes in adults in primary care settings in the United States.

Searching
MEDLINE and the Cochrane Library were searched from 2001 to July 2007 for English language publications. Search terms were reported. Reference lists of included studies were also searched. Experts in the field were contacted for additional data. Relevant systematic reviews were scanned for relevant studies.

Study selection
Studies that assessed the effects of screening programmes for type 2 diabetes and pre-diabetes (defined as impaired fasting glucose and/or impaired glucose tolerance) on long-term health outcomes in asymptomatic adults aged over 20 years (also stated as 18 years; study selection criteria are inconsistently reported), in primary care settings in the USA, were eligible for inclusion. Randomised controlled trials (RCTs) that assessed the effects of diabetes 2 interventions in individuals with disease duration of one year or less were also eligible for inclusion, as were pre-diabetes intervention studies and RCTs that compared the effects of interventions in individuals with diabetes to the effects in patients with normoglycaemia.

Included studies addressed five key questions and three subsidiary questions. Details on studies for screening of type 2 diabetes were not reported in the review. Studies of interventions for diabetes were conducted in various countries, including the USA, Finland, India, Japan, China, New Zealand and Sweden. The mean length of follow-up ranged from 16 weeks to five years. Where reported, the mean age of included patients ranged from 5.7 years to 55.1 years (5.7 years appeared to be a typing error). Interventions included: intensive lifestyle versus usual care, metformin or placebo; rosiglitazone, ramipril or acarbose versus placebo; orlistat or acarbose plus lifestyle versus placebo plus lifestyle; or reduced fat diet or dietary counselling versus usual care. Other characteristics were reported in the review.

Initial screening of titles and abstracts was undertaken by one reviewer. Two reviewers then assessed a sample of titles and abstracts, and screened full text articles for inclusion. Discrepancies resolved through discussion.

Assessment of study quality
The quality of RCTs was assessed according to the following criteria: randomisation, allocation concealment, baseline comparability of participants, blinding, and loss to follow-up. Cohorts and case control studies were assessed using the United States Preventive Services Task Force (USPSTF) approach. All studies were rated as good, fair, or poor quality.

The authors did not state how many reviewers performed the quality assessment.

Data extraction
One reviewer extracted hazard ratios and standard errors from individual studies. Where this was not reported, relevant data were used to calculate rate ratios or risk ratios and 95% confidence intervals (CIs). Data extraction was checked by a second reviewer.

Methods of synthesis
For one review question, hazard ratios, rate and risk ratios and their 95% confidence intervals were combined using a random-effects model to calculate summary relative risks (RRs) and 95% confidence intervals. Statistical heterogeneity was assessed using the $X^2$ test. Sensitivity analysis was undertaken by removing heterogeneous studies. For other review questions, a narrative synthesis was adopted.

**Results of the review**

For the effects of screening for type 2 diabetes or pre-diabetes on health outcomes in asymptomatic adults with high- or average-risk for diabetes complications, there were two cross-sectional studies and one case-control study (n=15,993 participants). Of the two cross-sectional studies, one was of poor quality; the case-control study was of fair quality. However, there was insufficient direct evidence on the effectiveness of screening for type 2 diabetes. No new studies were identified to answer the question on the effects of beginning treatment of type 2 diabetes early versus after clinical diagnosis on health outcomes.

For the effects of beginning treatment for pre-diabetes early versus after clinical diagnosis of type 2 diabetes on final health outcomes there were 11 RCTs of fair quality. Pooling of five lifestyle RCTs in pre-diabetes patients showed a reduction in the incidence of diabetes 2 over a follow-up of 2.8 to six years (RR 0.48, 95% CI 0.40 to 0.58), with no evidence of statistical heterogeneity. Seven pharmacotherapeutic intervention RCTs also showed a statistically significant reduction in incidence of diabetes 2 over a follow-up of two to four years (RR 0.65, 95% CI 0.51 to 0.83), but with significant statistical heterogeneity ($p=0.001$). Removal of one RCT resulted in homogeneous data, but it was unclear whether the overall findings were significantly affected. One study reported findings on the effects of various antihypertensive therapies in patients with diabetes, pre-diabetes, and normoglycaemia.

Findings from studies modelling screening interventions using various simulation techniques were reported in the review, as were adverse events resulting from screening of patients with pre-diabetes or type 2 diabetes (eight fair to poor quality cohort and cross-sectional studies).

**Cost information**

Some cost-effectiveness data were provided in the review, but were not related to the clinical effectiveness studies.

**Authors' conclusions**

There was no direct evidence for the effectiveness of screening for type 2 diabetes or pre-diabetes. There was evidence that lifestyle and pharmacotherapy interventions could reduce the progression of type 2 diabetes in patients with pre-diabetes, but little direct evidence that identifying individuals with pre-diabetes resulted in long-term health benefits, although longer-term follow-up had not yet been completed.

**CRD commentary**

The review questions were clear and were supported by broad inclusion criteria. The literature search was restricted by language, so language bias could not be ruled out. On-going studies were identified, but it was unclear whether attempts were made to identify unpublished studies. The authors conducted study selection and data extraction in duplicate, but it was unclear whether this was true for quality assessment, so reviewer error and bias could not be ruled out.

Appropriate criteria were used to assess study quality, but the included studies were of limited study design. Given the heterogeneity among studies, and potential problems associated with combining hazard ratios and relative risks, pooling of some of the studies may not have been appropriate. The authors acknowledged some of the limitations of the included studies, such as the majority of evidence being indirect, which had a number of limitations and limited the conclusions that could be drawn. There were also some slight inconsistencies in the age of eligible and included participants.

Although the authors' conclusions seemed to reflect the evidence, given the paucity in and limitations of the evidence and the potential for bias in the review, they should be interpreted with some caution.

**Implications of the review for practice and research**

**Practice:** The authors stated that the potential benefits of screening for diabetes and pre-diabetes must be weighed against the potential harms of screening and diagnosis. The authors also stated that this review assessed individuals at
high risk of developing diabetes and individuals with a mean diabetes duration of one year or less, so the findings may not be applicable to other populations.

**Research** The authors highlighted on-going research that may provide important data on the effectiveness of treatment of screen-detected type 2 diabetes populations on long-term health outcomes. They also recommended that further research is needed to identify individuals with pre-diabetes and identify risk factors for progression to type 2 diabetes and its complications, particularly identifying persons at high risk for cardiovascular events. Further research is also needed on lifestyle interventions and their effects on health outcomes, and cost-effectiveness studies on diabetes screening and interventions.

**Funding**
Agency for Healthcare Research and Quality, contract number 290-02-0024.

**Bibliographic details**

**Original Paper URL**
http://www.uspreventiveservicestaskforce.org/uspstf08/type2/type2es.pdf

**Additional Data URL**
http://www.annals.org/content/138/3/215.abstract

**Other publications of related interest**


**Indexing Status**
Subject indexing assigned by CRD

**MeSH**
Diabetes Mellitus, Type 2; Humans; Mass Screening; United States

**AccessionNumber**
12009104864

**Date bibliographic record published**
17/06/2009

**Date abstract record published**
22/06/2011

**Record Status**
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.