## Methods

**Data sources:** Medline (1966 to July 2006), EMBASE/Excerpta Medica (1980 to July 2006), Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews (Issue 2, 2006), references of relevant articles, and experts.

**Study selection and assessment:** randomised controlled trials (RCTs) in any language that evaluated an intervention to delay or prevent type 2 diabetes in people with impaired glucose tolerance and assessed development of diabetes as an outcome. 21 RCTs met the selection criteria, and 17 RCTs (n = 8084, mean age range 39–57 y, mean body mass index range 24–36 kg/m², average follow up range 0.4–4.6 y) were included in the meta-analysis. Among the 17 RCTs, 8 had quality scores ≥3 out of 5 on the Jadad scale, and 2 had allocation concealment.

**Outcomes:** development of type 2 diabetes and adverse events.

## Main Results

Meta-analysis using a random effects model showed that both lifestyle interventions (diet, exercise, or both) and pharmacological interventions (oral diabetes drugs [acarbose, flumamine, glipizide, metformin, or phenformin] or an anti-obesity drug [orlistat]) reduced the incidence of type 2 diabetes (table). 2 trials assessing troglitazone were excluded from the meta-analysis because the drug had been removed from several markets worldwide because of liver toxicity. In 1 trial, jiangtang bushen (a Chinese herbal) did not reduce diabetes (table). Adverse events related to pharmacological interventions (gastrointestinal and hypoglycaemic symptoms) were more common in the treatment groups (no statistical tests reported).

## Conclusion

In people with impaired glucose tolerance, lifestyle or pharmacological interventions prevent or delay type 2 diabetes.

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**Lifestyle or pharmacological interventions vs placebo to prevent or delay type 2 diabetes in people with impaired glucose tolerance**

<table>
<thead>
<tr>
<th>Outcome at mean 0.4–4.6 y</th>
<th>Comparisons</th>
<th>Number of trials (n)</th>
<th>Hazard ratio (95% CI)</th>
<th>NNT (credible interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lifestyle v placebo†</td>
<td>10 (4452)</td>
<td>0.51 (0.44 to 0.60)</td>
<td>7 (5 to 9)</td>
</tr>
<tr>
<td></td>
<td>Oral diabetes drug v placebo‡</td>
<td>8 (4580)</td>
<td>0.70 (0.62 to 0.79)</td>
<td>11 (9 to 13)</td>
</tr>
<tr>
<td></td>
<td>Orlistat v placebo</td>
<td>2 (814)</td>
<td>0.44 (0.28 to 0.69)</td>
<td>6 (5 to 8)</td>
</tr>
<tr>
<td></td>
<td>Jiangtang bushen v placebo</td>
<td>1 (51)</td>
<td>0.32 (0.03 to 3.07)</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

*Abbreviations defined in glossary.
†Lifestyle interventions included diet, exercise, or both.
‡Oral diabetes drugs were acarbose, flumamine, glipizide, metformin, or phenformin.

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**Commentary**

The natural history of type 2 diabetes includes a period of impaired glucose tolerance before a diagnosis of diabetes is made. The cornerstone for treating type 2 diabetes is lifestyle and/or pharmacological interventions. The meta-analysis by Gillies et al adds good evidence that lifestyle and pharmacological interventions may also prevent or delay the onset of type 2 diabetes. Although some clinicians may prefer reports of other outcomes variables (eg, glucose or glycated haemoglobin concentrations), Gillies et al were limited in their reporting to the data presented in the primary studies.

Strategies for successful lifestyle interventions include individualised, tailored, long term interactions with a facilitator; dietary and physical activity goal setting; and behaviour modification. Strategies for successful medication adherence in pharmacological interventions may include frequent nurse-patient communications and understanding the strengths and weaknesses of the patient’s social context. Cost effectiveness of interventions, from both short term and lifetime perspectives, needs further examination. Of interest, a follow up to the Finnish Diabetes Prevention Study revealed that sustained lifestyle changes and reductions in diabetes incidence continued to occur even after the intervention stopped. Lifestyle changes seem to be at least as effective as drugs for preventing type 2 diabetes. Healthcare workers should support such changes (smoking cessation, healthy eating, increased physical activity, and some weight loss) at every opportunity.

Sandra L Upchurch, RN, PhD
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Review: lifestyle or pharmacological interventions prevent or delay type 2 diabetes in people with impaired glucose tolerance

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