EVIDENCE BRIEF

The Australian Prevention Partnership Centre
Systems and solutions for better health

What large-scale lifestyle interventions work to prevent type 2 diabetes?

Background

- More than a million Australians have diabetes (all types) or are at high risk of diabetes. Type 2 diabetes makes up around 85% of these diabetes cases.
- Progression to diabetes can be prevented or delayed. Modifiable risk/protective factors for diabetes include body mass index, physical activity, smoking status and early life factors such as birthweight.
- Many lifestyle interventions for diabetes prevention help to prevent other chronic diseases such as cardiovascular disease.
- Delaying the onset and severity of diabetes is important because it can prevent diabetes-related complications.
- There have been at least 13 large-scale lifestyle intervention trials, and some additional associated follow-up and outcome studies. These interventions have taken place in Australia[1,2], China[3], Finland[4-7], Germany[8], India[6], Japan[6,9], the United Kingdom[8] and the United States[10].

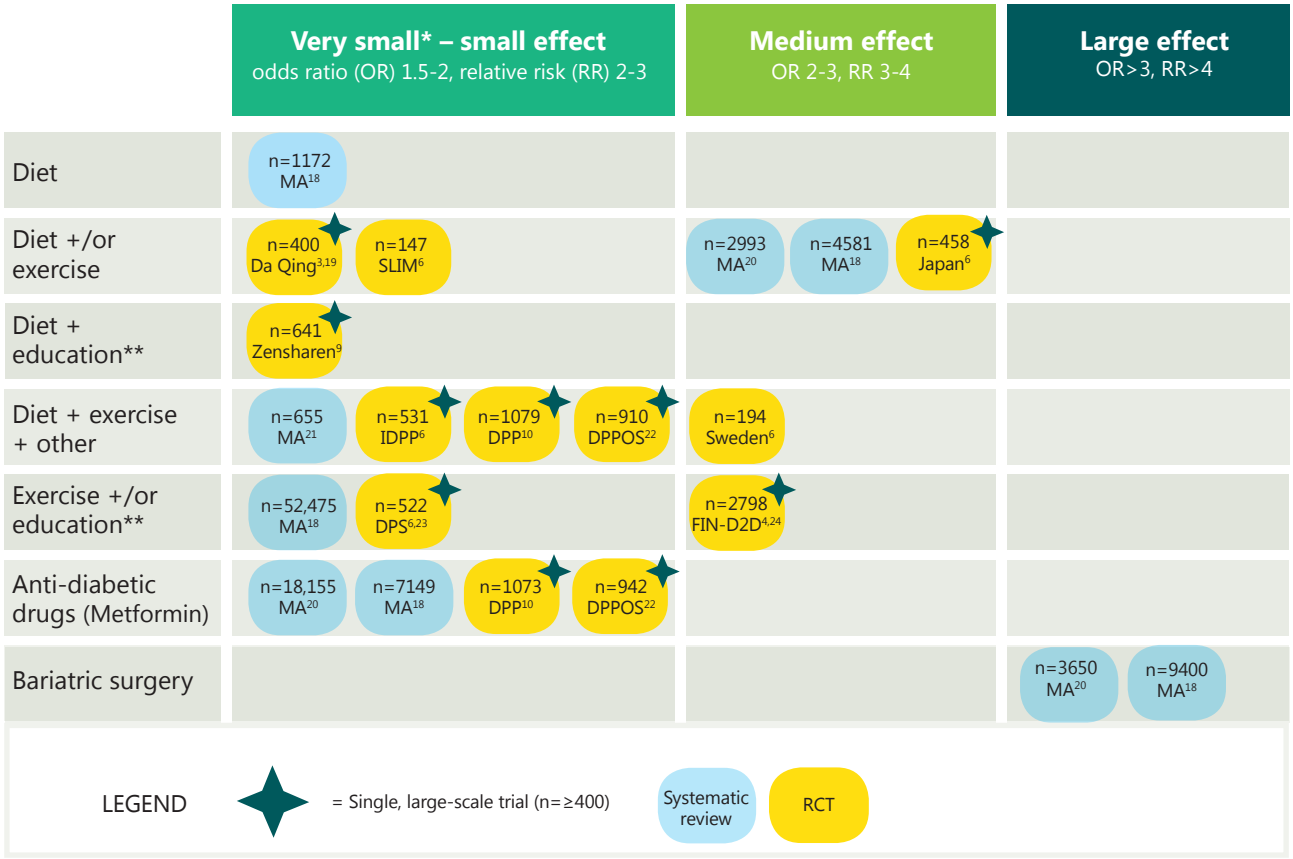
Review purpose

- To summarise existing evidence regarding type 2 diabetes prevention interventions, focusing on lifestyle interventions, and to showcase the extent to which different lifestyle interventions have been effective.
- To assess the effect size of different lifestyle interventions, and to consider the potential for scalability.
- To identify research gaps and areas of most potential to inform future research investment.

Key findings

- Twelve papers met the selection criteria. All the interventions demonstrated an effect on diabetes risk reduction.
- Some seemingly similar interventions had different effect sizes in different studies. Effect size differed according to the length of the intervention (tended to increase with length), length of follow-up (tended to decrease with length) and participation levels (tended to increase with high participation).
- While not lifestyle interventions, bariatric surgery and medications were included as comparators in many studies assessing lifestyle interventions. For this reason, bariatric surgery and medications were also included in this review.
- Bariatric surgery was the only intervention with a large effect size, but the studies only assessed participants who were obese and at high risk. Bariatric surgery is likely to be inapplicable and unfeasible at the general population level.
- Interventions with a medium effect size were: diet and/or exercise; diet and exercise and an additional component such as education; and exercise and/or education.
- Not all existing lifestyle intervention studies were included in this review as they did not meet the inclusion criteria. Many population-level interventions measured weight loss or other clinical indicators as a proxy for impact on diabetes risk[11-17]. Many study participants had successful and sustained weight loss, suggesting reduced diabetes risk. However, this information was inadequate to confidently calculate effect size.

Summary map of evidence



KEY TO SUMMARY MAP

- Da Qing, Da Qing Study, China
- DPP, Diabetes Prevention Program, the United States
- DPPOS, Diabetes Prevention Program Outcomes Study, the United States
- DPS, Diabetes Prevention Study, Finland
- FIN-D2D, National Type 2 Diabetes Prevention Program, Finland
- IDPP, Indian Diabetes Prevention Program, India
- Japan, randomised controlled trial in Japan
- MA, meta-analysis, value from more than one study
- SLIM, Study on Lifestyle intervention and Impaired glucose tolerance Maastricht, Netherlands
- Sweden, randomised controlled trial in Sweden
- Zensharen, Zensharen Study, Japan.

* Very small includes interventions with OR<1.5 and RR<2 if study authors stated that an intervention was significant.

** Education includes lectures, educational material and individual or group counselling.

Research gaps

- More research is needed to determine what 'dose' or intensity of lifestyle intervention is needed, what components of programs are most effective, and how programs should be modified to target specific population groups.
- There is little published evidence about the successful scaling up of interventions. Better research on the mainstreaming of clinical trial size interventions to population intervention programs is needed.
- Some interventions with the same components (e.g. diet and/or exercise) are more effective than others. Determining what characteristics make an intervention effective could lead to greater effect sizes of these interventions, and greater potential for successful scaling up.
- While there is good evidence that type 2 diabetes can be prevented or delayed, further research is needed to assess the effect size of lifestyle interventions at the general population level. Many existing lifestyle intervention studies did not assess diabetes incidence, compare the intervention group against a control group, or have not published results.

Summary of review method

- An electronic search was conducted of relevant articles published to March 2015, identified from the electronic databases including PubMED, Scopus and Google Scholar. Seminal articles were also identified through consultation with experts in the field.
- Studies were included if they measured diabetes incidence as an outcome and had an intervention duration of at least six months. Some large-scale type 2 diabetes interventions measured weight change and other clinical measurements but not diabetes incidence. Even though some of these other outcomes are known to be protective against diabetes, these studies were excluded because their effect size for reducing type 2 diabetes could not be confidently determined with confidence. To capture a breadth of population-wide interventions, all controlled study designs were included. As the scope of the review was primary prevention of type 2 diabetes, study participants were required to not have diabetes at baseline. Where possible, trials were only included once, and studies were excluded if they only offered duplicate data.
- Trials were grouped according to intervention domain (e.g. diet, diet and/or exercise, exercise and/or education), with some trials having multiple domains due to multiple cohorts. Data were extracted on study design, study population, intervention characteristics and primary outcomes (prevention of diabetes).
- A guide[25] was used to aid the classification of an intervention's effect size. If an effect was classified as no effect using the guide, but the authors of the study had reported an effect, a small effect size was given to the intervention. Where multiple effect sizes were measured during a study, the peak effect size was used to demonstrate what effect was possible for that intervention.
- **Limitations:** A rapid review approach was used. Completeness of such reviews are determined by time constraints. Potential bias associated with lack of inclusion of relevant studies was minimised by reliance on recent comprehensive systematic reviews, consultation with experts in the field, and an iterative snowball approach to identify any additional relevant papers from reference lists. In the absence of detailed data from each study, effect sizes were calculated on the basis of what was reported in studies. While every effort was made to ensure consistency when analysing studies' effect sizes, the heterogeneity of studies meant that comparisons between interventions can only be taken as a guide. For example, some of the studies were conducted only in males or in people that already had impaired glucose tolerance at baseline. However, this is not a significant limitation for the purpose of showcasing different types of interventions and their potential to prevent diabetes.

The Australian Prevention Partnership Centre

The Prevention Centre is finding out how we can build an effective, efficient and equitable system for the prevention of lifestyle-related chronic disease.

This report has been prepared by Emily Morrice, Dr Jo-An Atkinson and Professor Andrew Wilson.

The Australian Prevention Partnership Centre

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