



The Australian Prevention
Partnership Centre
Systems and solutions for better health

Preventing diabetes in pregnancy

Diabetes in pregnancy is putting more and more strain on the ACT's health system. We need to do things differently

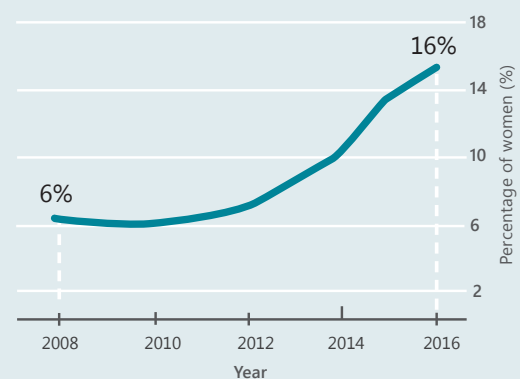
Diabetes in pregnancy, including gestational diabetes, is increasing both in the ACT and Australia. This is due to the rise in risk factors such as overweight and obesity, older mothers and more women from high-risk ethnic groups.

Gestational diabetes occurs when high levels of blood glucose are detected during pregnancy that, if untreated, increase the risk of poor pregnancy outcomes. It also predicts a future higher risk of permanent diabetes in mothers and obesity and diabetes in children.

Pregnancy is a time when public health interventions can have a big impact. Women are more motivated to make changes, and these can also positively affect the health of future generations.

Achieving even small delays in the development of diabetes will have significant implications for the longer-term burden of disease and costs to the health system.

Percentage of women diagnosed with diabetes in pregnancy who gave birth in the ACT,* 2008–2016



*Includes ACT residents only.

Source: ACT Maternal Perinatal Data Collection.

CASE STUDY

Pip is 37, she is about to have her first baby – and has gestational diabetes



Both Pip and her new daughter will be at increased risk of type 2 diabetes in future. Pip is one of about 800 women diagnosed every year in the ACT with gestational diabetes. She joins an ever increasing number of women whose future health and that of her children is at risk.

“Before I conceived, no-one ever suggested to me my history of polycystic ovary syndrome, diet, weight or age put me at risk of gestational diabetes. If I had known, I could have made changes before I became pregnant to try and reduce my risk.

Sometimes I feel like I'm doing this alone. Better support before and during my pregnancy would make a big difference, and would mean a better outlook for both me and the baby.”

What did we do?

We brought together diabetes in pregnancy experts including leading academics, policy makers and clinicians from across Australia. Their insights were combined with research and data to develop a dynamic simulation model of diabetes in pregnancy in the ACT.

“With the collaborative modelling approach, the people in the room have accumulated knowledge and expertise in the area over many years. To have that wealth and depth of knowledge involved is incredibly valuable.”

Professor Christopher Nolan, Director of Endocrinology and Diabetes, ACT Health

A dynamic simulation model is a sophisticated computer ‘what if’ tool that can test the likely impact of a range of possible solutions over time. It considers the short, intermediate, and long-term implications of the increasing prevalence of risk factors for diabetes in pregnancy and looks at alternative models of care.

Based on real data, the model can be used to test out different solutions to see which will be most effective and cost effective. The expert group identified, clarified and prioritised gaps in current knowledge and evidence which can be used to guide future research and, in turn, further improve the model.

BUILDING AND USING A DYNAMIC SIMULATION MODEL WITH STAKEHOLDERS

1 EVIDENCE SOURCE

Research evidence

Health service and survey data

Expert knowledge

Local practice experience

2 BUILD

- Build a conceptual map of the problem collaboratively



- Convert to a computer model

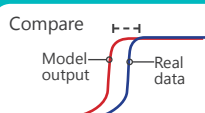


3 VALIDATE

- Does the model reproduce historic data trends?



- Refine the model



4 APPLY

- Switch on different intervention combinations. For example:



A. Pre-pregnancy intervention to lose weight

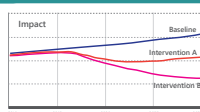


B. Family-centred programs to reduce weight

- Run ‘what if’ scenarios through the model



- Compare predicted impact over time



- Facilitate discussion to help drive policy action



x10

Gestational diabetes, increases the subsequent risk of type 2 diabetes in mothers almost ten fold.



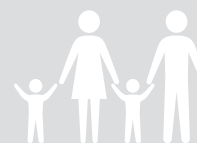
Babies of mothers who have gestational diabetes are at short-term risk of high birthweight, birth complications and hypoglycaemia.



Children of mothers who had gestational diabetes have a 2–4 fold increased risk of being overweight/obese and having long-term impaired glucose tolerance.



Both gestational diabetes and type 2 diabetes are associated with modifiable lifestyle risk factors such as diet and physical activity.



There are also strong genetic and family related risk factors which are not modifiable.

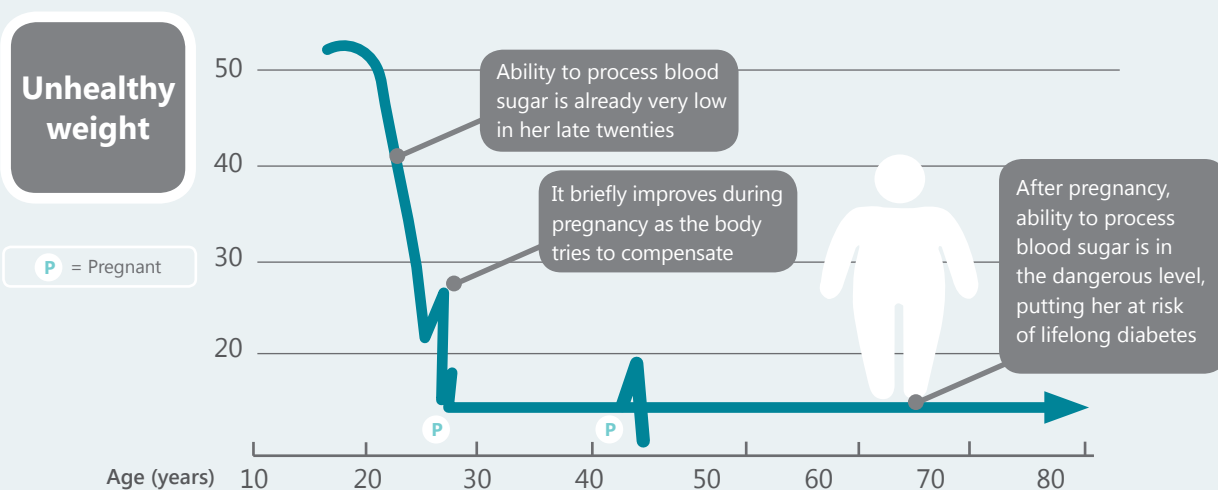
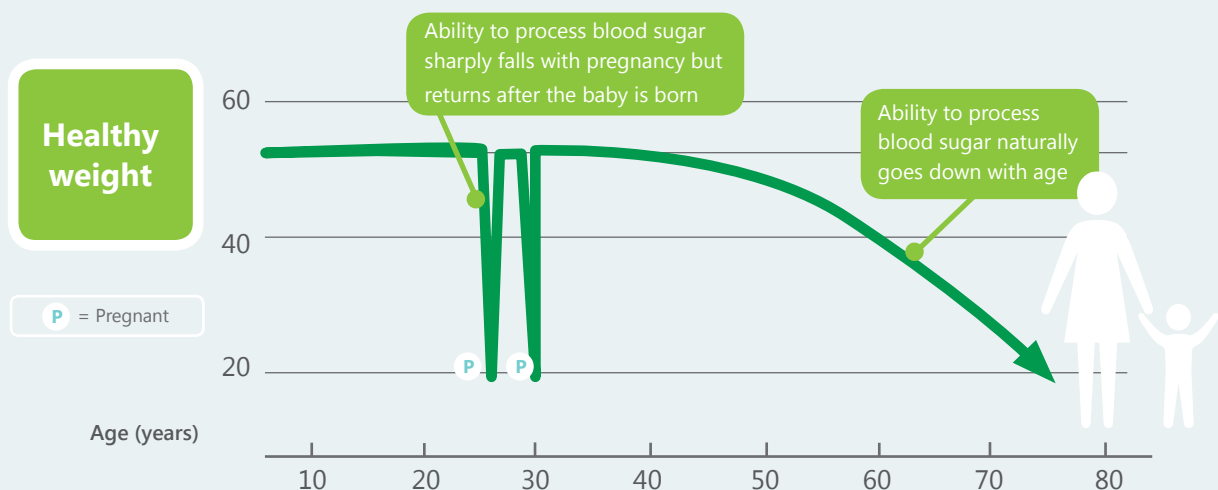
What did we find?

Early findings from the model reinforce the long-term benefits for women and their children of preventing diabetes in pregnancy:

- Women with obesity experience a sharper decline in insulin sensitivity compared with normal weight women (see image below)
- Interventions delivered between pregnancies or after pregnancy for women who have experienced diabetes in pregnancy could reduce their risk of progressing to Type 2 diabetes
- Pregnancy and pre-conception is a time when interventions can improve health outcomes for whole families
- It is possible to significantly reduce the number of women with diabetes in pregnancy by focusing on risk factors like diet, physical activity and weight
- These lifestyle interventions should target women in early adulthood, before pregnancy, to reduce the incidence of diabetes in pregnancy.

What happens to insulin sensitivity during pregnancy?

- High insulin-sensitivity helps keep blood glucose levels in the **normal range**
- Low insulin-sensitivity, or insulin resistance, is associated with **type 2 diabetes**.



Source: Early results from the diabetes in pregnancy dynamic simulation model.

Next steps

This project has demonstrated that participatory dynamic simulation modelling is an effective way of informing program and policy decision-making for diabetes in pregnancy in the ACT. Dynamic simulation models mature over time and can be continuously refined as new knowledge and evidence becomes available.

One of the main benefits of the modelling process was that it brought together a large group of stakeholders, including key decision makers, to discuss the causes of diabetes in pregnancy and impacts of interventions. Building these networks is a crucial step in driving a multi-sector approach that can lead to practical changes on the ground.

What interventions could be modelled in the future?

- Pre-pregnancy population level interventions, for example app-based support for women and couples to make lifestyle changes
- Targeted pre-pregnancy interventions for women with multiple risk factors
- Post-pregnancy interventions to support families to maintain a healthy lifestyle
- Different models of care for women with diabetes in pregnancy.

About this project

This project was implemented as a collaboration between the Prevention Centre and Australian Capital Territory Government Health Directorate (ACT Health).

The model harnesses advances in technology incorporating multiple methods including agent-based modelling, system dynamics and discrete event simulation into a logically consistent decision support tool for health policy and program decision making.

The model incorporates best available evidence, data and expert opinion. We collaboratively developed the model structure with recognised experts in providing care, planning services, undertaking research and developing policy for the diagnosis and management of diabetes. We used an iterative process of model development where we presented the model back to participants at meetings and workshops to continually incorporate their feedback and refine the structure. The model was built by systems modelling experts based in Canada.

Papers published

Atkinson J, O'Donnell E, Wiggers J, McDonnell G, Mitchell J, Freebairn L et al. Dynamic simulation modelling of policy responses to reduce alcohol-related harms: rationale and procedure for a participatory approach. *Public Health Res Pract.* 2017;27(1):e2711707.

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This factsheet was prepared by The Australian Prevention Partnership Centre

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