

Diabetes during pregnancy and  
method of birth: a population study  
of women giving birth in New South  
Wales, Australia

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# **Certificate of original authorship**

I, Reem Samir Zeki declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy in the Faculty of Health at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

This research is supported by an Australian Government Research Training Program.

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Reem Samir Zeki

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## **Format of the thesis**

This PhD thesis is in a compilation format. Each of four studies is reported in a thesis chapter. Chapters 4 and 5 have been published, and Chapter 6 has been resubmitted with revision and I am awaiting the decision. The fourth manuscript, Chapter 7, is currently being prepared for publication. The next section provides the publication details of Chapters 4, 5 and 6.

## **Published works by the author incorporated into the thesis**

**Study one** (Chapter 4): Zeki, R., Oats, J.J.N., Wang, A.Y., Li, Z., Homer, C.S.E. & Sullivan, E.A. 2018, 'Cesarean section and diabetes during pregnancy: An NSW population study using the Robson classification', *Journal of Obstetrics and Gynaecology Research*, vol. 44, no. 5, pp. 890-8.

**Study two** (Chapter 5): Zeki, R., Wang, A.Y., Lui, K., Li, Z., Oats, J.J.N., Homer, C.S.E. & Sullivan, E.A. 2018, 'Neonatal outcomes of live-born term singletons in vertex presentation born to mothers with diabetes during pregnancy by mode of birth: a New South Wales population-based retrospective cohort study', *BMJ Paediatrics Open*, vol. 2, no. 1.p. e000224.

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## **Statement of contributions to jointly authored works contained in the thesis**

Chapters 4, 5 and 6 have been submitted for publication in peer-reviewed journals. For each of these manuscripts, I have been responsible for deciding the research question, conducting the statistical analysis and drafting the manuscript.

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For Chapter 5, Professor Kei Lui provided his clinical opinion in the interpretation of the data. For Chapter 6, Dr Drew Marshall provide his clinical opinion in the interpretation of the data.

I take responsibility for the accuracy of the results presented in these manuscripts.

## Abbreviations

ACOG	American College of Obstetricians and Gynecologists
ADA	American Diabetes Association
ADIPS	Australasian Diabetes in Pregnancy Society
AIHW	Australian Institute of Health and Welfare
AOR	adjusted odds ratio
APDC	Admitted Patient Data Collection
BMI	body mass index
CEMACH	Confidential Enquiry into Maternal and Child Health
CHeReL	Centre for Health Record Linkage
CI	confidence interval
CS	caesarean section
EPDS	Edinburgh Postnatal Depression Scale
GCT	glucose challenge test
GDM	gestational diabetes mellitus
HAPO	Hyperglycemia and Adverse Pregnancy Outcome
IADPSG	International Association of Diabetes in Pregnancy Study Group
ICU	intensive care unit
LGA	large for gestational age
NICE	National Institute for Health and Care Excellence
NICU	neonatal intensive care unit
NSW	New South Wales
OASI	obstetric anal sphincter injury
OGTT	oral glucose tolerance test

PDC	Perinatal Data Collection
PPH	post-partum haemorrhage
RR	relative risk
SCN	special care nursery
SGA	small for gestational age
TSV	term singleton in vertex presentation
UK	United Kingdom
USA	United States of America
WA	Western Australia
WHO	World Health Organisation

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# **Abstract**

## **Background and aims**

Diabetes during pregnancy – including pre-existing diabetes and gestational diabetes mellitus (GDM) – is an increasing public health problem worldwide. The objective of this thesis is to investigate the association between method of birth and the perinatal outcomes of women with diabetes during pregnancy. It aims to:

- identify the main contributors to caesarean section amongst women with diabetes using the Robson classification for caesarean section
- determine neonatal outcomes for babies born to women with diabetes by method of birth
- compare the rate of obstetric anal sphincter injuries (OASIs) for women with and without GDM and investigate the association between combining episiotomy with method of birth and the risk of OASIs
- compare the perinatal outcomes for women giving birth with diabetes by public and private hospital sector.

## **Materials and method**

Four population-based studies were conducted using the New South Wales (NSW) Perinatal Data Collection. The study population comprised 1,103,380 women who gave birth in NSW between 2002 and 2013 and their babies. Of these women 7,200 (0.7%) had pre-existing diabetes, 57,822 (5.2%) had GDM and 1,038,358 (94.1%) had no diabetes. Women were stratified by onset of labour, method of birth, and birthweight. Neonatal outcomes included perinatal death, five minutes Apgar score, admission to

neonatal intensive care and/or special care nursery and neonatal resuscitation. The primary maternal outcome was OASI.

## **Results**

The total caesarean section rate was higher among women with pre-existing diabetes (53.6%) and women with GDM (36.8%) compared to women without diabetes (28.5%). Robson group five (multiparity with a history of caesarean section) was the main predictor of the total caesarean section rates in all women. Of the 39,625 women with diabetes who laboured, 32.1% had instrumental or caesarean births that were associated with poorer outcomes. Women with GDM who had an instrumental vaginal birth and gave birth to babies with birthweights  $\geq 4000\text{g}$  had a significant increase in the odds of OASIs compared to women without diabetes. Combining episiotomy and forceps was a protective factor on OASIs. Similar proportions of no labour caesarean section were observed among women with pre-existing diabetes in private and public hospitals. Proportions of induction of labour were similar among women with GDM in private and public hospitals.

## **Conclusion**

The Robson classification can be used to benchmark and monitor method of birth for women with diabetes. Information, education and counselling on the risks and complications associated with different methods of birth, should routinely be provided for women with diabetes antenatally.