

# Parity, Breastfeeding, and the Subsequent Risk of Maternal Type 2 Diabetes

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**OBJECTIVE** — To examine the effect of childbearing and maternal breastfeeding on a woman's subsequent risk of developing type 2 diabetes.

**RESEARCH DESIGN AND METHODS** — Using information on parity, breastfeeding, and diabetes collected from 52,731 women recruited into a cohort study, we estimated the risk of type 2 diabetes using multivariate logistic regression.

**RESULTS** — A total of 3,160 (6.0%) women were classified as having type 2 diabetes. Overall, nulliparous and parous women had a similar risk of diabetes. Among parous women, there was a 14% (95% CI 10–18%,  $P < 0.001$ ) reduced likelihood of diabetes per year of breastfeeding. Compared to nulliparous women, parous women who did not breastfeed had a greater risk of diabetes (odds ratio 1.48, 95% CI 1.26–1.73,  $P < 0.001$ ), whereas for women breastfeeding, the risk was not significantly increased.

**CONCLUSIONS** — Compared with nulliparous women, childbearing women who do not breastfeed have about a 50% increased risk of type 2 diabetes in later life. Breastfeeding substantially reduces this excess risk.

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Studies suggest that breastfeeding may reduce the risk of developing type 2 diabetes (1) or the metabolic syndrome (2,3) in later life. Rates of type 2 diabetes will increase substantially throughout the developed and developing world (4). Hence, it is important to identify whether simple and accessible interventions, such as promoting breastfeeding, may reduce the incidence of diabetes, and to provide reliable estimates of the size of any benefit.

## RESEARCH DESIGN AND METHODS

This study involved 53,726 women recruited into the Australian 45 and Up cohort study. The study methods have been described elsewhere (5). Briefly, participants were randomly selected from the Australian national universal health insurance database, which provides virtually complete cov-

erage of the population. Female participants answered a questionnaire (see [www.45andup.org.au](http://www.45andup.org.au)) on sociodemographic, lifestyle, medical, and reproductive factors, including information on the number of births, their age at first and last birth, the number of months that they breastfed, whether they had been diagnosed with diabetes, and their age at first diagnosis. Women were classified with type 2 diabetes if they reported being diagnosed with diabetes either at an age greater than that at which they last gave birth or, consistent with other epidemiological studies of type 2 diabetes, being first diagnosed with diabetes after age 30 years (6,7).

Analyses excluded women with diabetes diagnosed before age 31 years, or before the age when they last gave birth, or with unknown age at diagnosis. Also excluded were women with unknown

parity and, from analyses examining breastfeeding, unknown breastfeeding status. Odds ratios for the associations between parity and diabetes, and breastfeeding and diabetes, were estimated using logistic regression. Analyses adjusted for age, BMI, smoking, alcohol consumption, physical activity, family history of diabetes, household income, education level, country of birth, and number of births. Because BMI may be on the causal pathway through which breastfeeding could confer a reduced risk of diabetes (2), the effect of breastfeeding was also examined in subgroups of BMI. Sensitivity analyses were conducted by including all women who indicated they had been diagnosed with diabetes on their questionnaire, regardless of the age of diagnosis, and including or excluding them in the case definition.

The study was approved by the University of New South Wales Human Research Ethics Committee (approval number 05035), and written consent was obtained from participants.

**RESULTS** — After exclusions, 52,731 women remained in the analyses, 6.0% ( $n = 3,160$ ) of whom were classified as having type 2 diabetes. Most women (89.1%,  $n = 47,025$ ) had at least one birth, and among these women, the median parity was 3 (mean 2.8), and 86.7% ( $n = 40,202$ ) had breastfed for at least 1 month. Among women who breastfed, the median total duration of breastfeeding was 12 months (mean 15.9) or a median of 4.5 months (mean 5.8) per child.

Compared to nulliparous women, parous women had a similar risk of diabetes (adjusted odds ratio [OR] 1.09 [95% CI 0.96–1.25],  $P = 0.2$ ). There was no evidence of increased risk with increasing number of children either overall ( $P = 0.1$ ) or among parous women who had never breastfed ( $P = 0.4$ ). Among parous women, the total duration of breastfeeding and duration of breastfeeding per child was associated with a reduced likelihood of diabetes; the reduction in risk per year of breastfeeding was 14% (adjusted OR 0.86 [0.82–0.90],  $P < 0.001$ ) (available in an online appendix at <http://care.diabetesjournals.org/cgi/content/full/dc10-0347/DC1>).

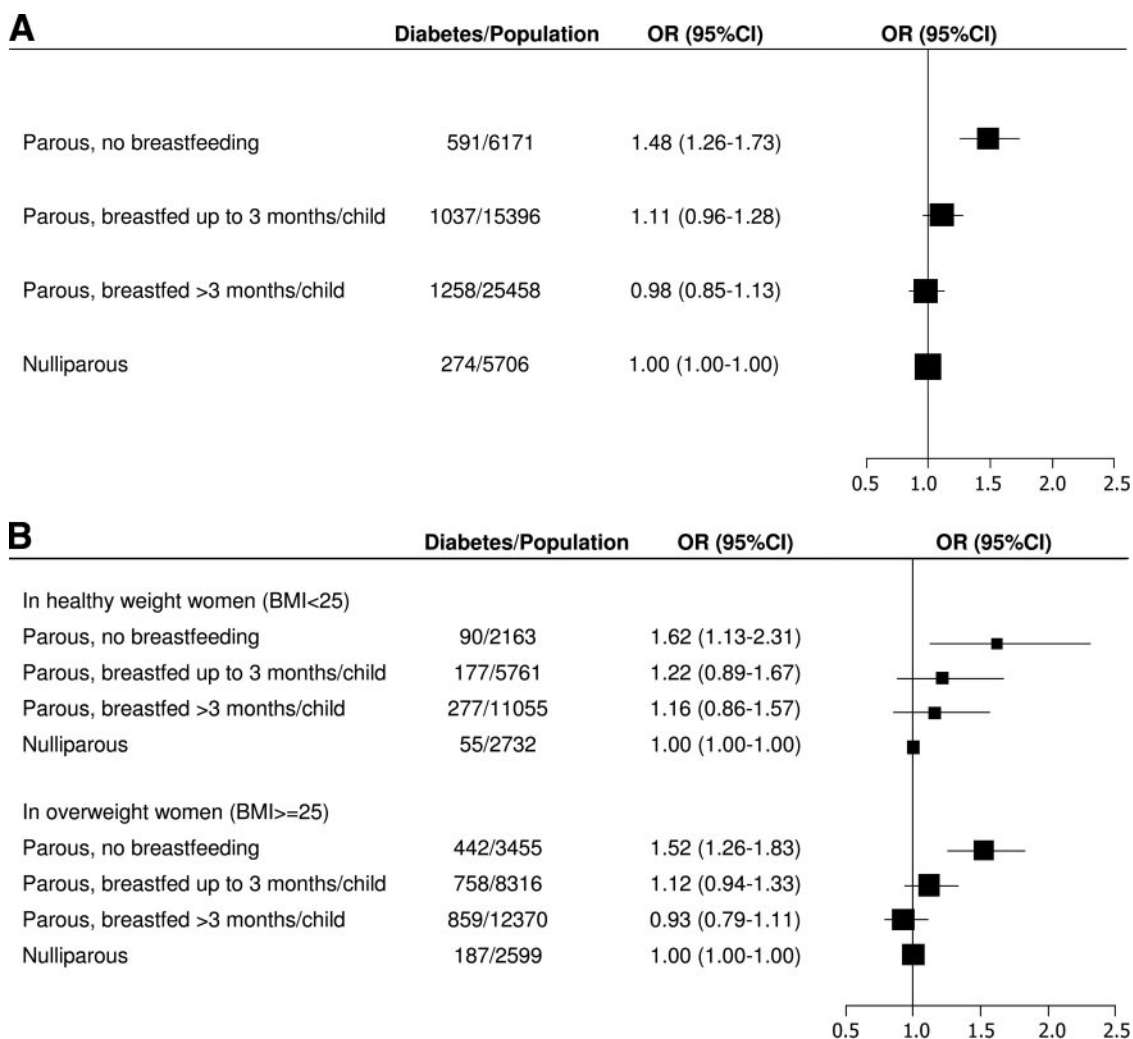
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**Figure 1**—ORs for type 2 diabetes comparing parous women and their duration of breastfeeding to nulliparous women in all women (A) and according to BMI (B). ORs were adjusted for age, BMI, smoking, alcohol consumption, family history of diabetes, household income, education, country of birth, and frequency of vigorous physical activity.

Compared to nulliparous women, the risk of diabetes was not significantly different for parous women who breastfed; however, for parous women who did not breastfeed, the risk of diabetes was significantly greater (OR 1.48, [1.26–1.73]) (Fig. 1A). This pattern of association was consistent, regardless of the number of children a woman had given birth to (results not shown) and regardless of BMI (Fig. 1B). This association, between breastfeeding and diabetes, was also found to be consistent in the sensitivity analyses (online appendix).

**CONCLUSIONS**— This study shows how the association between childbearing and type 2 diabetes is affected by breastfeeding. Our results confirm previous work suggesting that parous women who breastfeed can reduce their risk of devel-

oping type 2 diabetes in later life and that the benefit increases the longer the duration of breastfeeding (1–3). What is novel is, compared with nulliparous women, women who have children but do not breastfeed have an increased risk of diabetes in later life; however, this excess risk may be avoided in women who breastfeed.

Other large prospective studies suggest risk reductions in diabetes of ~15–20% per year of lactation (1–3); our findings concur with this estimate. There is less consistency among studies examining the association between parity and diabetes, with some suggesting either no effect (8) or a small (9) to moderate (10,11) increase in risk. This inconsistency may have arisen because none of these studies accounted for breastfeeding practices among parous women. We

found that when we compared all parous women to nulliparous women, there was no significant increase in the risk of diabetes but that among parous women, the risks differed according to who did and did not breastfeed (Fig. 1A).

The mechanism underlying a preventative role of breastfeeding for diabetes is unclear. It has been suggested that breastfeeding women have improved insulin sensitivity that persists after childbirth (12,13), but further research is needed to better understand the associations observed here.

We used self-reported information on breastfeeding, childbirth, and diabetes, and this must be taken into account when interpreting the results. We cannot exclude residual confounding, since we could not adjust for all potential confounders that may have affected our esti-

mates, such as BMI in earlier life or changes in BMI over time. We are also unable to comment on the effects of breastfeeding on women with gestational diabetes.

Our results suggest that for women who have children, breastfeeding may be an important strategy by which they can reduce their risk of developing type 2 diabetes in later life; the longer a woman is able to breastfeed, the more she reduces her risk, but even an average of 3 months of breastfeeding per child is beneficial. Inclusion of this message will potentially strengthen health promotion campaigns to increase breastfeeding.

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