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ORIGINAL ARTICLE

Gestational diabetes mellitus screening, management and outcomes in the Cook Islands

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Abstract

Aim To describe current practices for screening for gestational diabetes mellitus in the Cook Islands and consider the implications of alternative screening strategies.

Methods Eligible women had antenatal care from January 2009 to December 2012. A non-fasting 50 g glucose challenge between 24 and 28 weeks gestation (positive if 1-hour glucose ≥7.8 mmol/L) was followed by a 75 g oral glucose tolerance test (gestational diabetes mellitus diagnosed if fasting glucose ≥5.2 mmol/L or 2-hour glucose ≥8.0 mmol/L; pregnancy impaired glucose tolerance if positive screen and negative diagnostic test).

Results Uptake of the screening programme rose from 49.0% to 99.6% by the end of the study period. 646 women had a glucose challenge; for 186/646 (28.8%) the challenge was positive; 183 had an oral glucose tolerance test; 89/646 (13.8%) had pregnancy impaired glucose tolerance; 94/646 (13.9%) had gestational diabetes mellitus.

Median maternal weight gain was 6 kg (gestational diabetes mellitus) and 10 kg (normal glucose tolerance); caesarean section rates were 25% and 11% respectively; baby birthweights were not significantly different. 59 women with gestational diabetes mellitus had a post-natal glucose tolerance test at their 6-week check and 21 (35.6%) had diabetes confirmed.

Conclusion The gestational diabetes mellitus screening programme has a high uptake and current management appears effective in reducing maternal and fetal weight gain. A proposed new screening programme is outlined.

The Cook Islands consists of 15 islands and atolls with a resident population of about 15,000 at the 2011 Census, of whom 88% were Cook Island Māori and the remainder mostly New Zealand European.[1] There are 3655 female residents in the reproductive age group (15 to 49 years).[1] Obesity and diabetes represent a significant health challenge: 66% of adult women are obese and 21% have diabetes.[2] These rates are similar to other Pacific countries.[3,4]

There is no universally agreed approach to screening for gestational diabetes (GDM) or even agreement on appropriate glucose thresholds at which gestational diabetes is diagnosed.[5–7] Screening programmes inevitably need to balance the performance of different approaches to screening with the resources available.[7–9] Universal screening for gestational diabetes has been offered to all eligible women in Rarotonga, the Southern Group Islands and some of the Northern Group Islands since January 2009.

The diagnosis of GDM in the Cook Islands has been made using a two-step approach late in the second trimester. An initial screening test involves a non-fasting 50 gram (g) glucose challenge test (GCT) at 24–28 weeks gestation. Women are subsequently offered a diagnostic 75 g oral glucose tolerance test (OGTT) if their 1-hour glucose concentration is ≥7.8 mmol/L.[10,11]

GDM is diagnosed if the fasting sugar glucose (FBG) is ≥5.2 mmol/L and/ or the 2-hour glucose concentration is ≥8.0 mmol/L,[7,11] (compared to the New Zealand criteria of FBG ≥5.5, 2H ≥9.0 mmol/L). Pregnancy impaired glucose tolerance (pIGT) is diagnosed if the GCT is positive but the GDM test is negative.

Alternative screening strategies could include universal first trimester testing or enhanced first and second trimester screening for women at increased risk of gestational diabetes. Such approaches have been suggested by the International Association of Diabetes in Pregnancy Study Groups (IADPSG),[7,11] the American Diabetes Association (ADA)[12] and the National Institute for Clinical Excellence (NICE) in the UK.[13]

The New Zealand Ministry of Health is also developing plans for a new screening programme for gestational diabetes. The aim of this study is to determine how many women are being diagnosed with GDM using the current screening criteria and to compare pregnancy outcomes in women with and without GDM using the current criteria.

Methods

The study population included all known deliveries in the Cook Islands, for the period January 2009 to December 2012 inclusive. Women who delivered but were not of Cook Islands descent were excluded from all analyses, and women delivered overseas were excluded from outcomes analysis as these data were not known. Women with twin pregnancies were included. For women who had more than one delivery during the study period, only the most recent delivery was included.

Ethics approval was granted by the Ministry of Health. Data on demographic, antenatal, delivery and perinatal outcome characteristics were collected retrospectively from the Rarotonga Hospital obstetric patient register, and patient records held in the electronic patient management system (Medtech32; www.medtech.co.nz). Data were extracted by clinical staff.

Outcomes—Antenatal outcomes included the proportion of women who were screened for GDM, and results of screening. Intra-partum and neonatal outcomes were reported for the proportion (by glucose tolerance category) who had caesarean sections; who had shoulder dystocia; birth weight ≥4.0 kg or were admitted to neonatal intensive care (NICU). Postnatal outcomes included the proportion of women with GDM who had an OGTT postnatally, and were diagnosed with diabetes.

Statistical analysis—The extracted data was exported for analysis to Microsoft® Excel (version 2010), and Stata (version 12.1) software. Statistical tests were ANOVA for continuous variables across categories, Chi-squared for proportions; statistical significance is cited at $p \leq 0.05$.

Results

Of the 1020 women who attended antenatal clinics between January 2009 and December 2012, 724 (71%) were offered screening for GDM and all accepted. After 78 women were excluded (13 were not Cook Islanders and 65 were having a second or third pregnancy in the study period), 646 (90%) were included in the analyses. Of these, 186 (29%) had a positive screening test, 89 (14%) had pIGT and 94 (15%) had GDM. Three women with a positive screening test declined an OGTT. Characteristics of the women and their screening test results are shown in Table 1.

The proportion of women offered GDM screening rose through the four years of the study period: 123 of 251 women (49%) in 2009, 145 of 257 women (56% in 2010), 199 of 254 (78%) women in 2011, and 257 of 258 women (100%) in 2012.

Table 1. Characteristics of women included in study and results of screening test. Results are n, n (%) or median (25th centile, 75th centile)

Characteristics	N=646
Age youngest, oldest	29 (24–36) 15–48
Gravida highest Parity highest	3 (1–4) 13 1 (0–3) 12
Booking gestation number booked after 28 weeks	15.6 (10.4–21.5) 53 (8%)
Booking BMI	31.2 (26.2–36.1)
Smoking current never past	192 (30%) 436 (67%) 18 (3%)
Past GDM*	19 (3%)
Past birth weight ≥4000g*	70 (11%)
Family history of diabetes (1st degree relative)	237 (37%)
Polycose screening test gestation at polycose testing 1 hour glucose ≥7.8 mmol/L 1 hour glucose ≥11.0 mmol/L (GDM confirmed)	646 (100%) 27.1 (25.1–29) 186 (29%) 1
Oral Glucose Tolerance Test women tested fasting glucose ≥ 5.4 mmol/L (GDM confirmed) 2-hour glucose ≥8 mmol/L (GDM confirmed) both fasting and two hour test positive	 183 64 59 30
Total number of women with confirmed GDM	94 (15%)

*If not first baby/

Table 2 compares the characteristics of women with normal glucose tolerance, pIGT and GDM. There were statistically significant differences across the classifications for increasing age, gravida, parity, booking BMI, systolic and diastolic blood pressure and proportion with a family history of diabetes; and for proportions with previous GDM and a previous baby with a birth weight of 4 kg or more among women having second or subsequent babies.

Table 2. Characteristics of women at booking, by normal glucose tolerance, pIGT and GDM. Results are n, n (%) or median (25th centile, 75th centile)

Variables	Normal n=463 (71%)	pIGT n=89 (14%)	GDM n=94 (15%)	P value
Age	28 (23–34)	30 (24–37)	36 (28–40)	<0.001
Gravida	2 (1–4)	3 (2–4)	3 (2–5)	0.001
Parity	1 (0–2)	2 (0–3)	2 (1–4)	<0.001
Gestation	15 (10–21)	14 (11–21)	17 (12–24)	0.02
BMI	31 (26–36)	32 (27–37)	34 (30–39)	<0.001
Family history of diabetes	153/463 (33%)	37/89 (42%)	47/94 (50%)	0.007
Past GDM*	2/338 (1%)	1/67 (2%)	16/71 (23%)	<0.001
Past birth weight ≥ 4000g*	45/338 (13%)	7/67 (10%)	18/71 (25%)	0.02

*If not first baby.

All women with GDM were offered lifestyle and weight management advice. In addition 11 were given metformin, 2 were given insulin and 5 were given both. Table 3 shows the pregnancy outcomes for women who delivered in the Cook Islands.

By increasing glucose category, there was a lower maternal weight gain (6 kg in GDM compared with 10 kg in normal glucose tolerance) and a small but non-significant gain in baby birthweight (90 g higher in GDM than normal glucose tolerance). There were no instances of shoulder dystocia. There was one intra-uterine death (no post-mortem) and one neonatal death (respiratory distress) in the GDM group.

Table 3. Outcomes for women delivered in the Cook Islands, by normal glucose tolerance, pIGT and GDM. Results are n, n (%) or median (25th centile, 75th centile)

Variables	Normal N=428	pIGT n=84	GDM n=92	P value
Pregnancy weight gain (kg)	10 (6–14)	9 (5–12)	6 (3–11)	<0.001
Mode of delivery Normal vaginal Caesarean section Ventouse	 376 51 (11%) 1	 75 8 (9%) 1	 67 24 (25%) 1	 0.002 across modes
Pre-term	6	2	2	0.74
Admitted NICU	22	6	8	0.38
Birth weight (g)	3430 (3120–3750)	3445 (3035–3765)	3520 (3220–3920)	0.14
Birth weight ≥4000g	58 (14%)	16 (19%)	19 (21%)	0.14

Postnatal OGTT testing at 6-12 weeks post-partum was offered to the 59 women with GDM according to the 2 hour criteria. Ten women (17%) had impaired glucose tolerance and 21 (36%) had diabetes confirmed, one of whom was later confirmed to have type 1 diabetes.

In Figure 1 the age distribution of women with GDM and the normal group are shown. This shows an increasing proportion of GDM in older women.

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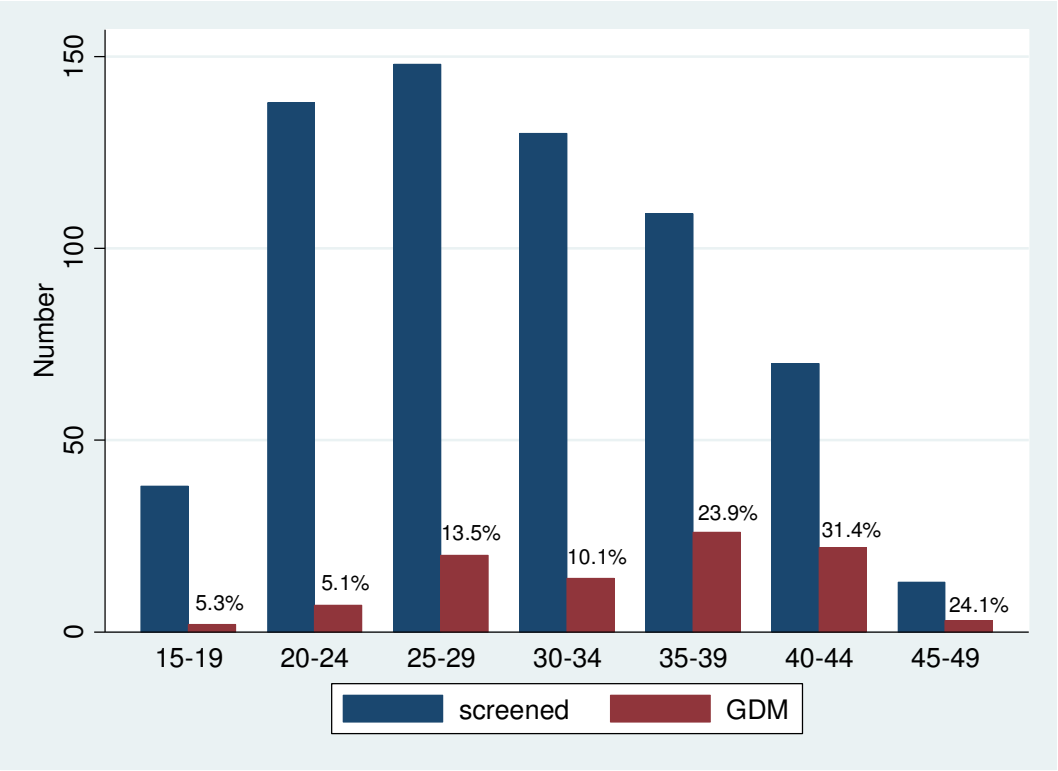
Figure 1. Percentage of women screened who have gestational diabetes mellitus (GDM), by age group



Discussion

This is the first study of the GDM screening programme and the prevalence and management of GDM among Cook Islands women since the introduction of universal screening in 2009 and to our knowledge, the first such study from any Pacific Island nation. The data represent more than 96% of all births in the Cook Islands during the study period.

The high uptake of screening and OGTT towards the latter half of the study period, together with the apparent effectiveness of the lifestyle programme, point to a high level of acceptance by Cook Island women of the need to detect and manage GDM and diabetes.

GDM management appears to have reduced maternal weight gain to less than women with normal glucose tolerance and pIGT, and restricted baby birthweights to a non-significant increase, with no increase in pre-term deliveries or NICU admissions.

Limitations of this study include not having outcome data on the small number of women who delivered overseas (mostly in New Zealand). We have no detailed data on the lifestyle advice given and its uptake by women with GDM. We had no data to describe glucose control achieved by the women with GDM.

Women with GDM are at increased risk of developing type 2 diabetes in later life.[14,15] Studies in non-European ethnic groups suggest that up to 60% of women with GDM will develop type 2 diabetes within 5 to 20 years and most of these will develop type 2 diabetes within 5 years.[16,18] No such studies have been performed in Pacific Island women but high obesity rates and a high incidence of type 2

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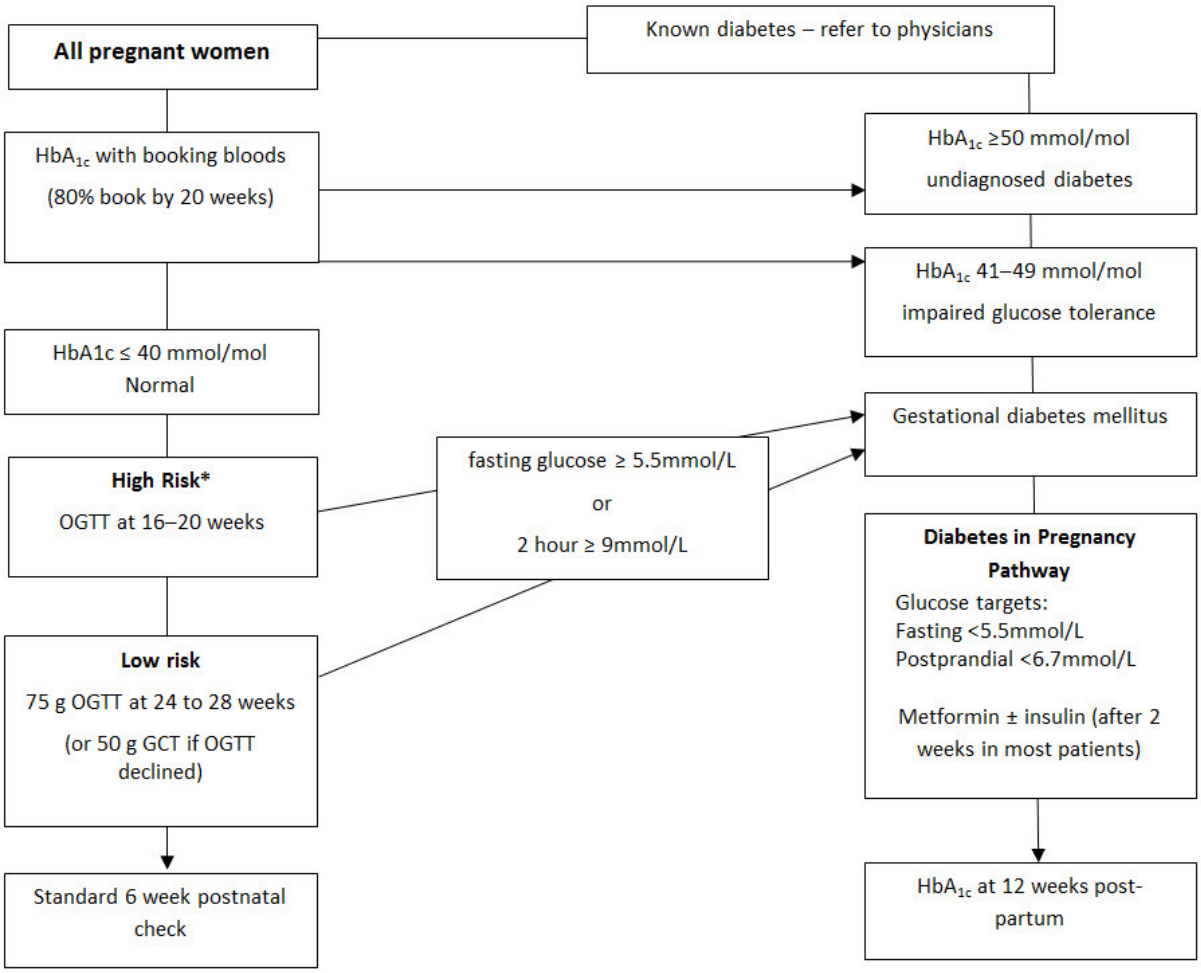
diabetes in this group suggest it is likely that Pacific island women are at a similar or higher risk. GDM screening in the Cook Islands is likely to identify women with a high chance of developing type 2 diabetes.

The current screening programme, testing at 24 weeks and later, will not detect women with pre-existing type 2 diabetes. In our study a third of the women with GDM, who had a post-natal OGTT, had type 2 diabetes. It is likely that most of these women had undiagnosed type 2 diabetes prior to pregnancy.

Figure 2. Proposed strategy for screening for diabetes in pregnancy in the Cook Islands



***Women considered to be at high risk of pre-existing diabetes**

- Age 35 years or older
- BMI ≥ 35
- one first degree relative with diabetes
- Glycosuria
- Previous gestational diabetes
- Previous baby ≥ 4kg
- Polycystic ovarian syndrome

OGTT – oral glucose tolerance test; GCT – glucose challenge test.

Early detection of these women is a key part of recently described approaches to GDM screening such as the 2010 IADPSG consensus screening strategy for GDM.[17] This approach measures HbA_{1c} or a fasting/random glucose test at booking in women at high risk of pre-existing diabetes. However, almost all women in our population would fall into an IADPSG high risk group[18–20] suggesting that in the Cook Islands universal first trimester testing would be appropriate. Measuring HbA_{1c} at a booking visit is convenient for women and the service.

Choosing the most appropriate fasting and two hour cut offs for the diagnosis of GDM in the Cook Islands is problematic. However, since Cook Island obstetric services work closely with New Zealand, and since most Cook Island women who deliver overseas do so in New Zealand, it is likely that new standards adopted by New Zealand will also be adopted in the Cook Islands.

Figure 2 shows a proposed new screening strategy for the Cook Islands incorporating universal first trimester screen, second trimester screening in higher risk women and a universal diagnostic test at 24–28 weeks. Almost all women in the Cook Islands deliver in Rarotonga, transferring from outlying islands in late pregnancy.

It is possible that future additional testing will significantly increase the resources needed to provide antenatal care in outlying islands. If this proposed approach is introduced it will be important that all screening, intervention, glucose control and outcome data are collected prospectively to assess its acceptability, cost and effectiveness.

Competing interests: Nil.

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References

1. Census Report 2011. Cook Island Ministry of Finance and Economic Management Statistics Department, 2012. http://www.mfem.gov.ck/
2. Cook Islands NCD STEPS survey fact sheet. Geneva: World Health Organization; 2004. http://www.who.int/chp/steps/cook_islands/en/
3. Mola GSR. Gestational Diabetes in Papua New Guinea. PNG Medical Journal 1991;34:104–8.
4. Salih S. Screening for Gestational Diabetes Mellitus in indigenous Melanesian population on the Islands of Vanuatu. Journal of Obstetrics and Gynaecology 2009;29:98–100.
5. Buckley BS, Harreiter P, Damm R, et al. Gestational diabetes mellitus in Europe: prevalence, current screening practice and barriers to screening. A Review. Diabetic Medicine 2012;29:844–854.
6. Cho NH. Gestational diabetes mellitus – challenges in research and management. Diabetes Research and Clinical Practice 2013;99:237–39.

7. Metzger BE. International association of diabetes and pregnancy study groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. Diabetes Care 2010;33:676–82.
8. WHO Expert Committee on Diabetes Mellitus; second report. Tech Rep Ser. World Health Organization 1980;646:1–80.
9. Diabetes mellitus: report of a WHO study group. Tech Rep Ser. World Health Organization 1985;727:1–113.
10. Diagnosis of gestational diabetes. College Statement C-Obs 07. Royal Australian and New Zealand College of Obstetrics and Gynaecology 2011. Melbourne, Australia.
11. Metzger BE, Coustan DR. Summary and recommendations of the Fourth International Workshop-Conference on Gestational Diabetes Mellitus. Diabetes Care 1998;21 (suppl 2):B161–167.
12. American Diabetes Association. Standards of medical care in diabetes-2011. Diabetes Care 2011;34 (suppl 1):S11–61.
13. Diabetes in pregnancy. Management of diabetes and its complications from preconceptions from preconception to the postnatal period. 2008 London. National Institute of Health and Clinical Excellence.
14. Bellamy CJ. Type 2 Diabetes mellitus after gestational diabetes:a systematic review and meta-analysis. Lancet 2009;373:1773–79
15. O'Sullivan JB. Body weight and subsequent diabetes mellitus. JAMA 1982;248:949–52.
16. Kjos SL, Peters RK, Xiang A, et al. Predicting future diabetes in Latino women with gestational diabetes. Diabetes 1995;44:586–91.
17. Metzger BE. Hyperglycemia and adverse pregnancy outcomes. New England Journal of Medicine 2008;358:1991–2002.
18. Landon MB, Gabbe SG. Gestational diabetes. Obstetrics and Gynecology 2011;118:1379–93.
19. Wendland EM, Torloni MR, Falavigna M, et al. Gestational diabetes and pregnancy outcomes – a systematic review of the World Health Organization (WHO) and the International Association of Diabetes in Pregnancy Study Groups (IADPSG) diagnostic criteria. BMC Pregnancy and Childbirth 2012;12:23.
20. Cho NH. Gestational diabetes mellitus – challenges in research and management. Diabetes Research and Clinical Practice 2013;99:237–39.