Self reported past gestational diabetes as a risk factor for abnormal glucose tolerance among Australian Women

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At least 50% of women who have a pregnancy complicated by gestational diabetes mellitus (GDM) progress to permanent type 2 diabetes (1). Although few long term studies have been undertaken (2), progression from GDM to abnormal glucose tolerance (AGT) might not occur in all women. We hypothesized that if AGT occurs, progression to diabetes would be more likely, and that a greater excess of diabetes rather than impaired glucose tolerance/impaired fasting glucose (IGT/IFG) would occur over time. We have used two cohorts of Australian women who participated in either AusDiab (Australian Diabetes, Obesity and Lifestyle Study) (3,4) or CUDS (Crossroads Undiagnosed Disease Study) (5), to investigate the relationship between current glucose tolerance status and self-reported history of diagnosis of GDM.

Research Design and Methods

AusDiab (May 1999-December 2000) involved 42 randomly selected areas across Australia and CUDS (June 2001-March 2003) randomly selected households across 6 small towns and a regional center in rural Victoria (3-5). Both studies included all usual residents aged ≥25 years within a household who responded to an initial census and used identical questionnaires and laboratory for sample analysis. Several staff were the same. Attendance rates for women were 58% (n=6198) and 69% (n=819) respectively, among whom 174 had incomplete data, 991 were nulliparous and 13 had Type 1 diabetes on clinical criteria. Among the remaining 5,839 parous women, those without known diabetes had a 75g OGTT (6), height, weight and blood pressure measurements. Plasma glucose and serum lipids concentrations were determined enzymatically. ATPIII criteria were used for the metabolic syndrome (7). Questions regarding women's health included "When you were pregnant, were you ever tested for diabetes? That is a blood or urine sugar test. This may have involved drinking a very sugary drink", "Were you ever told that you had gestational diabetes or pregnancy-related diabetes?" (defined here as "past GDM") and "Were you ever tested again for diabetes after pregnancy."

All tests are 2 tailed and $p<0.05$ taken as significant. Discrete variables were compared using Chi squared test and adjusted for age group using Mantel Haenszel test. Odds ratios are shown with 95% confidence intervals. Continuous variables are compared using analysis of variance or analysis of covariance. The studies were approved by the relevant ethics committees and signed individual consent obtained.

Results

Past GDM was reported in 4.1%. In comparison with other women, those with past GDM were younger (44±12 vs 53±14 years, $p<0.001$), with a higher body mass index (28.0±6.5 vs 27.0±5.6 kg/m^2, $p=0.006$), and more likely to be of non-European descent (10.0% vs 5.8% $p=0.008$). Parity and age at first pregnancy were comparable. Current diabetes was more likely among those with past GDM (12.5 vs 7.0%, $p<0.05$), but the prevalence of IGT/IFG was similar in the two groups (16.7% vs 16.2%). The metabolic syndrome prevalence was not significantly different (25.4% vs 21.9%).

The prevalence of self-report GDM screening decreased progressively with increasing age, as did the proportion with self report past GDM (Table). Current diabetes and IGT/IFG prevalence was similar among women, whether they remembered being screened or not. Among the former, the proportion with

past GDM remained similar across all age groups.

The excess of current diabetes among women with past GDM commenced from 35-44 years. A statistically significant excess of IGT/IFG was apparent in those aged 25-44 years, but not in older age groups. A significant excess of any abnormal glucose tolerance among those with past GDM was seen up to the age of 54 years, but not beyond.

Conclusions

Attempting to interpret longitudinal patterns across cross sectional data is fraught with difficulty (8,9). Notwithstanding this, and the unreliability of self reports of past GDM testing and diagnosis, data validity here is supported by the relative risk of diabetes among women with past GDM being comparable to the 6 fold excess shown by Cheung et al (2). Furthermore, with increasing age, the proportion of "screened" women with current diabetes after self reported past GDM increased to a proportion slightly less than the original O'Sullivan cohort follow up (in spite of the different diagnostic criteria) (10).

Among women with past GDM, the excess of current diabetes was seen at all ages, while no excess of current IGT/IFG was shown after 55 years. If our observations are not a product of the various confounders, the proportion of older women with any AGT is comparable with and without past GDM. This suggests an excess loss of women with past GDM (through eg death or non participation), or that there are only a proportion of women with GDM who will actually progress to AGT. Within those with AGT though, a higher proportion of older women with past GDM have diabetes rather than IGT/IFG suggesting that an additional process (eg reduced insulin secretory capacity (11,12)) has led to a greater transition to diabetes. Whether this is genetically determined, due to the experience of GDM itself (13), excess obesity, or some other reason is unclear.

Interestingly, the prevalences of diabetes and IGT/IFG here were comparable whether women had been screened for GDM or not. The high risk of developing future diabetes among women with GDM, found in this study, supports recommendations for screening all pregnant women for diabetes. Furthermore, it emphasizes the need for interventions to reduce the risk of progression to type 2 diabetes in this group, and for regular post-partum screening for diabetes.

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Table 1 Prevalence of diabetes, penetration of screening by recall, proportion with self reported GDM and with abnormal glucose tolerance

	Age Group						Total	
	25-34	35-44	45-54	55-64	65-74	>=75		Sig across ages
N	571	1384	1528	1073	829	454	5839	
Current Diabetes (%)	2(0.4%)	27(2.0%)	80(5.2%)	93(8.7%)	130(15.7%)	91(20.0%)	423	<.001
Recalls being screened (%)	427(74.8%)	680(49.1%)	323(21.1%)	160(14.9%)	83(10.0%)	32(7.0%)	1705(29.2%)	<.001
Self reported past diabetes in pregnancy (%)	62(10.9%)	87(6.3%)	50(3.3%)	26(2.4%)	9(1.1%)	6(1.3%)	240(4.1%)	<.001
Current diabetes prevalence (%)								
Recalls being screened	0.2%	2.1%	5.0%	11.9%	16.9%	12.5%	4.0%	<.001
Recalls not being screened	1.0%	1.6%	5.4%	9.2%	16.3%	21.1%	9.3%	<.001
Not sure	0%	2.6%	4.9%	5.0%	12.3%	17.9%	6.3%	<.001
Current IGT/IFG prevalence (%)								
Recalls being screened	7.5%	10.6%	13.3%	19.4%	27.7%	31.3%	12.4%	<.001
Recalls not being screened	3.8%	9.4%	16.1%	19.6%	27.4%	23.1%	18.3%	<.001
Not sure	2.5%	9.4%	15.1%	15.7%	28.8%	26.9%	16.4%	<.001
GDM within reportedly screened (%)	62/427 (14.7%)	87/680 (12.8%)	50/323 (15.5%)	26/160 (16.3%)	9/83 (10.8%)	6/32 (18.8%)	240/1705 (13.7%)	.632
Current diabetes among reportedly screened women								
-No past GDM	0.3%	1.2%	1.8%	9.7%	14.9%	3.8%		
-Past GDM	0%	8.0%	22.0%	23.1%	33.3%	50.0%		
OR (Past vs no past GDM)	-	7.3(2.5-21.4)	15.1(5.0-45.8)	2.8(1.0-8.2)	2.9(0.6-13.2)	25.0(1.9-324)	6.0(3.5-10.2)	
Current IGT/IFG among reportedly screened women								
-No past GDM	6.3%	9.6%	12.1%	19.4%	29.7%	38.5%		
-Past GDM	14.5%	17.2%	20.0%	19.2%	11.1%	0%		
OR (Past vs no past GDM)	2.5(1.1-5.8)	2.0(1.1-3.6)	1.8(0.8-4.0)	1.0(0.3-2.9)	0.3(0.1-2.5)	-	1.5(1.0-2.1)	
Current diabetes/IGT/ IFG among "screened" women								
-No past GDM	6.6%	10.8%	13.9%	29.1%	44.6%	42.3%		
-Past GDM	14.5%	25.3%	42.0%	42.3%	44.4%	50.0%		
OR	2.4(1.1-5.5)	2.8(1.6-4.8)	4.5(2.3-8.6)	1.8(0.8-4.2)	1.0(0.2-4.0)	1.4(0.2-8.1)	2.6(1.9-3.6)	

GDM=Gestational diabetes mellitus; IGT/IFG=Impaired glucose tolerance and/or impaired fasting glucose; OR=Odds ratio