Diabetes in Pregnancy :
New Findings from the West Midlands

West Midlands Cohort and Confidential Enquiry into Pregnancy in Women with type 1 and type 2 diabetes in 2002-2003.

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Introduction - New Findings

- *West Midlands DIP Report – out Spring 2008.*
- *Cohort results*
- *Confidential Enquiry – methodology / reasons / results*
- *Type 2 DM in pregnancy*
- *Poor Pregnancy outcomes – congenital anomalies*
  - stillbirths
- *Summary*

WM Cohort Study

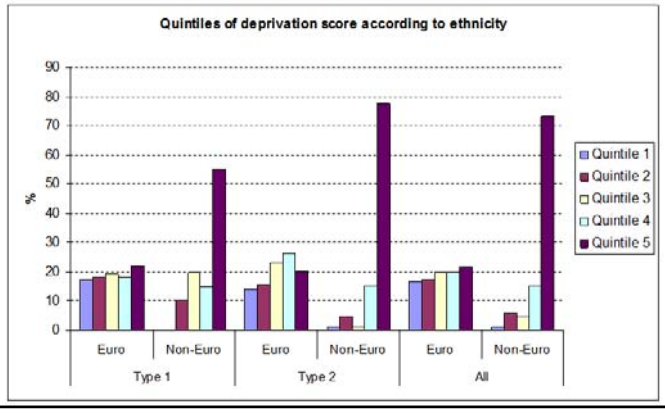
	Total Study Population (n)
Women in study	405
Pregnancies	418
Multiples	8
Total babies	426
Early fetal losses < 20 weeks	30
Late fetal losses 20-24 weeks	6
Pregnancies ongoing >24 weeks	382
Live births delivered > 24 weeks	373
Live births delivered < 24 weeks	0
Total live births	373
Neonatal deaths	3 *
Total live at 28 days	370
Stillbirths	17
All births registered	390
Congenital malformations	32

Table 3.1 shows demographic characteristics of the women.

	Number of pregnancies		
	Type 1 n=269	Type 2 n=149	All n=418
Median age of mother at entry to study, Years (IQR)	29 (9)	33 (8)	31 (9)
Ethnicity n (%)			
European	249 (92.6)	64 (43.0)	313 (74.9)
Black African	0	4 (2.7)	4 (1.0)
Black Caribbean	5 (1.9)	12 (8.1)	17 (4.1)
Indian	7 (2.6)	11 (7.4)	18 (4.3)
Pakistani	3 (1.1)	45 (30.2)	48 (11.5)
Bangladeshi	0	7 (4.7)	7 (1.7)
Other	5 (1.9)	6 (4.0)	11 (2.6)
Parity n (%)			
Primigravida	94 (34.9)	21 (14.1)	115 (27.5)
Multigravida	175 (65.1)	128 (85.9)	303 (72.5)
Median age at onset of diabetes, years (IQR)	13 (13.25)	28 (9)	20 (16)
Median duration of diabetes, years (IQR)	14 (13.25)	4 (4)	9 (13)

Table 3.3: Quintiles of deprivation score according to ethnicity:

Quintile of IMD	Type 1 Euro v Non Euro (%) n=269	Type 2 Euro v non Euro (%) n=149	All Euro v Non Euro (%) n=418
1	17.3 v 0	14.1 v 1.2	16.6 v 1.0
2	18.1 v 10.0	15.6 v 4.7	17.6 v 5.7
3	19.3 v 20.0	23.4 v 1.2	20.1 v 4.8
4	18.1 v 15.0	26.6 v 15.3	19.8 v 15.2
5	22.1 v 55.0	20.3 v 77.6	21.7 v 73.3
Unclassified	5.2 v 0	0 v 0	4.2 v 0



Key Findings : Demographics

- *Women of Asian ethnicity make up 17.5% pop^{n} compared to 10.5% nationally.*
- *Significantly greater proportion of Type 2 diabetic women in West Midlands (36% v 27% CEMACH dataset)*
- *Type 2 mothers are older, multiparous, ethnic minority and in quintile of highest social deprivation.*

Clinical Standards Analysed

(Referenced separately at the end of the document)

1 Preconception counselling
2 Prepregnancy folic acid.
3 First trimester ultrasound scan for accurate dating.
4 Corticosteroids for early delivery.
5 HbA1C < 7% (standard reported on in chapter IV).
6 Hypoglycaemia events / Glucagon use.
7 Retinal screening in first trimester.
8 Neonatal facilities.
9 Mode and timing of delivery discussed.
10 Continuous electronic fetal heart monitoring.
11 IV glucose and insulin for delivery.

Preconception counselling:

Standard: A preconception clinic should be run jointly by the adult diabetes service and the maternity service for women with diabetes wishing to become pregnant.

Table 4.1a Documentation of pre pregnancy counselling and control

	Type 1 (%) n = 269	Type 2 (%) n = 149	All women (%) n = 418
Pre-pregnancy counselling documented	82 (30.4%)	36 (24.2%)	118(28.2%)
Pre-pregnancy HbA1C	125 (46.4%)	48 (32.2%)	173 (41.4%)
Pre-pregnancy HbA1C < 7% in those that had a test	31 (24.8%)	22 (45.8%)	53 (30.6%)

Cohort Glycaemic Control

Table 5.1a: Number of women with a recorded HbA1C measurement.

	Pre-pregnancy	Test closest to 10 wks	Test Closest to 20 wks	34 weeks onwards
Type 1 (n=269)	125 (46.5%)	236 (87.7%)	226 (83.3%)	220 (81.8%)
Type 2 (n=149)	48 (32.2%)	111 (74.5%)	122 (84.0%)	116 (77.9%)
All (n = 418)	173 (41.4%)	347 (83%)	348 (81.9%)	336 (80.4%)

Table 5.2: Number of measurements within target (<7%) (irrespective of hospital range)

	Pre-pregnancy	10 weeks	20 weeks	34 weeks
All Women: Result <7% n(%) [a]	53 (30.6)	155 (44.7)	244 (70.1)	230 (68.5)
Women with Type 1 diabetes: Result <7% n(%) [a]	31 (24.8)	95 (40.3)	149 (65.9)	141 (64.1)
Women with Type 2 diabetes: Result <7% n(%) [a]	22 (45.8)	60 (51.4)	95 (77.9)	89 (76.7)

[a] =Number of HbA1c tests with results below 7% as a proportion of all HbA1c tests for that period;

Key Findings : Labour and Delivery

Table 6.3: Modes of delivery for all women compared to National dataset and general maternity population.

MODE	Type 1 (n = 247)	Type 2 (n = 135)	All (n = 382)	National Dataset	Normal Population
Vaginal Spontaneous Instrumental	58 (23.5%) 44(17.8%) 14 (5.7%)	49 (36.3%) 45 (33.3%) 4 (3.0%)	107 (28%) 89 (23.3%) 18 (4.7%)	32.1% 24.4% 7.7%	 67% 11%
C Section Emergency Elective	188 (76%) 107 (43%) 81 (33%)	86 (60%) 41 (29%) 45 (30%)	274 (71.7%) 148 (38.7%) 12 (33%)	67.4% 37.6% 29.8%	22% 13% 9%
Not vaginal delivery	1 (%)	0	1 (%)	0.2%	0%

perinatal institute

Key Findings : Labour and Delivery

- *28% vaginal delivery rate in WM – 14% spontaneous labour*
- *72% CS rate – primarily due to obstetric reason*
- *- maternal diabetic complications/maternal request are rare*
- *1 in 3 women are induced – 60% vaginal del rate*
- *32% preterm delivery rate*

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Key Findings :Neonatal Outcomes

Table 8.3: Neonatal admission at any time following delivery, by gestation at delivery (percentages are proportion of babies in category out of the total number of babies with valid response, i.e. excluding 'not applicable' and 'missing')

Gestation at delivery, completed weeks n (%)				
Type of Neonatal Care	**<32 (n=16)**	**32-36 (n=98)**	**37+ (n=259)**	**All (n=373)**
Special Care	4 (25.0%)	39 (39.8%)	54 (20.8%)	97 (26.0%)
High Dependency Care	5 (31.3%)	28 (28.6%)	45 (17.4%)	78 (20.9%)
Intensive Care	6 (37.5%)	16 (16.3%)	22 (8.5%)	44 (11.8%)
Other Specialist Care	0	0	3 (1.2%)*	3 (0.8%)
Postnatal ward normal care with Mother	0	15 (15.3%)	133 (51.4%)	148 (39.7%)
Not Known	1 (6.3%)	0	2 (0.8%)	3 (0.8%)

Table 9.3: Reasons for admission to special care in 222 babies where information is given:

Reason for Admission	All infants (n = 222)
Routine/observation/infant of diabetic mother/maternal/not known	54 (24.3%)
Hypoglycaemia/feeding problem	85 (38.3%)
Prematurity	52 (23.4%)
Respiratory /Ventilated	23 (10.4%)
Other infant medical problems	8 (3.6%)

West Midlands Confidential Enquiry

- Panel compositions
- Proforma used
- Case notes and documents reviewed
- Panel assessments

- Results analysis – cases vs controls

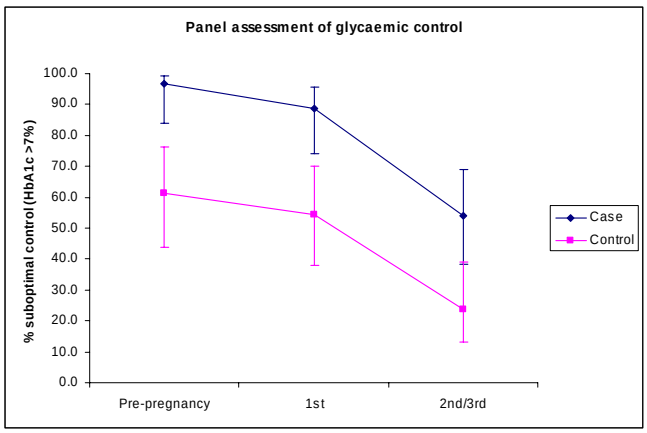
CE outcomes

	Early fetal loss<20/40	Late feta Loss >20 23+6	Stillbirth	Neonatal Death	Alive at 28 days	Grand Total
Cases	2	6	15	3	13	39
Type 1 Type 2	1 1	5 1	8 7	1** 2	8 5	23 16
Congenital Anomalies	2	4	3	2	11	22
Controls Type 1 Type 2	0 0 0	0 0 0	0 0 0	0 0 0	38 20 18	38

Access to Health services

	Cases (n=39)	Controls (n=38)
First contact with health professional (From EDD) Days /IQR	47 (25.5)	48.5 (17.75)
First hospital appointment (from EDD) Days / IQR	62 (19)	67 (31)
Health professional involved with care (%)		
DNS	33 (84.6)	31 (81.6)
Physician	37 (94.9)	37 (97.4)
Dietician	19 (48.7)	18 (47.4)
Midwife	5 (12.8)	5 (13.2)
Obstetrician	37 (94.9)	36 (94.7)

Glycaemic control



Panel comments on glycaemic control

'Non acceptance of her diagnosis. Input from clinical psychologists would have helped'

'woman not testing, not taking diabetes seriously'

'recurrent hypoglycaemia'

'Insulin regime inappropriate'

'No dietician. No targets' 'Only one HbA1c recorded in second trimester'

'patient unhappy with close monitoring, no HbA1c after 24 weeks'

'Poor attendance and doubtful compliance'

'communication issue, should have had QDS insulin earlier, too long between appointments'

Diabetes complications during pregnancy

Specific diabetes complication	Women in the enquiry n/N (%)
Recurrent hypoglycaemia during pregnancy	37/71 (52.1)
Hypoglycaemia requiring external help	12/56 (21.4)
Retinal assessment performed in1st trimester	43/65 (66.2)
Evidence of Retinopathy in pregnancy	22/55 (40.0)
Pre-existing retinopathy	9/55 (16.4)
Pre-existing retinopathy - deteriorating	4/55 (7.3)
New retinopathy	7/55 (12.7)
Nephropathy	3/71 (4.2)

Panel Assessment of suboptimal care

	Cases n= 39 N %	Controls n= 38 N %
Diabetic care during pregnancy (other than glycaemic control)	23/37 62	25/38 66
Maternity Care - antenatal	23/39 59	15/38 40
Maternity care - delivery	13/37 35	14/37 38
Diabetic care – postnatal	14/32 44	16/29 55

Panel comments on antepartum care

	Cases (n23)	Controls (n15)
Issues relating to provision of health service		
Clinical practice		
- Fetal surveillance	7	5
-Management of pregnancy complications	4	10
-Mode / timing of delivery	2	2
-Use of steroids	2	1
-Need for senior Obstetric input	0	1
-Poor / no management plan	3	2
-Blank	3	2
Resources		
-In-appropriate appointments	3	0
-Use of interpreter	1	0
-Neonatal cots	0	1
Communication		
-Between professionals	3	1
-Between professionals & woman	0	0
Issues relating to woman / family		
Maternal actions - Smoking	1	1
Maternal compliance	1	0
Poor attendance	1	0
Total Comments	31	26

Conclusions from Confidential Enquiry

1. Evidence of poor/ no preparation for pregnancy with general lack of preconception care.
2. Poor glycaemic control can be associated with poor pregnancy outcomes
3. Suboptimal care was present in all aspects of care provided and throughout pregnancy.
4. Particular areas for concern – glycaemic control
   - communication with patient and other professionals
   - use and guidance of local guidelines for management
   - lack of Senior input in decision making
   - patient compliance in early pregnancy
   - inadequate documentation

Type 2 diabetes in WM

	Early Fetal loss <20/40	Late fetal Loss >20-23+6	Stillbirth	Neonatal Death	Alive at 28 days	Grand Total
Cohort						
Poor Outcomes	13	1	8	2	9	33
Congenital Anomalies	1	0	1	1	9	12
Good Outcomes	0	0	0	**0**	116	116
Total						149

PNMR = 52.6/1000 births
Congenital MR = 88.2/1000 births

Type 2 group demographics

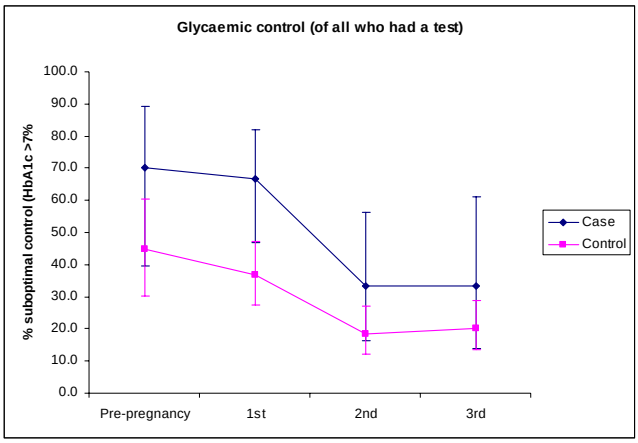
- Good outcome group – 44% European / 56% non-european
- - duration of DM 4.1- 4.8 yrs
- - age of onset of DM 28.0 yrs (27-29.3)
- - IMD 5 range 22% - 77%
- - mean age 32.5 yrs

- Poor outcome group – 40% European / 60% non-european
- - duration of DM 5.2-5.3 yrs
- - age of onset of DM 25.8 yrs (25.2-26.4)
- - IMD 5 range 16% - 80%
- - mean age 31.1 yrs

Type 2 – glycaemic control

		Type 2 Cohort poor outcomes n33	Type 2 Cohort - live excl. NND and anomaly n116
HbA1c Values		*n=33*	*n=116*
Pre-pregnancy	Mean	9.0% (n10)	7.4% (n38)
10 week	Mean	7.7% (n24)	6.7% (n87)
20 week	Mean	6.4% (n18)	5.9% (n103)
34 week	Mean	6.8% (n12)	6.2% (n104)

32% taking insulin pre-pregnancy – more commonly in poor outcomes group (48.5% v 27.6%, p=0.04)



Type 2 mode of delivery

Mode of delivery	European	Non-European	Total
SVD	12 (21)	33 (43)	45 (33)
Instrumental	2 (3)	2 (3)	4 (3)
Emergency CS	15 (26)	26 (34)	41 (30)
Elective CS	29 (50)	16 (21)	45 (33)
Fetal losses	6	8	14
Total	64	85	149

Type 2 DM treatment regimes

Pre-pregnancy:	
Diet	6
OHA	16
Insulin	8
OHA & INSULIN	3
Not Documented	1

In Pregnancy:	
Diet	3
already on Insulin	11
On OHA & Insulin	1
commenced Insulin	19

Postnatally:	
Diet	6
OHA	11
Insulin	16
Documentation poor	1

Pre-pregnancy : 47% OHA (Metformin in 14/18 pts) , 18% Diet.
Pregnancy : 56% commenced insulin – usually 1st Trimester (80%)
20% remained on same treatment throughout pregnancy – 2 diet / 5 on insulin
80% changed onto different treatment – half maintained insulin regime booking-delivery
- half changed insulin regimes in pregnancy
Use of basal bolus and mixed insulin bd regimes equal
Postnatally : 50% reverted back to pre-pregnancy treatments

Correlation to WM Cohort – 84 T2 women started on insulin in pregnancy (56%)

Panel Enquiry comments

no diabetic input in first trimester, referred to wrong consultant

no information prior to pregnancy

No folic acid. V poor communication, poor use of interpreters.

poor GP care

not sent for earlier assessment

Unplanned. On Ace inhibitor

no folic acid, metformin not stopped

incorrect dose of folic acid

No folic acid, no pre pregnancy care

Very poor glycaemic control pre conception.Not interested in weight loss & no clear targets

not sufficient urgency to refer

not advised not to get pregnant

Fructosaminine difficult to interpret, no home monitoring records, unusual insulin regime

No dietician. No targets

Poor communication & didn't attend

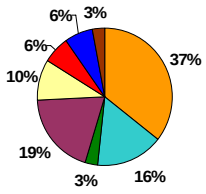
Issues of care for Type 2 diabetic pregnancies

1. High and increasing levels of type 2 pregnancies
2. Poor preparation for pregnancy
3. Time & resources involved in providing care
4. Compliance issues
5. Language and communication difficulties
6. Importance of optimizing glycaemic control
7. Failure to refer to appropriate professional / lack of senior involvement in care decisions

Key Findings : Pregnancy Outcomes – Congenital Malformations

- *Congenital Malformation Rate = 82.1/1000 births. This is twice that national dataset and 4x EUROCAT.*

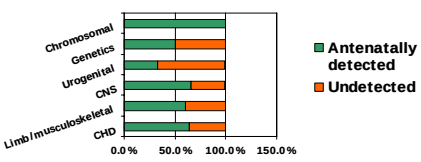
CAs by anatomical system



- Cardiac
- Limb/Musculoskeletal
- Respiratory
- CNS
- Urogenital
- Genetics & Microdeletions
- Chromosomal
- Facial

Outcomes : 32 major CA's :T1 20 / T2 12
7 early fetal losses
5 perinatal losses
20 babies alive at 28 days.
17/29 CA's diagnosed by USS >16 weeks gestation.
12/29 CA's were undetected.
Antenatal Diagnostic rate = 59%

Ultrasound antenatal detection rates for CAs by fetal system



Congenital malformations by type of diabetes and ethnicity

Ethnicity	Type 1 (n=20) (%)	Type 2 (n=12) (%)	All (n=32) (%)
European	18 (90.0)	7 (58.3)	25 (78.1)
Black African	0	1 (8.3)	1 (3.1)
Black Caribbean	1 (5.0	0	1 (3.1)
Indian	1 (5.0)	0	1 (3.1)
Pakistani	0	2 (16.7)	2 (6.3)
Bangladeshi	0	1 (8.3)	1 (3.1)
Other	0	1 (8.3)	1 (3.1)

Table 7.2: Perinatal mortality in women with diabetes in one calendar year (1/3/02 – 28/2/03)

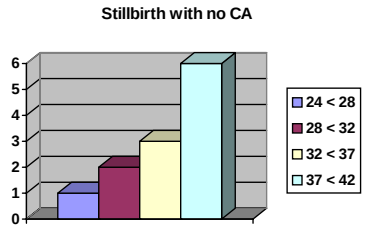
Classification	Numbers	West Midlands cohort			WM cohort vs. WM region[1] RR	WM cohort vs. National CEMACH data RR	WM cohort vs. National maternity pop RR ^
		All (n=297)	Type 1 (n=188)	Type 2 (n=109)			
Stillbirth Rate *(per 1000 livebirths & stillbirths)*	10	38.0	35.7	42.1	6.0	1.4	6.7
Neonatal Death Rate *(per 1000 livebirths)*	3	11.9	6.2	22.0	2.5	1.3	3.3
Perinatal Mortality Rate *(per 1000 livebirths & stillbirths)*	12*	45.6	41.7	52.6	4.5	1.4	5.4

* comprises 10 stillbirths and 2 early neonatal deaths; RR = relative risk

[1] West Midlands Perinatal Mortality (Update March 2006)

Panel Enquiry into Stillbirths and Neonatal deaths

- SBs – 15 - 3 with CAs / NNDs – 3
- Type 1 = type 2 / antepartum 11/15, intrapartum 4/15
- Similar demographic make-up to controls
- No difference in presence of DM complications / med or surg complications



Previous preg resulting in PTD :
All SB&NND (7/11) in multips vs controls (4/32)) – p<0.01

Ethnic Group	Perinatal deaths	Registerable Births after 24 wks (n=390)	PNM rate (per 1000 live & stillbirths)
European	11	292	37.7
Non-European	9	98	91.8

		SB/NND (no anomaly) A *n=13*	Panel Anomaly* B *n=22*	Panel control C *n=38*	Cohort - live excl. NND and anomaly D *n=350*
Pre-preg		**13.6**	**9.1**	**7.6**	**7.7**
10 week		**7.8**	**7.9**	**7.2**	**7.1**
20 week		**6.6**	**6.1**	**6.3**	**6.2**
34 week		**7.1**	**6.8**	**6.3**	**6.3**

- **Significant Stillbirth/ perinatal mortality associations :**
  - ethnic minorities
  - history of previous preterm labour
  - 1st and 3rd trimester suboptimal glycaemic control

Key Findings :West Midlands DIP Report

- *Large pre-gestational DM population with high Type 2 make-up which is ethnically diverse*
- *Significant association with high social deprivation*
- *High PNMR and CMRs – significantly higher than national CEMACH dataset / general maternity pop^{n}*

- *Why ? Comparable clinical standards of care*
- *Better rates of glycaemic testing and control*

- *Reasons ? Poor preparation for and care provided in early pregnancy*
- *Lack of integrated, joined up coordinated care programme*