Oxford Fetal Medicine Unit

Oxford University Hospitals NHS
NHS Foundation Trust

Consequences of a universal 36 week growth scan

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Why is this of interest?

UK, Scandinavia, much of Northern Europe and US don’t do many growth scans

36 week scan as perinatal mortality reduction tool: the theory

SGA as defined by <10th c (Hadlock): EFW SGA

Approx 20% of SBs are SGA: (BW SGA)

So 80% aren't SGA (AGA)

USS has SGA detection rate (best estimate) of 50%

Also approx. 50% (+) SGA babies are not at risk (they are not FGR)

How will this work then? Let's imagine a 10/1000 SB rate

2 potential SBs are SGA

You detect them and you manage them perfectly= 8/1000

But actually you have a 50% chance of detecting it

and you don't manage perfectly (i.e. babies that you know to be SGA can still die)>9/1000

It gets worse…

You have a 50% chance of calling it SGA when it is not- and intervening

And even of all babies that are SGA, >50% will be fine with no action

For every	1 SGA, FGR baby you deliver…you will also deliver…
	1 non-SGA baby
	1 SGA, non-FGR baby
and you will miss	1 SGA, FGR baby
and	1+ non-SGA FGR baby

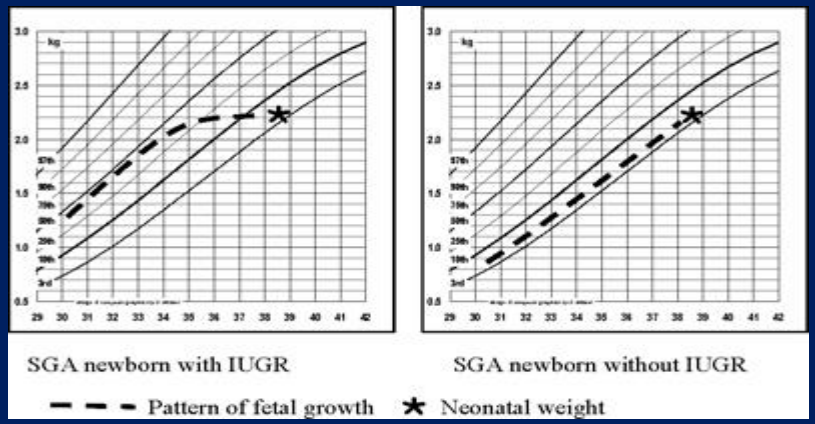
SGA and FGR

80% of SBs are AGA

But > 50% of SBs have ‘placental failure’

We use the term FGR but its probably not right because it implies size is all that matters

1. Chronic failure= small for gestational age (SGA()
2. Chronic failure= smaller than potential but not small (AGA)



3. Subacute failure (eg post dates)= not small (AGA)
4. Acute failure (eg abruption)= some small (AGA)

Dude teacher

Orlando Impey:
Gold medal

Much bigger boy:
Silver medal

The relationship between size and death

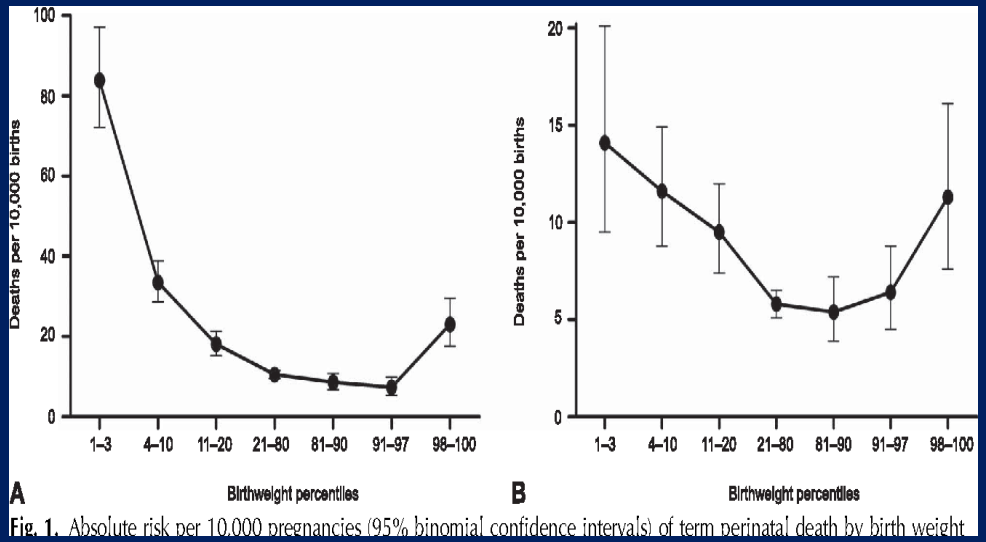
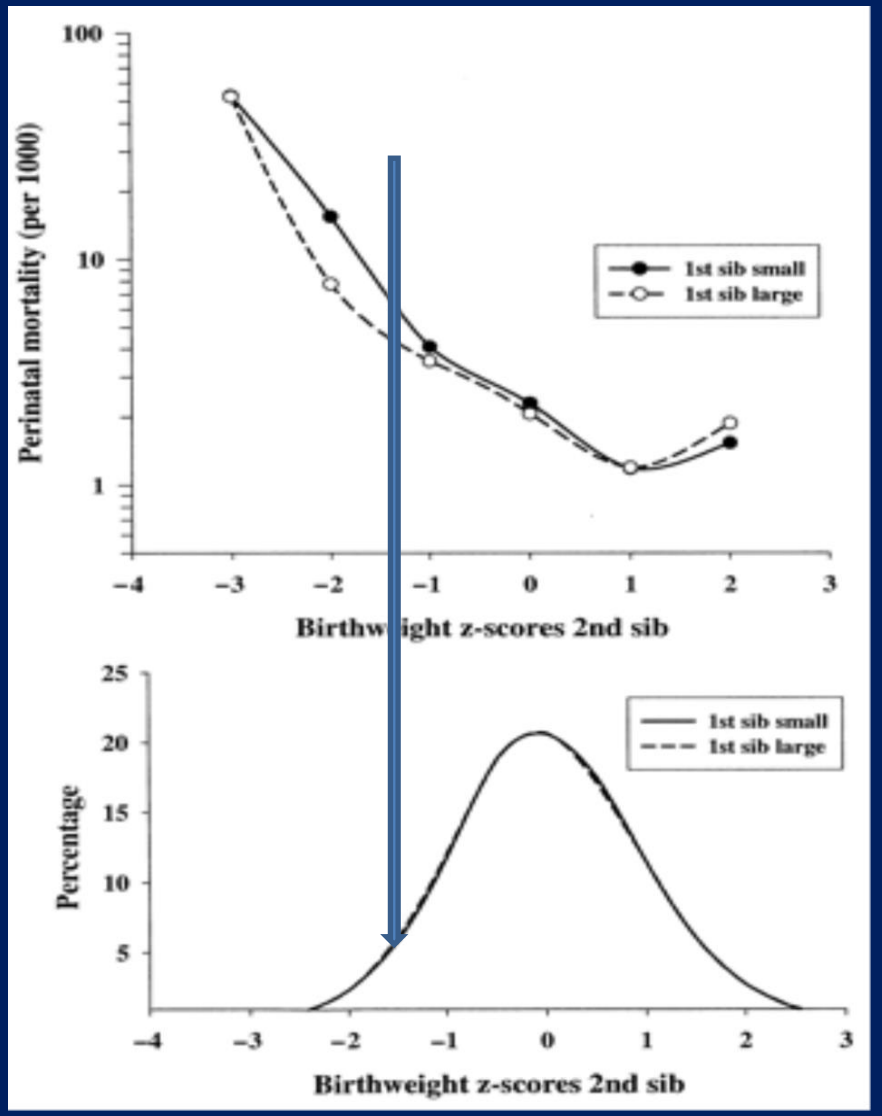


Fig. 1. Absolute risk per 10,000 pregnancies (95% binomial confidence intervals) of term perinatal death by birth weight

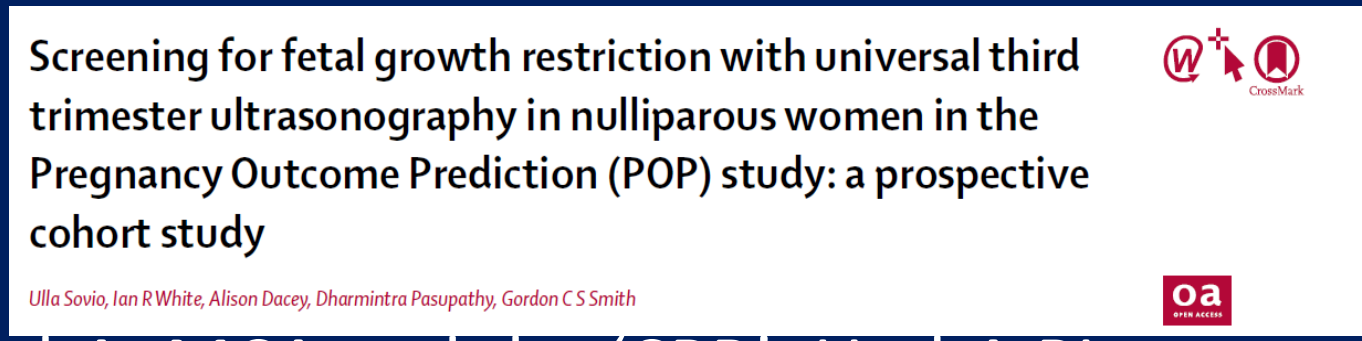
Size really matters
The smaller the worse
Big is bad too

But most deaths occur between 10 and 50th c because
these are 40/100 babies, not 10/100



Can you detect FGR on scan?

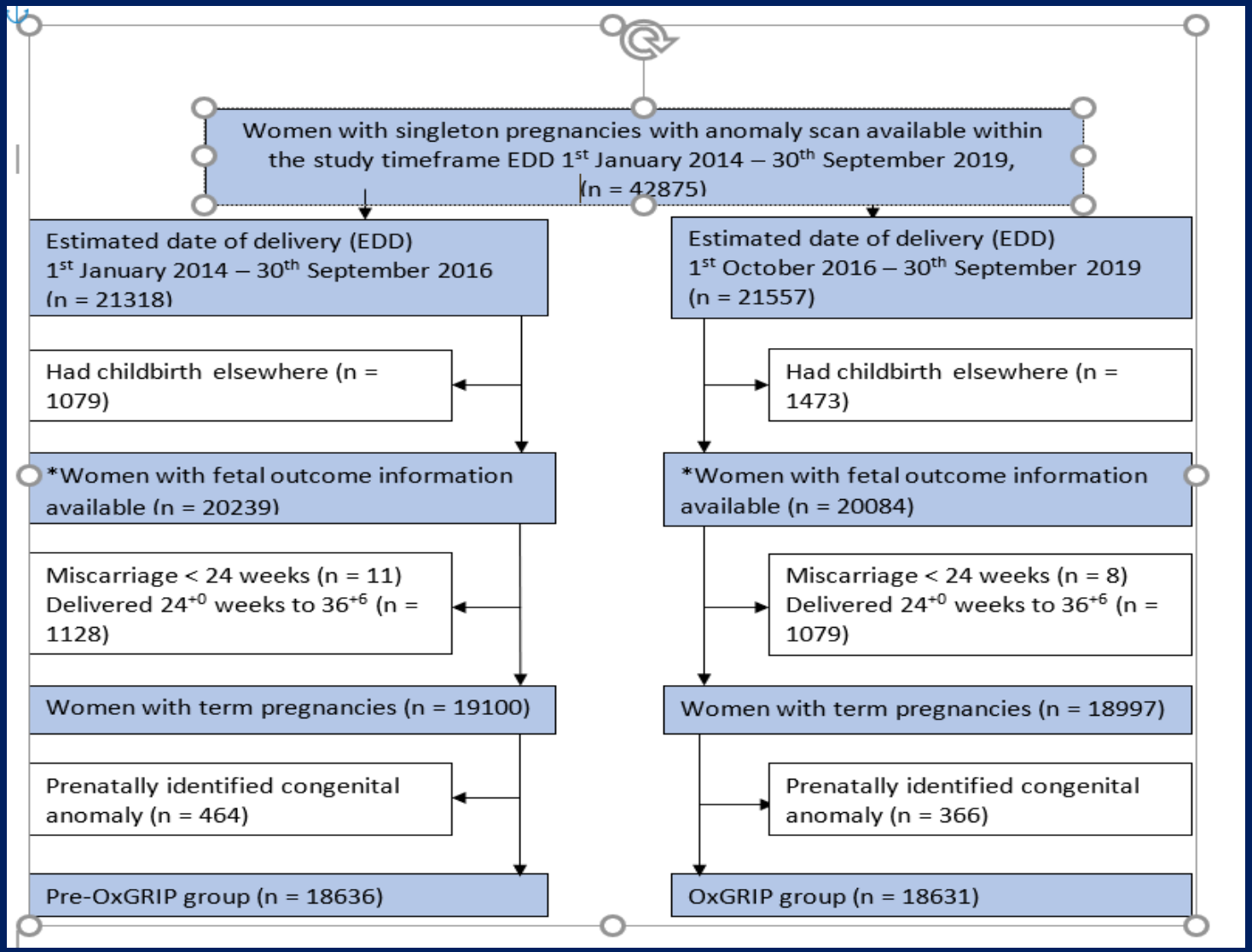
- Absolute size: EFW <10th c
- Growth velocity: ACGV <10th c



- Doppler: umbA; MCA and the 'CPR': UmbA PI> 95th c; CPR <5th c

- Uterine arteries; Non scan risk factors

2016: universal 36 week scan for FGR in Oxford



Which term SGA babies are FGR?

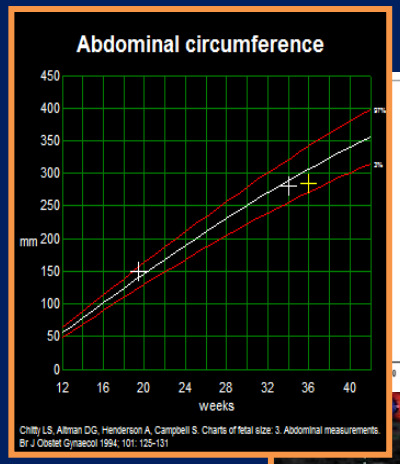
How they got there: ACGV

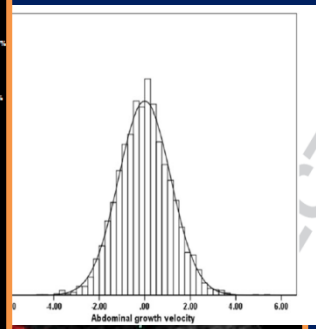
Cerebro-placental ratio (MCA PI/umbA PI)

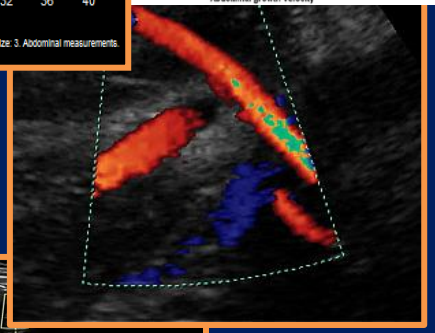
Uterine artery Doppler

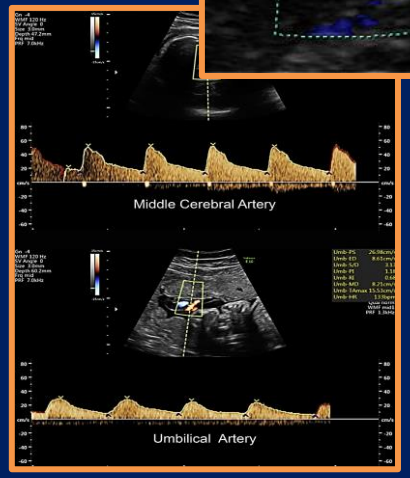
Absolute size (EFW)

Other risk factors eg pre eclampsia









UOG17544

Ultrasound Obstet Gynecol 2018; 0: 000–000
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Small-for-gestational-age babies after 37 weeks: impact study of risk-stratification protocol

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Principle: try to reach 39 weeks

Guidelines for fetal growth assessment (FGA) clinics (prev SGA clinic) protocols LI/CI/AC 21/02/18 draft 10

Referral criteria following 36 week growth scan

1) EFW <10th centile
2) AC reduction > 40 percentile points
3) Isolated CPR < 1.0 or isolated Umbilical PI >95th centile

Check:

1) EFW incl AC reduction (consider sex adjustment: female fetus: 10th c is total population 8th c; male fetus 10th c is total population 12th c)
2) CPR
3) Uterine arteries
4) PAPP-A

Management in FGA clinic

36-37 weeks:

- Deliver if EFW <10th centile ***AND*** CPR < 1.0 or Umbilical PI > 95th centile: please perform CTG in the clinic
- Otherwise reassess 1-2 weeks and see below

From 37+0 weeks:

Deliver if:

- EFW <3rd centile
- EFW >3rd <10th c ***AND*** CPR < 1.0 or Umbilical PI > 95th centile: please perform CTG in the clinic
- EFW >3rd <10th c ***AND*** 1+ of the following criteria →
- CPR < 1 ***AND*** 1+ of the following criteria →

  - Abnormal uterine arteries: 20 weeks total PI > 2.5 or current total PI > 2.0
  - Maternal age >/= 40
  - ACGV <10th centile or below (from the anomaly scan)
  - PAPP-A < 0.3 MoMs
  - Medicated hypertension (note for preeclampsia deliver > 36 weeks anyway)
  - Diabetes on metformin/insulin (note delivery plan should be in place)

Consider CTG if isolated extreme CPR

umbA PI raised with normal CPR, all else normal: treat as normal

Review at the following intervals:

1 week:

- Isolated CPR < 1 (consider earlier repeat)

2 weeks:

- All others i.e. Isolated EFW >3rd c with no complicating features
- Isolated ACGV reduction with (above) no complicating features

Outcomes comparing before and after

Stillbirth/ severe morbidity changes

What happened to intervention? incl CS

Breech presentation

SGA and FGR detection rates

Other consequences

Table 1: Demographic and pregnancy characteristics before and after universal 3rd trimester ultrasound

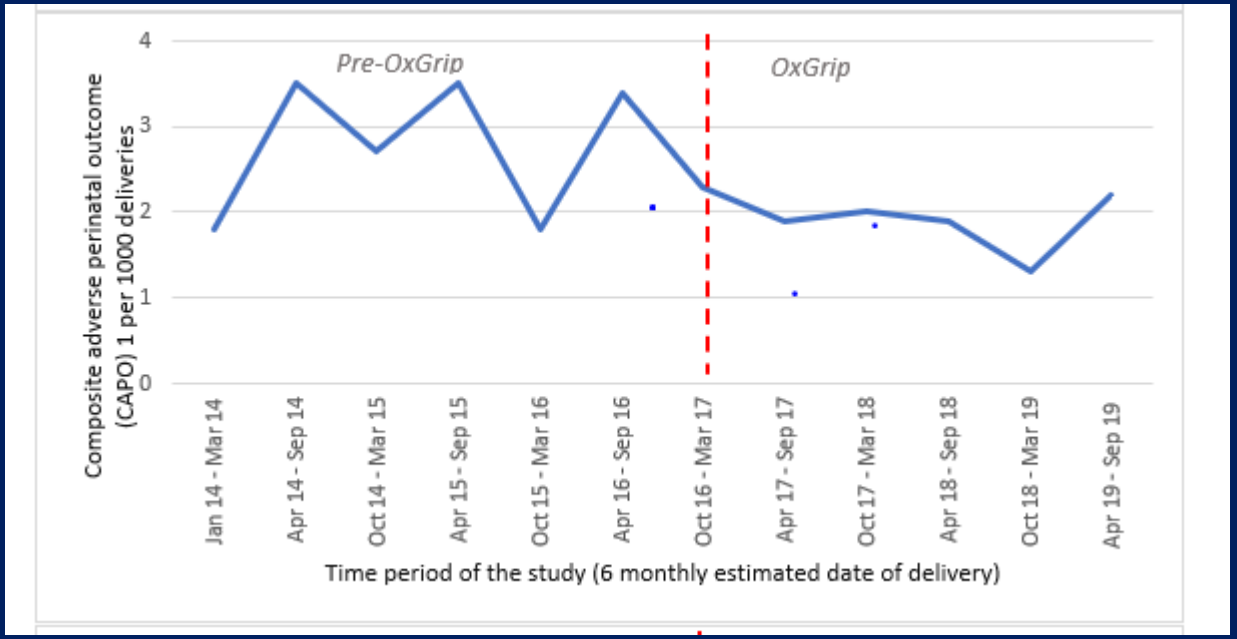
Variable	Pre-OxGRIP n = 18636	OxGRIP n = 18631
Maternal age - years, median (IQR)	31.0 (27.0 – 35.0)	31.0 (28.0 – 35.0)
Maternal Age in (years, n (%))		
< 20	440 (2.4)	320 (1.7)
20 – 34	13311 (71.4)	13246 (71.1)
≥ 35	4885 (26.2)	5065 (27.2)
Body mass index - kg/m^2, median (IQR)	24.1 (21.5 - 27.8)	24.3 (21.6 – 28.1)
Body Mass Index - kg/m^2, n (%))		
Underweight (<18.5)	534 (2.9)	542 (2.9)
Normal (18.5 - 24.9)	9896 (53.1)	9785 (52.5)
Overweight (25.0 - 29.9)	4687 (25.1)	4827 (25.9)
Obesity (≥ 30.0)	2956 (15.9)	3310 (17.8)
Data Missing	560 (3.0)	167 (0.9)
Ethnicity, n (%)		
White	14773 (79.3)	14844 (79.7)
Black or African Descent	392 (2.1)	385 (2.1)
Asian or Asian Descent	1322 (7.1)	1444 (7.7)
Mixed or others	316 (2.7)	609 (3.3)
Data Missing	1652 (8.8)	1349 (7.2)
Parity, n (%)		
0	7982 (42.8)	8161 (43.8)
1	6988 (37.5)	6779 (36.4)
2 – 4	3506 (18.8)	3538 (19.0)
≥ 5	160 (0.9)	153 (0.8)
Deprivation (IMD Quintile, n (%))		
1 (Most deprived)	999 (5.4)	968 (5.2)
2	1758 (9.4)	1709 (9.2)
3	3087 (16.6)	3118 (16.7)
4	5313 (28.5)	5224 (28.0)
5 (Least deprived)	7471 (40.1)	7596 (40.8)
Data Missing	8 (0.0)	16 (0.1)
Smoking at any point in pregnancy, n (%)	1899 (10.2)	1842 (9.9)
Missing	805 (4.3)	274 (1.5)
Current illicit substance use, n (%)	63 (0.3)	126 (0.7)
Missing	611 (3.3)	1015 (5.4)
Assisted conception - In-vitro fertilisation, n (%)	312 (1.7)	329 (1.8)
Any PIH or preeclampsia, n (%)	932 (5.0)	905 (4.9)
Maternal Hyper-glycaemia, n (%)		
Type I/ 2 diabetes	93 (0.5)	85 (0.5)
Gestational diabetes Mellitus	852 (4.6)	1086 (5.8)
Place of birth, n (%)		
Consultant-led unit	15076 (80.9)	14264 (76.6)
Midwifery-led Unit	3087 (16.5)	3818 (20.5)
Home	406 (2.2)	410 (2.2)
Birth before arrival	67 (0.4)	139 (0.7)
Gestational age at birth – weeks, median (IQR)	40.0 (39.1 – 40.9)	40.1 (39.1 – 41.0)
Sex of baby, n (%)		
Female	9073 (48.7)	9089 (48.8)
Male	9563 (51.3)	9541 (51.2)
Missing/ not known	0 (0.00)	1 (0.0)

Mortality and morbidity

27% reduction in extended PMR

33% reduction in PMR or HIE grade 2-3

Neither of these was ‘statistically significant’



Detail of results

Variable	pre-OxGRIP events/number in group	OxGRIP events/number in group	Unadjusted OR (95% CI)	aOR (95% CI) [b]
[a] Primary Outcomes				
[b] Extended perinatal mortality, per 1,000 total births	32/18636 (1.7/1000)	23/18631 (1.2/1000)	0.72 (0.42 – 1.23)	0.73 (0.43 – 1.25)
[c,d] Composite adverse perinatal outcome -1(CAPO 1), (per 1000 total births)	54/18636 (2.9/1000)	36/18631 (1.9/1000)	0.67 (0.44 – 1.02)	0.67 (0.44 – 1.03)
[e] Expedited birth - pre-labour caesarean section or induction (%)	6564/18636 (35.2)	7026/18631 (37.7)	1.11 (1.07 – 1.16)	1.08 (1.04 – 1.14)
[f] Secondary Outcomes				
[g] Composite adverse perinatal outcome -2 (CAPO 2), per 1000 total births)	172/18636 (9.2/1000)	163/18631 (8.7/1000)	0.95 (0.76 -1.17)	0.89 (0.71 - 1.12)
[h] Composite adverse perinatal outcome -3 (CAPO 3), (per 1000 total births)	458/18636 (24.6/1000)	399/18631 (21.4/1000)	0.87 (0.76 - 0.99)	0.81 (0.70 – 0.94)
Stillbirth per 1,000 total births	25/18636 (1.3/1000)	16/18631 (0.9/1000)	0.64 (0.34 – 1.20)	0.71 (0.36 – 1.38)
Perinatal death per 1,000 total births	31/18636 (1.7/1000)	20/18631 (1.1/1000)	0.64 (0.37 – 1.13)	0.69 (0.37 – 1.26)

Induction and CS

Variable	Pre-OxGRIP n = 18636	OxGRIP n = 18631	Unadjusted Odds Ratio (95% Confidence Intervals)	[e]Adjusted Odds Ratio (95% Confidence Intervals)
Onset of labour or birth				
Spontaneous labour	12072 (64.8)	11605 (62.3)	1	1
Induction of labour	4620 (24.8)	4789 (25.7)	1.08 (1.03 - 1.13)	1.05 (1.00 – 1.10)
Pre-labour CS	1944 (10.4)	2237 (12.0)	1.20 (1.12 – 1.28)	1.16 (1.13 – 1.31)
Gestational age at delivery - weeks, n (%)				
< 39	**3553 (19.1)**	**3184 (17.1)**	**0.89 (0.85 – 1.94)**	**0.82 (0.75 – 0.90)**
39^{+0} – 40^{+6}	**10641 (57.1)**	**10668 (57.3)**	**1**	**1**
≥ 41	**4442 (23.8)**	**4779 (25.7)**	**1.07 (1.02 – 1.13)**	**1.19 (1.09 - 1.29)**

Breech presentation

Undiagnosed breech (before labour): 22.3% to 4.7%

Breech presentation unchanged: 2.6% to 2.7% in spite of increase detection and comprehensive ECV service

PLOS MEDICINE

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

The impact of a routine late third trimester growth scan on the incidence, diagnosis, and management of breech presentation in Oxfordshire, UK: A cohort study

Ibtisam Salim, Eleonora Staines-Urias, Sam Mathewlynn, Lior Drukker, Manu Vatish, Lawrence Impey

Published: January 15, 2021 • https://doi.org/10.1371/journal.pmed.1003503

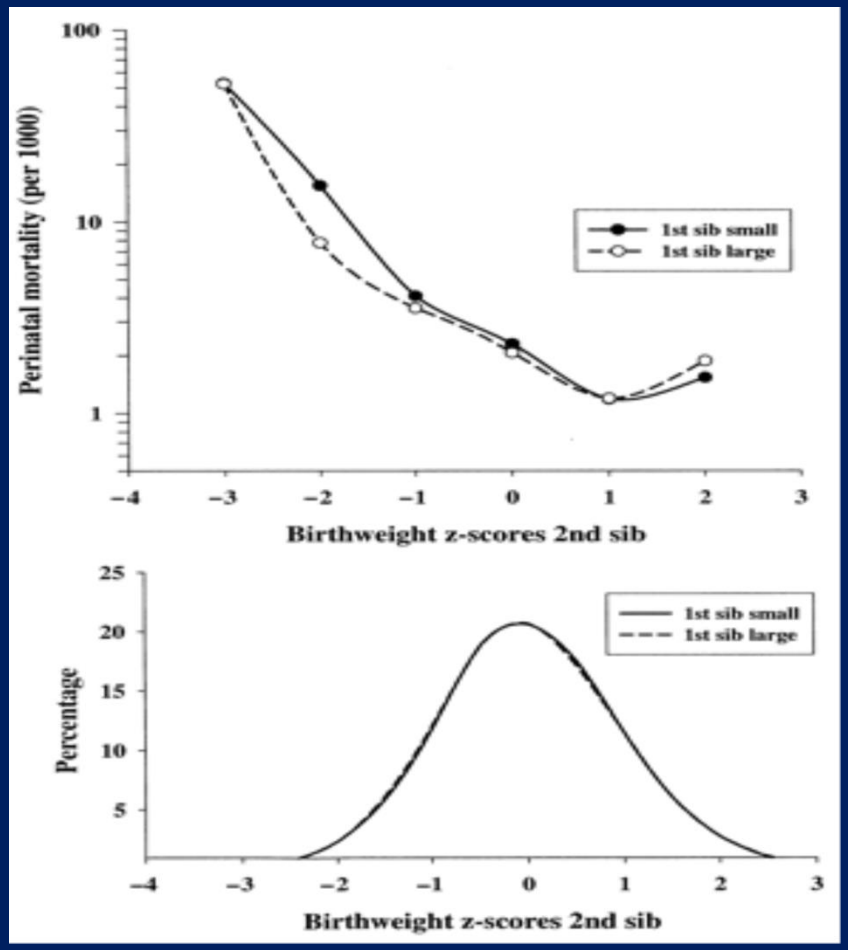
SGA and FGR detection (EFW Hadlock for BW UK90)

	Before	After
SGA <10th c	25.7%	31.4%
SGA <3rd c	21.5%	26.9%
Chance of scan showing EFW <10th c (SPR):	10.7%	4.1%

Using criteria for FGR:

SGA <10th c	40.5%
SGA <3rd c	57.2%
Chance of scan showing criteria for FGR:	7.1%

LGA: the big babies



Sensitivity similar to SGA

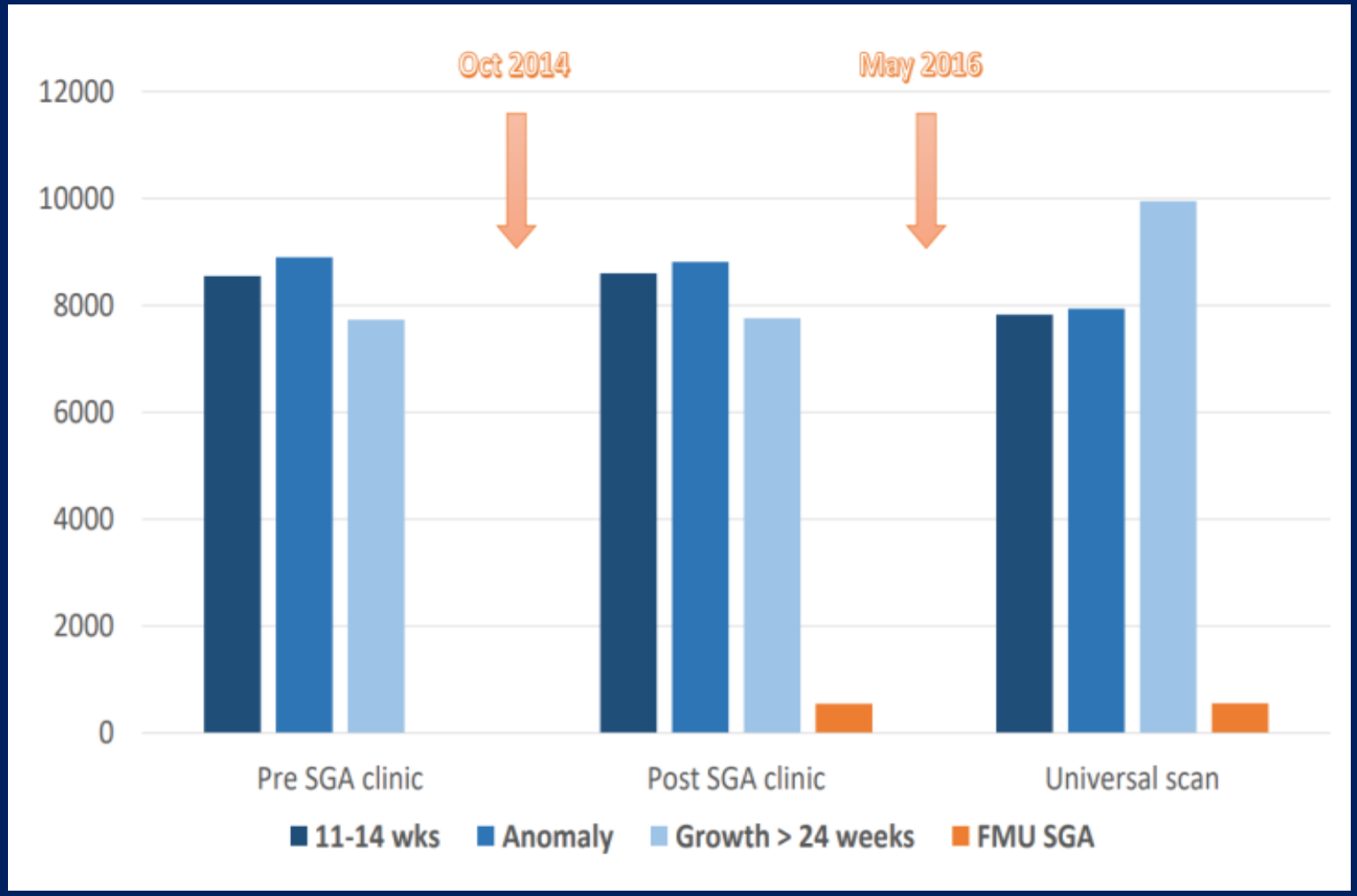
Do we screen for GDM?

Maternal anxiety

Do we do CS or IOL?

If not- if we knew they were big why did we not do anything?

Workload


Oct 2014
May 2016
12000
10000
8000
6000
4000
2000
0
Pre SGA clinic
Post SGA clinic
Universal scan
11-14 wks
Anomaly
Growth > 24 weeks
FMU SGA

Lessons from the universal 36 week scan

You will not prevent all mortality

You will not detect all SGA

You will not even detect every breech

Induction and CS increases can be ameliorated by a clear risk stratification process

Indeed, if you don’t do this, you will cause long term harm by too much early term birth

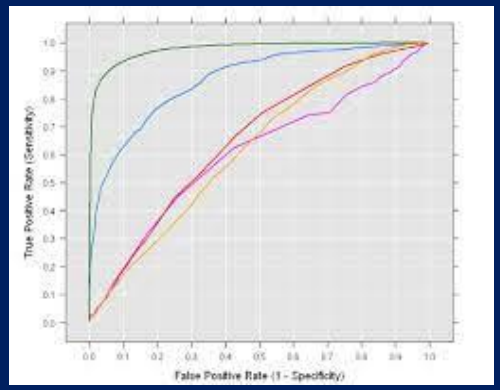
Reducing mortality with minimum morbidity

There are multiple independent risk factors for stillbirth

Given a linear relationship between degrees of risk (eg age), algorithms that rely on categorical ‘cut offs’ will work poorly

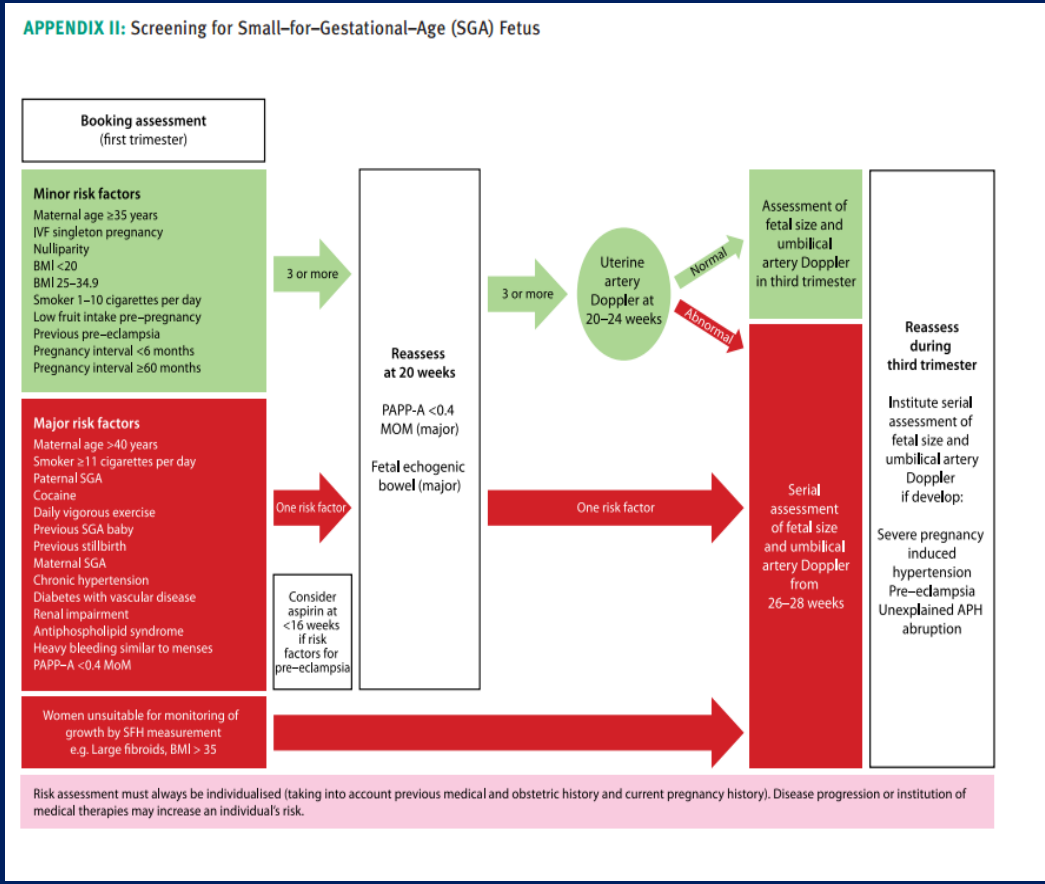
The answer is a risk prediction model, integrating *continuous* data on *independent* risks to produce an *individual* risk

..and then decide…



Thank you

Ultrasound: who to scan? And when?



What did existing data suggest?

- Universal scan does not change mortality
- (underpowered and old data)
- Universal scan does not improve morbidity (low risk)
- Universal scan considerably increases SGA detection (nullips)

Macrosomia: EFW >95th c

- As sensitive as for SGA
- AC >95th c more sensitive and less specific than EFW
- What do you do with these babies? – now you, the woman and the lawyers know

Worry about the very small (<3rd c)

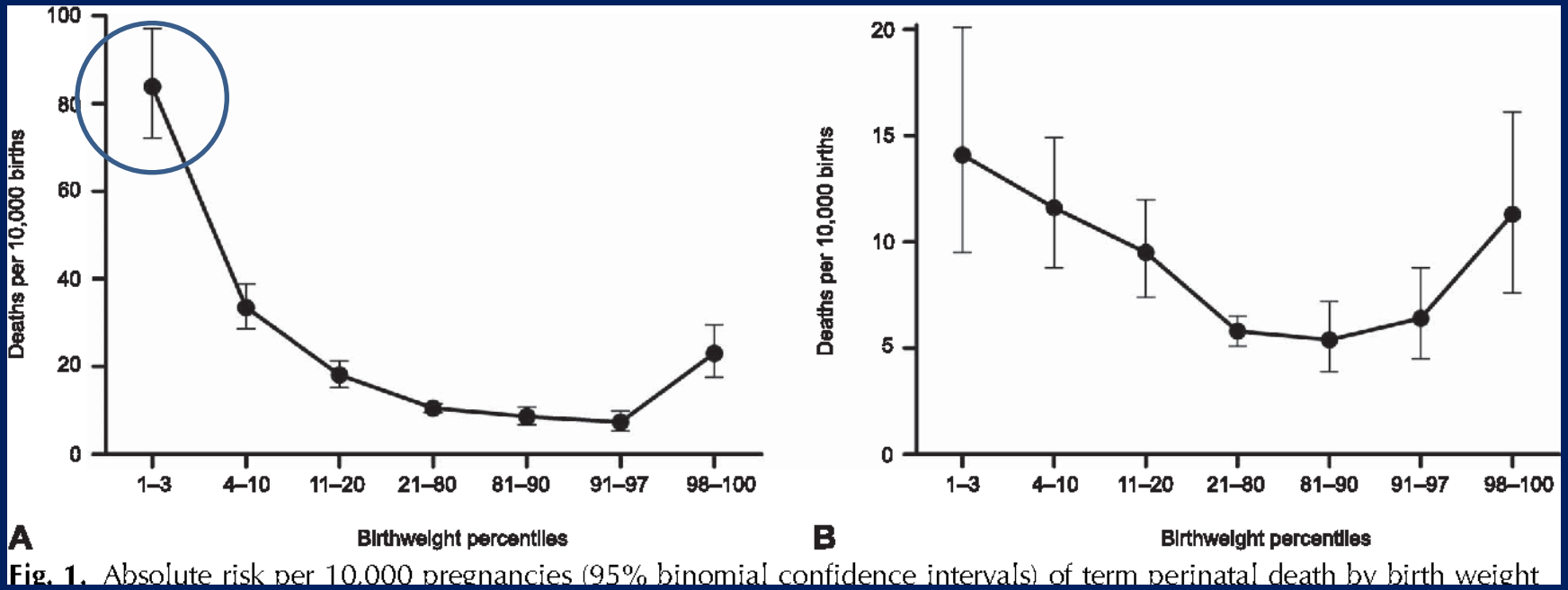


Fig. 1. Absolute risk per 10,000 pregnancies (95% binomial confidence intervals) of term perinatal death by birth weight

Worry about the Doppler

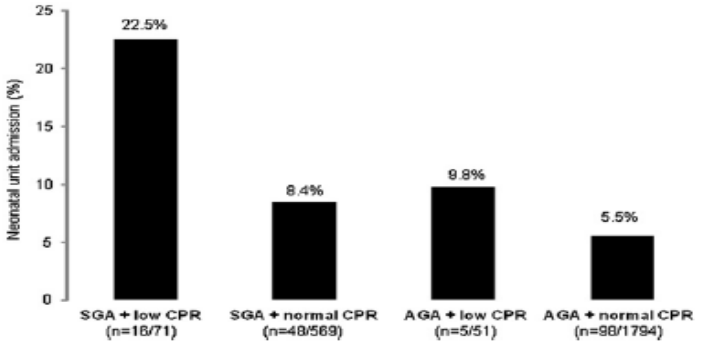
Umbilical artery (UmbA): good <34 weeks; increasingly poor later. AEDF= advanced problem but very rare >34 weeks

Uterine artery: will help tell the abnormal from the normal, and the SGA OK from the SGA FGR

Cerebroplacental ratio: (MCA PI/ UMbA PI): better than MCA or UmbA >34 weeks. Will help tell the SGA OK from the SGA FGR. And occasionally detect the AGA FGR

But the AGA FGR is very difficult to find, and these deaths are very difficult to prevent without wholesale intervention
And this may cause more problems

FIGURE 3
Rates of neonatal unit admission in the 4 study groups



The rates of neonatal unit admission in the 4 study groups according to a combination of a BW cutoff of the 10th percentile and a CPR cutoff of 0.6765 MoM.

AGA, average for gestational age; *BW*, birthweight; *CPR*, cerebroplacental ratio; *SGA*, small for gestational age.

Khalil. Doppler and neonatal unit admission. Am J Obstet Gynecol 2015.

Worry about the CTG

- This is not a good tool unless used daily
- Because it only detects pre preterminal compromise
- But an abnormal antenatal CTG is an ominous sign and this includes ‘not meeting criteria’

Worry about induction of labour <38 weeks

- Of course its sometimes a lifesaver
- But you are taking a risk with someone else's life and this should not be undertaken lightly

Don’t worry about

- Recurrent reduced fetal movements
- Well controlled gestational diabetes
- Mild cholestasis
- The small (ish) baby with reassuring features

OxGRIP principles

36 week growth scan for all

Assessment of ACGV (growth trajectory) and umbA and MCA Doppler (CPR)

Refer rather than induce 'abnormal'

'Pay for' extra scan by reducing others: keep it simple and disciplined

'Automatic' risk assessment at existing 20 week scan incl universal uterine artery

Only do 'serial growth scans' if abnormal/ other hx

Other scans according to strict guideline only: new complications

Not automatic IOL for SGA at 37 weeks

What do you do with all the 'abnormal'

Guidelines for fetal growth assessment (FGA) clinics (prev SGA clinic) protocols LI/CI/AC 21/02/18 draft 10

Referral criteria following 36 week growth scan

1) EFW <10th centile
2) AC reduction > 40 percentile points
3) Isolated CPR < 1.0 or isolated Umbilical PI >95th centile

Check:

1) EFW incl AC reduction (consider sex adjustment: female fetus: 10th c is total population 8th c; male fetus 10th c is total population 12th c)
2) CPR
3) Uterine arteries
4) PAPP-A

Management in FGA clinic

36-37 weeks:

- Deliver if EFW <10th centile ***AND*** CPR < 1.0 or Umbilical PI > 95th centile: please perform CTG in the clinic
- Otherwise reassess 1-2 weeks and see below

From 37+0 weeks:

Deliver if:

- EFW <3rd centile
- EFW >3rd <10th c ***AND*** CPR < 1.0 or Umbilical PI > 95th centile: please perform CTG in the clinic
- EFW >3rd <10th c ***AND*** 1+ of the following criteria →
- CPR < 1 ***AND*** 1+ of the following criteria →

- Abnormal uterine arteries: 20 weeks total PI > 2.5 or current total PI > 2.0
- Maternal age >/= 40
- ACGV <10th centile or below (from the anomaly scan)
- PAPP-A < 0.3 MoMs
- Medicated hypertension (note for preeclampsia deliver > 36 weeks anyway)
- Diabetes on metformin/insulin (note delivery plan should be in place)

Consider CTG if isolated extreme CPR

umbA PI raised with normal CPR, all else normal: treat as normal

Review at the following intervals:

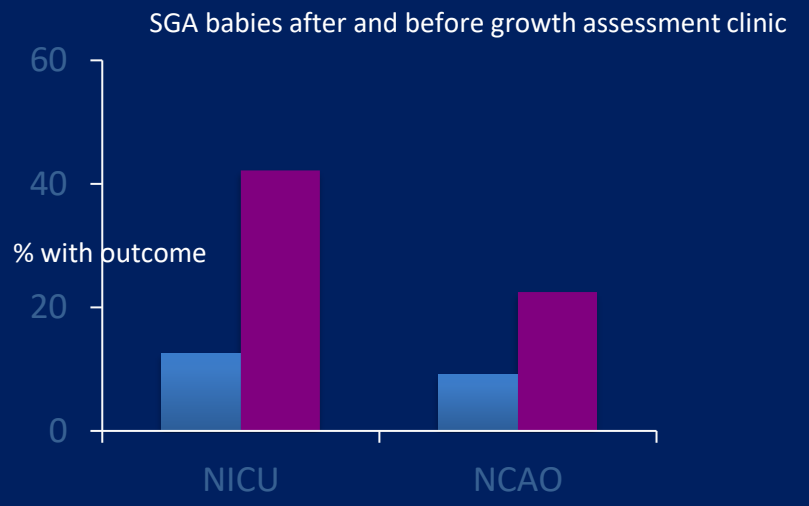
1 week:

- Isolated CPR < 1 (consider earlier repeat)

2 weeks:

- All others i.e. Isolated EFW >3rd c with no complicating features
- Isolated ACGV reduction with (above) no complicating features

Sorting term SGA and FGR



SGA with normal umbA PI at >34 weeks

Pre:
follow RCOG GTG via antenatal clinics

Post:
assess risk factors and allow expectant management to 41 weeks
Deliver *only* according to strict guidelines re EFW, CPR, maternal risk factors

Assess the impact of introduction (n= 143 post; 138 pre)

(now also using uterines and AC growth trajectory)