

## SERVICE MODELLING ROUTINE OBSTETRIC ULTRASOUND WEST MIDLANDS

### SUMMARY

This report describes a modelling of the routine obstetric ultrasound service in the West Midlands. It has been undertaken to quantify the proposed expansion in routine service necessary to adopt national and regional guidelines.

The changes are:

- **First trimester** - Introduction of combined test for Down's syndrome screening - National Screening Committee (NSC) and NICE Guidelines.
- **Second trimester** - Inclusion of cardiac outflow tracts (OFT) in the content of the mid trimester anomaly scan - NICE guidelines.
- **Third trimester** - Introduction of regional standard for scanning provision in high-risk pregnancy - Regional Ultrasound Group recommendation.

It is estimated that the West Midlands obstetric ultrasound service needs to expand by 48%. This reflects an increase in the annual scanning requirement of 46,210 scans and 32,262 scanning hours.

**Table 1 - Summary of results: West Midlands Obstetric Ultrasound service**

Scan type	Current service		Proposed service		Estimated change			
	Scans	Hours	Scans	Hours	Scans	Hours	% hours trimester	% hours total
<b>1st trimester</b>	74,350	14,870	85,057	24,774	10,706	9,903	+67%	+15%
<b>2nd trimester</b>	80,896	26,965	84,573	41,367	3,677	14,402	+53%	+21%
<b>3rd trimester</b>	100,859	25,215	132,685	33,171	31,827	7,957	+32%	+12%
<b>All scans</b>	<b>256,105</b>	<b>67,050</b>	<b>302,316</b>	<b>99,312</b>	<b>46,210</b>	<b>32,262</b>	<b>+48%</b>	<b>+48%</b>

If it were assumed that a sonographer employed full-time with no additional non-clinical commitments scans for 35 hours per week for 45 weeks per year; the additional scanning time of 32,262 hours would equate to an additional 20.5 whole time equivalent sonographers.

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## BACKGROUND

The routine antenatal ultrasound package consists of two scans offered to all pregnant women; a first trimester (dating) and a second trimester (mid trimester anomaly) scan. Antenatal ultrasound is standardised across the West Midlands, with all units routinely offering these two scans to all women. In addition, those at high-risk of perinatal mortality may undergo third trimester ultrasound, which may need to be performed on multiple occasions to assess fetal growth.

An expansion of the routine antenatal ultrasound package is necessary to accommodate national (National Screening Committee, NICE) and regional (Perinatal Institute/Regional Ultrasound Group) standards affecting all trimesters.

## METHODS

The key parameters included in the service modelling are listed below (Table 2). Other parameters affecting service requirement have been excluded, e.g. trends in birth rate, deprivation, and obesity. These are likely to need more gradual long-term changes to the ultrasound service.

The modelling is limited to routine obstetric ultrasound service; diagnostic scans and invasive procedures are excluded as these are usually performed by fetal medicine or obstetric staff. Data are service-based (births at West Midlands units) using births from 2007.

**Table 2 - Key parameters used in modelling**

<b>Constant(s)</b>	<b>Constant despite changes to service</b>
Pregnancy attrition rate	Reflects spontaneous fetal losses/miscarriages throughout pregnancy.
<b>Variable(s)</b>	<b>Changes made to ultrasound service</b>
Number/type of scans offered	The number of women undergoing scans is determined by 5 factors: <ul style="list-style-type: none"> <li>i) Routine ultrasound package - the number of scans offered to all women.</li> <li>ii) <i>Indications</i> for non-routine scans (3rd trimester) i.e. the proportion of women defined as high-risk.</li> <li>iii) <i>Number/frequency</i> of non-routine scans (3rd trimester) offered to high-risk women.</li> <li>iv) Uptake rate for scans - assumed to be 100% except for first trimester Down's syndrome screening.</li> <li>v) Recall rates - proportion of scans needing to be repeated because satisfactory images cannot be obtained.</li> </ul>
Appointment times	Increasing complexity of scans requiring more scanning time.

Estimates for the values of the constants and variables in Table 2 are derived from West Midlands data where available or from national data. Where no published data exist, "best guess" estimates are made.

### Pregnancy attrition rates

Attrition rates are based on those used by the Down's Syndrome Screening Quality Assurance Support Service (DQASS).

**Table 3 - Pregnancy cohort for each trimester - West Midlands units 2007**

<b>Trimesters</b>	<b>Pregnancies</b>	<b>Attrition rate → birth</b>
First trimester	74,350	3.93%
Second trimester	73,542	1.20%
Third trimester	72,541	0.60%
At birth	71,539	0.00%

## Number/type of scans

### First trimester

The National Screening Committee (NSC) model of best practice<sup>1</sup> sets a standard for Down's syndrome screening which includes nuchal translucency (NT) measurement. There is currently no routine NHS provision for NT measurement within the West Midlands. A first trimester contingency screening programme (requiring NT for 20% of the screened population) has been implemented and tested in Stafford.

#### Estimates used (1st trimester):

Uptake of first trimester screening	90%	A proportion of women will decline screening and others will book too late for NT measurement (13 <sup>+6</sup> weeks).
Recall rate for dating scan including NT	15%	Data from Glasgow study <sup>2</sup> , n = 5, 084

### Second trimester

The NICE antenatal care guidelines<sup>3</sup> recommend the inclusion of cardiac outflow tracts (OFT) in the content of the mid trimester anomaly scan. This will also increase the number of recall scans necessary to acquire satisfactory images. Recording of images and formal consent-taking will also increase appointment times.

#### Estimates used (2nd trimester):

Recall rate for mid trimester anomaly scan excluding cardiac OFT	10%	Best guess
Recall rate for mid trimester anomaly scan including cardiac OFT	15%	UK NSC estimate <sup>4</sup>

### Third trimester

The Birmingham and Black Country's Confidential Enquiry into stillbirths with intrauterine growth retardation (IUGR) repeatedly found evidence of inadequate growth assessment including a lack of serial assessment by ultrasound when indicated<sup>5</sup>, which independent panels considered as contributing to avoidable deaths. A subgroup of the West Midland Regional Ultrasound Group has defined the standard for scanning provision in high-risk pregnancy, with an agreed definition for what constitutes "high-risk pregnancy"<sup>7</sup>.

Serial growth scans should be offered to women where growth surveillance by fundal height measurement (FH) is not possible (e.g. high BMI, fibroids) or who are at high-risk for IUGR or stillbirth (e.g. previous history, twins). Referrals will also be generated from fetal growth screening by FH measurement. There is expected to be no change in the requirement for non-growth third trimester scans, e.g. for placental site, fetal presentation.

The content of third trimester scans is not particularly complex and therefore recall rates are assumed to be zero.

### Estimates used (3rd trimester):

<i>Scans/pregnancy</i>		
Current activity non-growth scans/pregnancy	0.37	WM workforce/workload survey <sup>6</sup>
Current activity growth scans/pregnancy	1.02	WM workforce/workload survey <sup>6</sup>
Proposed: high-risk population, or screening by FH measurement not possible	4.5	Fetal growth assessment <sup>3,7</sup> at 3 week intervals from 28 weeks, half of pregnancies will deliver before 40 week scan
Proposed: low-risk population FH screening true +ve (IUGR)	4	Fetal growth assessment at 2 week intervals, duration will depend on gestation of diagnosis and delivery
Proposed: low-risk population FH screening false +ve (not IUGR)	1	Single scan will confirm FH screening as false +ve
Proposed: low-risk population - decreased fetal movements	1	Single scan
<i>% women for ultrasound growth assessment</i>		
Proposed: high-risk population, or where FH screening not possible	25%	Prevalence of risk factors - risk categories are not mutually exclusive
Proposed: low-risk population, FH screening true +ve (IUGR)	4.8%	Target of 60% detection of IUGR (low risk prevalence of IUGR: 8%)
Proposed: low-risk population FH screening false +ve (not IUGR)	15%	From FH screening
Proposed: low-risk population decreased fetal movements	10%	Review by Frøen <sup>8</sup>

### Appointment times

Appointment times for routine first and second trimester ultrasound have been increased due to new content from changes to screening programmes.

Unless otherwise stated, estimates for scan duration are taken from West Midlands Ultrasound Workload/Workforce survey 2007<sup>6</sup>. Data on duration of scans that include NT measurement are taken from national ultrasound survey<sup>9</sup>. Regional data are not available, as NT measurement is not routinely performed in West Midlands units.

**Table 4 - Routine ultrasound scan duration (minutes)**

Routine scan duration		mins
1st trimester	Dating*	12
	Extra time nuchal translucency*	6
	Recall nuchal translucency*	18
2nd trimester	Mid trimester anomaly†	20
	Extra time new anomaly content‡	10
	Recall mid trimester anomaly †	25
3rd trimester	Growth†	15
	Non-growth†	15

\* UK data NSC Ultrasound Survey 2002<sup>9</sup>

† West Midlands data RUG Workforce/workload survey 2007<sup>6</sup>

‡ Best guess.

Recall rates depend on the difficulty involved in acquiring satisfactory images, fetal position, and maternal characteristics including body-mass index. They are also a product of the length of the routine appointment; the longer the time allocated for a particular scan, the more likely that all the images are achieved, and therefore the recall rate will be lower.

## RESULTS

**Table 5 - Service modelling: West Midlands Obstetric Ultrasound service**

Scan type	Current service		Proposed service		Estimated change			
	Scans	Hours	Scans	Hours	Scans	Hours	% hours trimester	% hours total
Dating	74,350	14,870	7,435	1,487				
Dating + NT	-	-	66,915	20,075				
Recall NT	-	-	10,706	3,212				
<b>1st trimester</b>	<b>74,350</b>	<b>14,870</b>	<b>85,057</b>	<b>24,774</b>	<b>10,706</b>	<b>9,903</b>	<b>+67%</b>	<b>+15%</b>
Mid T	73,542	24,514	-	-				
Mid T + OFT	-	-	73,542	36,771				
Recall mid T	7,354	2,451	11,031	4,596				
<b>2nd trimester</b>	<b>80,896</b>	<b>26,965</b>	<b>84,573</b>	<b>41,367</b>	<b>3,677</b>	<b>14,402</b>	<b>+53%</b>	<b>+21%</b>
Growth	73,828	18,457	105,655	26,414				
Non-growth	27,030	6,758	27,030	6,758				
<b>3rd trimester</b>	<b>100,859</b>	<b>25,215</b>	<b>132,685</b>	<b>33,171</b>	<b>31,827</b>	<b>7,957</b>	<b>+32%</b>	<b>+12%</b>
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It should be noted that the model assumes a standard regional ultrasound service. This is true in broad terms but it is likely that there is local variation in practice, e.g. some units are attempting to record outflow tracts for a proportion of pregnancies.

The quality of the radiology information systems in use throughout the region means that detailed data on current workload and indications for scan are not available. This prevents a more sophisticated prediction of changes to ultrasound services.

<sup>1</sup> Fetal Anomaly Screening Programme - Screening for Down's Syndrome: UK NSC Policy recommendations 2007–2010: Model of Best Practice.

[http://www.fetalanomaly.screening.nhs.uk/images/Fetal/Publications/DH\\_084731\[1\].pdf](http://www.fetalanomaly.screening.nhs.uk/images/Fetal/Publications/DH_084731[1].pdf).

<sup>2</sup> Stenhouse E J, Crossley J A, Aitken D A, Brogan K, Cameron A D, Connor J M. First-trimester combined ultrasound and biochemical screening for Down syndrome in routine clinical practice. *Prenat Diagn* 2004; 24: 774-780.

<sup>3</sup> National Institute for Health and Clinical Excellence. Antenatal care: routine care for the healthy pregnant women NICE clinical guideline 6. London: NICE, 2008.

<sup>4</sup> UK National Screening Committee NHS Fetal Anomaly Screening Programme for England. A consultation on the 'screening menu' for the 18 to 20 week 6 days ultrasound scan for pregnant women. May 2005.

<sup>5</sup> Perinatal Institute (2007) Confidential Enquiry into Stillbirths with IUGR Report.

[http://www.perinatal.nhs.uk/rpnm/CE\\_SB\\_Final.pdf](http://www.perinatal.nhs.uk/rpnm/CE_SB_Final.pdf).

<sup>6</sup> West Midlands Regional Ultrasound Group. Regional survey 2007 Workforce/Workload.

<http://www.pi.nhs.uk/ultrasound/workforce/workforce.htm>.

<sup>7</sup> West Midlands RUG Subgroup Fetal growth surveillance. Ultrasound standards for fetal growth assessment. <http://www.perinatal.nhs.uk/ultrasound/standards/growth.htm>.

<sup>8</sup> Frøen J F. A kick from within – fetal movement counting and the cancelled progress in antenatal care. *J Perinat Med* 2004; 32: 13–24.

<sup>9</sup> UK National Screening Committee. Antenatal Ultrasound Screening Ultrasound Survey of England 2002. London: UK National Screening Committee Programmes Directorate; 2005.