

**Interim Report on SSBCNMN analysis of the Neonatal Data Analysis Unit (NDAU)**  
**Neonatal Mortality Data 2010-2012**

**1. Summary points of the NDAU Neonatal Mortality report:**

- 1.1 NDAU has reported mortality data per network for all babies born at <32+0 gestation in England<sup>1</sup>
- 1.2 SSBCNMN is network 14 in the funnel plots in the NDAU neonatal mortality report
- 1.3 SSBCNMN has the 2nd highest SMR (raw 1.35, adjusted 1.27) in England but is not an outlier with both the unadjusted and adjusted SMR falling within the control limits in the funnel plots
- 1.4 The NDAU report is limited as data is taken only from the BadgerNet system and therefore only reports deaths that are recorded in this system and excludes deaths that occurred outside of neonatal units e.g. stillbirths, deaths in labour ward, hospices, surgical units. There is wide variation in the use of BadgerNet between neonatal units in recording deaths that occur in these areas
- 1.5 NDAU identify that as the number of expected deaths is low there is a fairly low power (50%) to detect unusual performance
- 1.6 The NDAU data does not reflect other confounding factors on mortality rates such as social deprivation, maternal smoking etc.

**2. Summary of SSBCNMN NDAU data analysed**

- 2.1 135 deaths are reported by NDAU to have occurred for babies booked to be delivered in SSBCNMN in 2010-2012 (NB full 2010 data would not be included as the network did not officially start using the Badger neonatal data system until April 2010 although some units started entering some babies before this, therefore number of deaths and also denominator data are inaccurate for 2010)

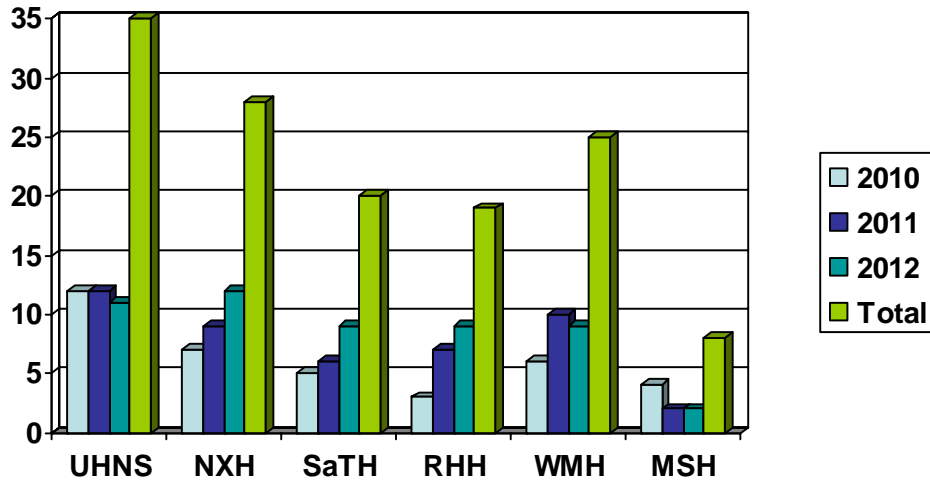
**3. Levels of neonatal units in SSBCNMN**

- 3.1 Neonatal Intensive Care Units (NICU) provide the highest level of care to the smallest and/or sickest babies. E.G. babies that need breathing support from a ventilator for more than 48 hours, weigh less than 1000g, or are born before 27 weeks of pregnancy.
- 3.2 Local Neonatal Units (LNU) provide a high level of care, but the babies are not as small or sick. Breathing support including ventilation for up to 48 hours and other treatment such as intravenous fluids for babies too ill or small to feed by mouth can be provided.
- 3.3 Special Care Baby Units (SCBU) provide care that cannot be given on a postnatal ward, including tube feeding, oxygen, and treatment for jaundice or infection.
- 3.4 There are six neonatal units in SSBCNMN, the table below identifies the abbreviations used for each unit in the following graphs and tables, the level of neonatal unit and the hospital trust.

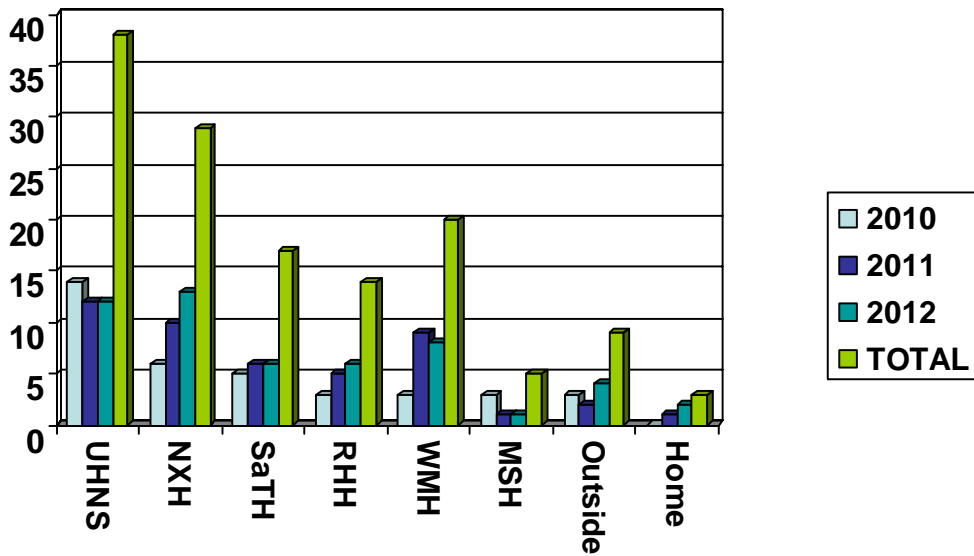
<b>Key to SSBCNMN Neonatal Units</b>		
<b>Abbrev.</b>	<b>Level</b>	<b>Hospital Trust</b>
UHNS	NICU	University Hospital of North Staffordshire NHS Trust
NXH	NICU	Royal Wolverhampton Hospitals NHS Trust
SaTH	LNU	Shrewsbury and Telford Hospital NHS Trust
RHH	LNU	Dudley Group NHS Foundation Trust
WMH	LNU	Walsall Healthcare NHS Trust
MSH	SCBU	Mid Staffordshire NHS Foundation Trust
BBA	Born before arrival	

#### 4. Findings

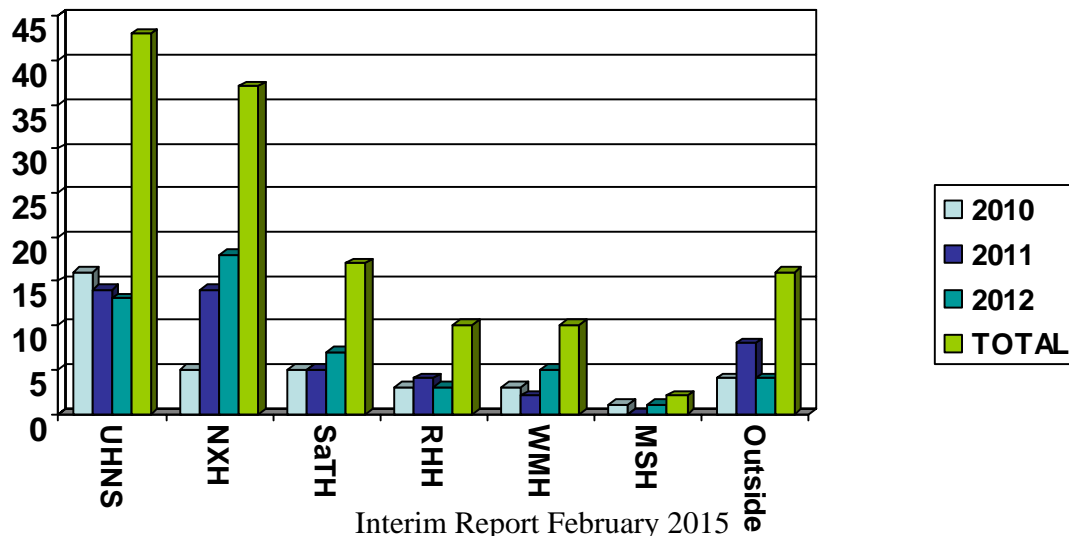
Graph 1: Number of deaths by hospital of booking



Graph 2: Number of deaths by hospital of birth



Graph 3: Number of deaths by hospital of death



- 4.1 Graphs 1 to 3 illustrate the movement of babies both in-utero and ex-utero towards the NICUs and also outside of the network (presumably to NICUs but this cannot be confirmed).
- 4.2 The difference in the numbers of deaths attributable to the different units between graphs 1 and 2 illustrates the effect of in-utero transfers and the difference between graphs 2 and 3 the effects of ex-utero transfers.
- 4.3 It should be noted that the difference in the number of deaths between the 2 NICUs may be related to the fact that UHNS has approximately 6000 deliveries a year with NXH having approximately 4000.
- 4.4 WMH does appear to have a disproportionate number of deaths compared to the other LNUs despite similar birth rates.
- 4.5 The graphs also demonstrate the fact that a significant number of babies die at the LNUs and never make it to an NICU. Table 1 below gives the percentage of all deaths occurring at each level of unit.

**Table 1: Number of deaths occurring at different levels of unit**

Year	SCBU		LNU		NICU		Outside	
2010	1	3%	11	28%	21	57%	4	11%
2011	0	0%	11	24%	28	61%	7	15%
2012	1	2%	15	29%	31	60%	5	10%

- 4.6 As can be seen from Table 1 a significant proportion of all babies <32 weeks died at an LNU (24-29%) and almost half of these (43%) were <27 weeks. According to the network care pathways babies <27 weeks should be cared for at NICUs, although the network care pathways were only introduced in April 2011 and have taken time to be fully implemented this is an area that requires further investigation to understand why these babies were born and died in an LNU.

- 4.7 The network care pathways are as follows:

Hospital	Level	Gestation limits	Primary receiving unit
UHNS	NICU	None	N/A
NXH	NICU	None	N/A
SaTH	LNU	>27+0	UHNS
RHH	LNU	>27+0	NXH
WMH	LNU	>28+0	NXH
MSH	SCBU	>32+0	UHNS

**Table 2: Inborn within network (Excludes IUT and EUTs)**

Year	No. Inborn	No. inborn deaths	Percentage
2010	422	29	7%
2011	489	31	6%
2012	561	36	6%
Total	1472	96	
3 year average	489	32	<b>7%</b>

**Table 3a: In-utero transfers within network**

Year	No. IUTs in network	No. IUT deaths	Percentage
2010	10	3	30%
2011	30	1	3%
2012	14	3	21%
Total	54	7	
3 year average	18	2	<b>13%</b>

Table 3b: In-utero transfers out of network

Year	No. IUTs out of network	No. IUT deaths	Percentage
2010	22	3	14%
2011	24	2	8%
2012	34	3	9%
Total	75	8	
3 year average	25	3	<b>11%</b>

Table 4a: Ex-utero transfers within network

Year	No. EUTs in network	No. EUT deaths	Percentage
2010	14	2	14%
2011	24	7	29%
2012	29	8	28%
Total	67	17	
3 year average	22	6	<b>25%</b>

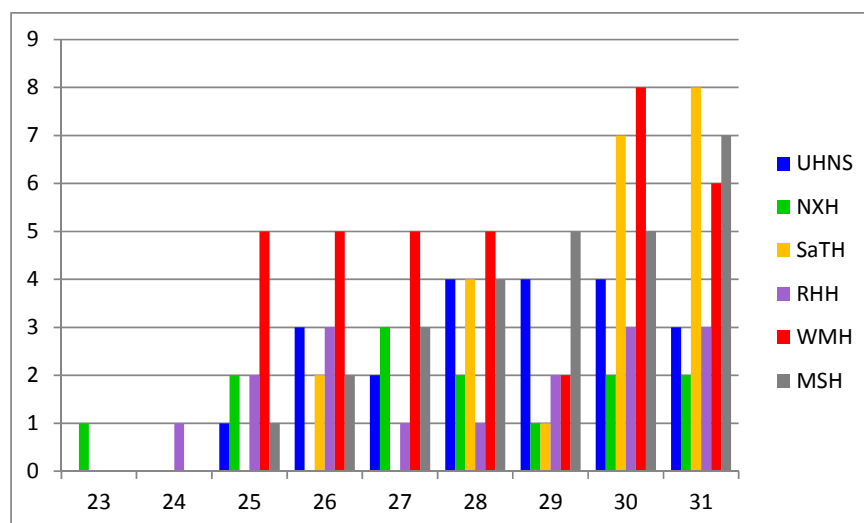
Table 4b: Ex-utero transfers out of network

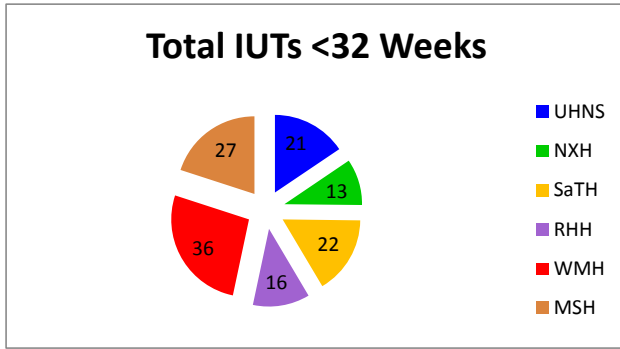
Year	No. EUTs out of network	No. EUT deaths	Percentage
2010	4	0	0%
2011	6	6	100%
2012	20	1	5%
Total	30	7	
3 year average	10	2	<b>23%</b>

4.8 Tables 2- 4 illustrate that the lowest death rates are in inborn babies, with a slightly higher death rate in in-utero transfers and a much higher death rate in ex-utero transfers. There is little variation in the death rate between transfers that stay within or go outside of the network.

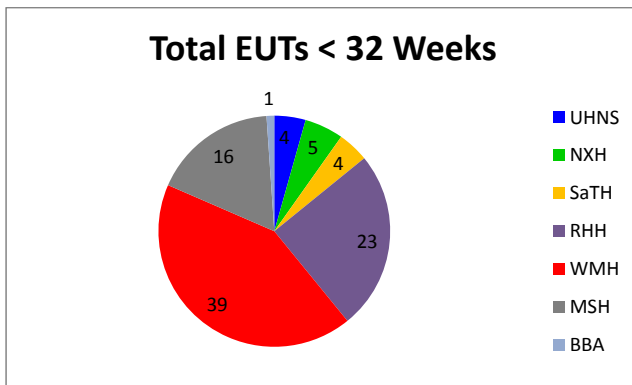
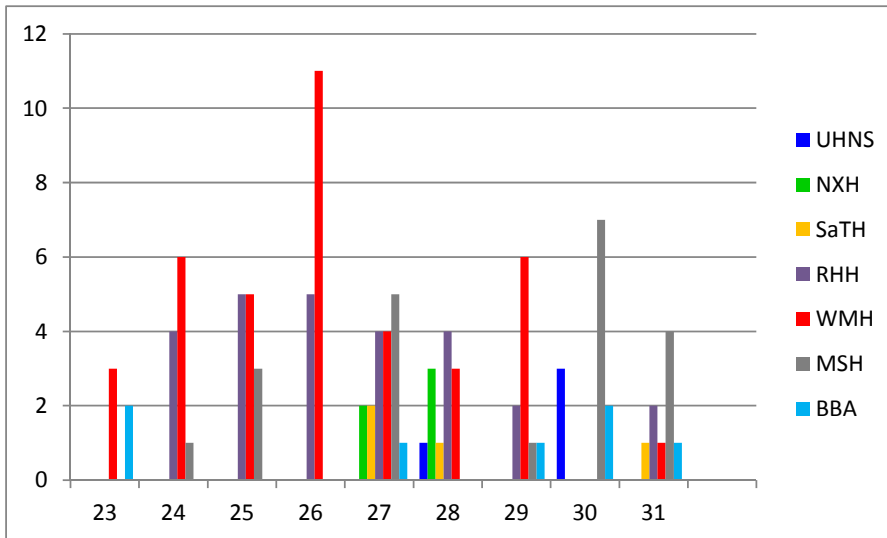
4.9 Combining the previous finding that a large proportion of babies were born and died at LNUs with the finding that ex-utero transfers have a higher death rate reinforces the recommendation that these babies should be transferred in-utero to NICUs as per the network care pathways. These findings are in line with the Epicure data <sup>2</sup>

Graph 4: Number of IUTs by gestation and neonatal unit





Graph 5: Number of EUTs by gestation and neonatal unit



- 4.10 Graph 4 identifies a large number of IUTs occurring after 27 weeks gestation despite the three LNUs being able to provide care for babies above this gestation indicating capacity issues in these neonatal units
- 4.11 Graphs 4 and 5 illustrate the originating unit of the IUTs and EUTs, both show a disproportionate number of transfers originating at WMH.

Table 5: Mortality by gestation and whether inborn, IUT or EUT

Gestation	Overall	Inborn	IUT	EUT
23	74%	71%	80%	0%
24	48%	53%	36%	0%
25	41%	56%	23%	27%
26	26%	31%	6%	33%
27	16%	12%	33%	14%
28	8%	7%	17%	10%
29	7%	6%	10%	7%
30	4%	4%	0%	7%
31	4%	5%	11%	0%

4.12 Table 5 indicates a higher mortality seen in babies < 27 weeks gestation who are inborn compared to IUT, this reflects the number of babies < 27 weeks born in LNUs and therefore exceptions to the network care pathways as discussed in 4.6 on page 3.

Table 6: Percentage mortality by gestation and levels of unit combined by unit of booking

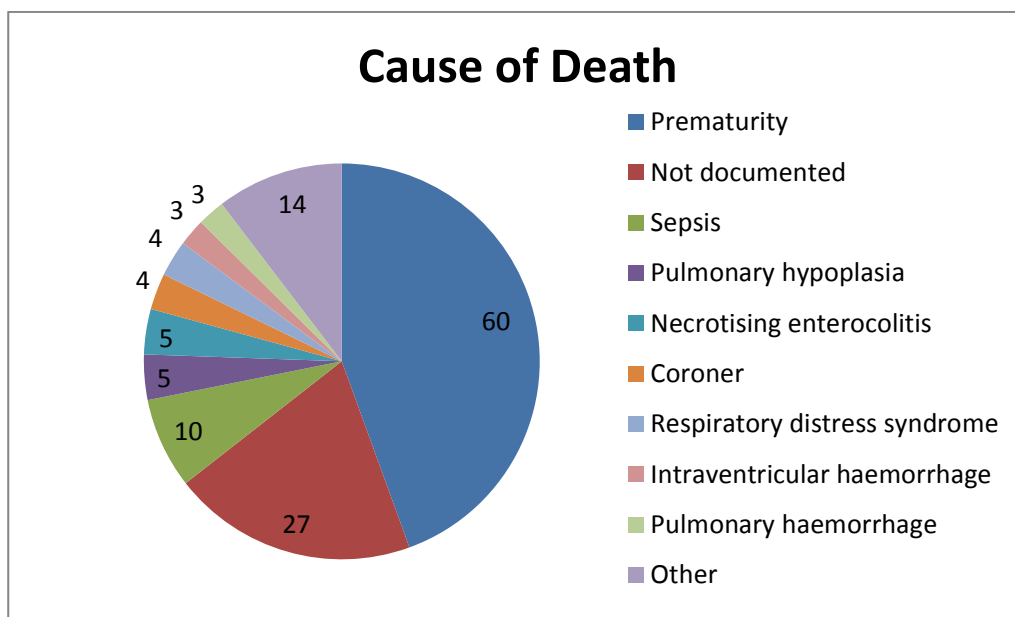
Gest	NICU			LNU			SCBU		
	In	IUT	EUT	In	IUT	EUT	In	IUT	EUT
23	71	0	NA	71	100	100	NA	NA	NA
24	55	NA	NA	22	0	40	100	NA	0
25	38	33	NA	20	29	30	NA	0	33
26	19	33	NA	33	40	6	NA	0	N
27	10	0	50	14	0	20	NA	67	40
28	4	17	0	8	0	38	NA	0	N
29	2	0	NA	8	20	13	NA	0	0
30	2	0	0	4	6	NA	0	20	0
31	5	0	NA	3	0	25	17	NA	0

4.13 It should be noted that the LNU figures in tables 6 & 7 are skewed by one unit that did not transfer out babies <27 weeks according to their care pathway. As the numbers involved are very small one death can alter the percentages markedly. Table 7 shows the numbers of babies admitted and the number of deaths by week of gestation and level of neonatal unit:

Table 7: Numbers of babies who died /number of babies admitted by gestation and level of unit

Gest	NICU			LNU			SCBU		
	In	IUT	EUT	In	IUT	EUT	In	IUT	EUT
23	10/14	0/1	NA	5/7	1/1	4/4	NA	NA	NA
24	17/31	NA	NA	2/9	0/1	4/10	1/1	NA	0/1
25	11/29	1/3	NA	2/10	2/7	3/10	NA	0/1	1/3
26	6/32	1/3	NA	6/18	4/10	1/16	NA	0/2	NA
27	6/60	0/5	0/5	5/36	0/6	2/10	NA	2/3	2/5
28	2/54	1/6	0/4	5/65	0/10	3/8	NA	0/4	NA
29	1/52	0/5	NA	5/59	1/5	1/8	NA	0/5	0/1
30	1/56	0/6	0/3	3/74	1/18	0	0/1	1/5	0/7
31	5/108	0/5	NA	3/102	0/17	1/4	1/6	NA	0/4

Chart 1: Badger documented causes of death



4.14 From this chart it can be seen that documentation of cause of death on Badger is poor with the primary cause of death not documented in 27 cases and that the broad cause of prematurity/extreme prematurity is often used as the primary cause of death, though this may not necessarily be the same as the cause of death recorded on the death certificate.

## 5. Action plan

5.1 Analysis of the data has identified several areas requiring improvement and further areas of work as follows;

	<b>Intention</b>	<b>Action</b>	<b>Lead</b>	<b>Timescale</b>
1	Decreased number of extremely premature babies less than 27 weeks being born in the hospitals without NICUs	<p>Work with maternity colleagues to initiate care pathways for mothers with threatened preterm labour following telephone triage at their unit of booking to be able to be directed to attend directly at a hospital with a NICU or be moved in a timely fashion as an IUT</p> <p>Remind WM Ambulance Service of the appropriate place for delivery of babies less than 27 weeks</p> <p>Monitor numbers of In Utero and Ex Utero transfers into NICUs and report quarterly</p>	<p>Adam Gornall Lead Obstetrician</p> <p>Ruth Moore Manager / Lead Nurse</p> <p>Mel Sutcliffe Clinical Effectiveness Lead</p>	<p>Pilot RWH/WMH Apr-Oct 2015</p> <p>February 2015</p> <p>Quarterly in 2015 to QIPP &amp; Board meetings</p>
2	Improved adherence to network care pathways	<p>Continue to monitor and report exceptions to network care pathways and feedback to network board</p> <p>Meet with units to feedback exceptions and explore ways to improve compliance with care pathways</p>	Ruth Moore Manager / Lead Nurse	Quarterly in 2015 to QIPP & Board meetings
3	Increased awareness amongst expectant women and their partners of how neonatal services are organised and the importance of being in the right level of unit for the care their baby requires	<p>Introduce an updated network leaflet explaining how neonatal care is organised to be given to all women at their 20 week scan.</p> <p>Display posters with similar information in the antenatal clinic areas</p>	Ruth Moore Manager / Lead Nurse	March 2015
4	Increase awareness amongst community midwives and GP Practices of how neonatal services are organised in the network and the improved outcomes for extremely preterm babies born in a hospital with an NICU	Work with Heads of Midwifery to cascade appropriate information to community midwives and GP Practices	Adam Gornall Lead Obstetrician	March 2015



5	Increased acceptance of IUTs of extremely premature babies to the hospitals with NICUs	Explore use of capacity and staffing to optimise the NICUs and attached labour wards availability to accept IUTs	Ruth Moore Manager / Lead Nurse	Review with Trusts at Network Visits in February 2015
6	Ensure documentation is accurate and that the cause of death as recorded on the death certificate is entered in the badger system	Provide information on the importance of accurate documentation of cause of death to each unit to cascade to all neonatal staff who enter information on the badger system	Babu Kumararatne Lead Clinician	Monitor through Mortality Review group and inform provider trusts –April 2015
7	Identify any obstetric factors contributing to the high neonatal SMR in SSBCNMN	Review the obstetric history of the babies who died in 2012	Adam Gornall Lead Obstetrician	
8	Identify other areas to explore through comparisons with other networks	Seek comparisons of SSBCNMN data with other networks with a low neonatal SMR	Ruth Moore Manager /Lead Nurse	Requested in January 2015
9	Complete further analysis of the SSBCNMN data to correct deaths for Gestation and intention to treat	Request denominator data from obstetric units for further improve analysis, Numbers booked, numbers delivered each year and number of deliveries and number of labour ward deaths babies at 23 and 24 weeks gestation	Ruth Moore Manager/Lead Nurse	Requested in January 2015
10	Identify further analysis that can be undertaken	Seek advice from Neil Marlow (CRG) and NDAU for any further analysis and interpretation of the data that might be valuable for SSBCNMN to undertake	Babu Kumararatne Lead Clinician	March 2015
11	Ensure robust neonatal and maternity data regarding perinatal deaths in SSBCNMN	Work with SWMMNN to develop a business case for a shared data analyst	Ruth Moore Manager /Lead Nurse	March 2015
12	Implement a standardised perinatal mortality review proforma	Work with Southern West Midlands Maternity & Newborn Network to develop and implement a standardised process for reviewing perinatal deaths in both networks. Feedback progress to the WM Perinatal Mortality Taskforce	Babu Kumararatne Lead Clinician	December 2015

- 5.2 SSBCNMN commenced a network neonatal mortality review process in 2012 through quarterly meetings reviewing shared learning from all deaths that occurred in neonatal units in the network using a standard template completed and submitted by each neonatal unit.
- 5.3 The network mortality review process continues to develop and in 2013 obstetric factors relating to each neonatal death were also reviewed using a standard template.
- 5.4 The network process is continually reviewed and the possibility of developing in depth case reviews of specific cases is currently being explored.
- 5.5 SSBCNMN arranged and hosted the first joint annual perinatal mortality and morbidity education event with Southern West Midlands Maternity and Neonatal Network in 2013 to increase the opportunity for shared learning of outcomes between networks.
- 5.6 Appendix A is an overview of network mortality from financial year 2010/11 to 2013/14 which already shows that improvements have been made following closer adherence to the network care pathways.
- 5.7 SSBCNMN is not only interested in improving mortality rates but also has implemented a neurodevelopmental follow up process at 2 years of age for babies born less than 31 weeks and/or 1250gms to understand the morbidity seen following neonatal care in SSBCNMN. Two year outcomes are reported in a supplement to the SSBCNMN 2013/14 annual report.

## 6. References

1. Analysis of neonatal mortality data, Neonatal Data Analysis Unit, Imperial College London March 2014 Available to download from:  
[http://www1.imperial.ac.uk/departmentsofmedicine/divisions/infectiousdiseases/paediatrics/neonatalmedicine/ndau/reports\\_1/archived\\_reports/](http://www1.imperial.ac.uk/departmentsofmedicine/divisions/infectiousdiseases/paediatrics/neonatalmedicine/ndau/reports_1/archived_reports/)
2. "Perinatal outcomes for extremely preterm babies in relation to place of birth in England: The EPICure 2 study" N Marlow, C Bennett, E S Draper, E M Hennessy, A S Morgan, K L Costeloe Arch Dis Child Fetal Neonatal Ed doi:10.1136/archdischild-2013-305555

## **SSBCNMN Mortality Data 2010/11-2013/14**

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### **Introduction**

- **Since April 2010 all units in SSBCNMN have been inputting all babies onto Badger system**
- **This allows for an accurate record of all babies that die within SSBCNMN**



### **However..**

- **Despite this babies that die at a surgical centre, a hospice or at a centre may not be captured**
- **Since April 2012 a Network Mortality subgroup has received summaries from all 6 units within the Network allowing for these babies to also be captured**

## Network Admissions and Deaths

	2010/11	2011/12	2012/13	2013/14
<b>Number of Distinct Babies</b>	<b>2867</b>	<b>3283</b>	<b>3996</b>	<b>4653</b>
<b>Number of Deaths</b>	<b>65</b>	<b>66</b>	<b>68</b>	<b>46</b>

### Number of distinct babies admitted according to gestational age

Gestational age	2010/11	2011/12	2012/13	2013/14
22	1	0	0	0
23	20	12	13	8
24	27	39	29	32
25	29	39	42	32
26	43	49	66	48
27	54	73	59	33
28	62	56	65	79
29	78	60	65	62
30	71	84	61	77
31	93	93	102	91
32	129	134	107	129
33-36	928	1067	1112	1151
37-42	1330	1577	2274	2908
>42	0	0	0	3
<b>Total</b>	<b>2867</b>	<b>3283</b>	<b>3996</b>	<b>4653</b>

Number of distinct babies admitted according to birthweight

Birth Weight/g	2010/11	2011/12	2012/13	2013/14
<500	4	2	2	3
500-749	61	81	77	72
750-999	109	121	127	109
1000-1249	133	134	125	95
1250-1499	136	145	120	131
1500-1749	184	160	189	167
1750-1999	232	262	208	249
2000-24999	674	791	852	886
2500-2999	432	522	713	840
3000-3499	390	484	691	938
>3500	510	581	892	1161

## Deaths by gestation

10/11			11/12			12/13			13/14		
Gestation	Admissions	Death	Gestation	Admissions	Death	Gestation	Admissions	Death	Gestation	Admissions	Death
22	1	1	22	0	0	22	1	0	22	0	0
23	20	11	23	12	9	23	13	5	23	8	5
24	27	11	24	39	10	24	29	10	24	32	8
25	29	4	25	39	5	25	42	9	25	32	5
26	43	8	26	49	7	26	66	7	26	46	3
27	54	3	27	73	2	27	59	7	27	33	2
28	62	4	28	56	2	28	65	1	28	79	3
29	78	4	29	80	3	29	65	3	29	62	3
30	71	1	30	84	4	30	61	2	30	77	3
31	93	4	31	93	2	31	102	3	31	91	1
32	129	3	32	134	3	32	107	0	32	129	1
33 - 36	926	3	33 - 36	1067	9	33 - 36	1112	9	33 - 36	1151	5
37 - 42	1330	8	37 - 42	1577	28	37 - 42	2274	12	37 - 42	2906	7
>42	0	0	>42	0	0	>42	0	0	>42	3	0
<b>Total</b>	<b>2867</b>	<b>65</b>	<b>Total</b>	<b>3283</b>	<b>66</b>	<b>Total</b>	<b>3996</b>	<b>68</b>	<b>Total</b>	<b>4653</b>	<b>46</b>

Gest	2010/11		2011/12		2012/13		2013/14	
	Survival		Survival		Survival		Survival	
22	0		N/A		100		N/A	
23	45.0		25.0		61.5		37.5	
24	59.3		74.4		65.5		75	
25	86.2		84.6		78.6		84.4	
26	81.4		91.8		89.4		93.8	
27	94.4		87.7		88.1		93.9	
28	93.5		92.9		98.5		96.2	
29	94.9		98.3		95.4		95.2	
30	98.6		98.8		96.7		96.1	
31	95.7		96.8		97.1		98.9	
32	97.7		98.5		100		99.2	
33-36	99.7		99.6		99.2		99.6	
37-42	99.4		99.2		99.5		99.8	
>42	N/A		N/A		N/A		100	
Total	97.7%		98.0%		98.3%		98.9%	

## Deaths by birthweight

10/11			11/12			12/13			13/14		
Bwt	Admissions	Deaths	Bwt	Admissions	Death	Bwt	Admissions	Death	Bwt	Admissions	Death
< 500	4	2	< 500	2	0	< 500	2	2	< 500	2	2
500 - 749	61	19	500 - 749	81	22	500 - 749	77	18	500 - 749	72	14
750 - 999	109	15	750 - 999	121	12	750 - 999	127	15	750 - 999	109	8
1000 - 1249	122	7	1000 - 1249	124	5	1000 - 1249	125	7	1000 - 1249	95	4
1250 - 1499	126	4	1250 - 1499	145	4	1250 - 1499	120	5	1250 - 1499	121	4
1500 - 1749	184	4	1500 - 1749	160	4	1500 - 1749	189	2	1500 - 1749	167	2
1750 - 1999	222	2	1750 - 1999	262	4	1750 - 1999	208	1	1750 - 1999	249	2
2000 - 2499	674	4	2000 - 2499	791	2	2000 - 2499	852	2	2000 - 2499	886	0
2500 - 2999	422	2	2500 - 2999	522	2	2500 - 2999	712	6	2500 - 2999	840	2
3000 - 3499	290	2	3000 - 3499	484	1	3000 - 3499	691	2	3000 - 3499	928	4
> 3499	510	2	> 3499	581	8	> 3499	892	5	> 3499	1161	2
<b>Total</b>	<b>2657</b>	<b>65</b>	<b>Total</b>	<b>3283</b>	<b>66</b>	<b>Total</b>	<b>3995</b>	<b>68</b>	<b>Total</b>	<b>4691</b>	<b>46</b>

## Deaths of <27 weeks and 1000g

	<27 weeks			<1000g		
	Admissions	Deaths	% survival	Admissions	Deaths	% survival
2010/11	118	35	70.3	174	36	79.3
2011/12	139	29	81.3	204	36	82.4
2012/13	151	31	79.5	206	35	83
2013/14	124	31	75	184	24	87
2010-13 av	136	32	76.5	195	36	81.5
2011-14 av	138	30	78.3	198	32	83.8

### Causes of death 2012-14

	2012/13	2013/14
Prematurity	30	13
Infection	5	4
HIE	11	8
Respiratory	9	7
IVH	3	5
NEC	3	2
Coroners	0	2
Congenital Malformation	5	2
Chromosomal	0	0
Myopathy	0	0
Metabolic	0	1
Miscellaneous	2	2
<b>Total</b>	<b>68</b>	<b>46</b>

### Survival to discharge –Comparing the Networks

	2010/11	2011/12	2012/13	2013/14
<b>SWMNN</b>	<b>98.1%</b>	<b>98.3%</b>	<b>98.7%</b>	
<b>SSBCNMN</b>	<b>97.7%</b>	<b>98.0%</b>	<b>98.3%</b>	<b>98.9%</b>

### Summary

- **SSBCNMN has had a steady increase in activity since 2010**
- **Survival rate has increased from 97.7 to 98.9%**
- **Main cause of death remains extreme prematurity but more specific causes are being recorded more frequently**