

Twelfth Annual Report on Very Low Birth Weight Infants born in Northern Ireland in 2010 & 2011

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Focusing on: mortality and morbidity outcomes for infants 401 to 1500g birth weight.

This short report of the Neonatal Intensive Care Outcomes Research & Evaluation (NICORE) group focuses on, and provides analyses of, information relating to all infants with a birth weight of 401 to 1500g who were born during the time period 1st January 2010 to 31st December 2011. Full Vermont Oxford Network (VON) datasets for each individual neonatal unit (2004 to date) are available online via the Nightingale System (<http://www.vtoxford.org/>).

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Summary of findings

Throughout the time period 1st January 2010 to 31st December 2011 there were, 51583 live births in Northern Ireland (hospitals, en route to hospital and home births, resident & non-resident; Table 1a & 1b). There were 491 live born infants reported for Northern Ireland with a birth weight of 401 to 1500g. Four hundred and seventy-nine infants were reported by the five participating neonatal units for inclusion in the NICORE/Vermont Oxford Network (VON subset) 2010 & 2011 databases. Twenty-nine of these infants died in the delivery room (delivery room data were only collected for participating units). Twenty-two additional infants with a birth weight other than 401 to 1500g were excluded from the analyses for this report (five delivery room deaths of 22 weeks' gestation and seventeen infants admitted to neonatal care (22 weeks (1), 25 weeks (1), 27 weeks (1), 28 weeks (1) and 29 weeks (13)). Denominator data for total births in Northern Ireland were provided by the Child Health System Bureau Service.

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Table 1a Total births in Northern Ireland for the time period 1st January 2010 to 31st December 2010 by birth weight banding.

2010	BW not recorded	≤ 400g	401 to 1500g	> 1500g	Total
Live Births	34	13	257	25643	25947
Still births	3	5	37	65	110
Total births	37	18	294	25708	26057

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Table 1b Total births in Northern Ireland for the time period 1st January 2011 to 31st December 2011 by birth weight banding.

2011	BW not recorded	≤ 400g	401 to 1500g	> 1500g	Total
Live Births	26	16	234	25360	25636
Still births	1	5	24	64	94
Total births	27	21	258	25424	25730

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Birth details & location of initial neonatal care

For 2010, there were 111 (46.4%) male and 128 (53.6%) female infants (of 401 to 1500g birth weight) cared for in participating neonatal units. Seventy-one (29.7%) of these infants were from a multiple birth, with 62 twins and nine triplets. For 2011, there were 86 (40.8%) male and 125 (59.2%) female infants (of 401 to 1500g birth weight) cared for in participating neonatal units. Sixty-seven (31.8%) of these infants were from a multiple birth, with 64 twins and three triplets. Table 2 shows the location of initial neonatal care for infants of 401 to 1500g birth weight by participating unit. Delivery room deaths have been excluded.

Table 2 Location of initial neonatal care for each participating neonatal unit and location of birth: inborn (IB) and out born (OB).

Neonatal Unit	2010 IB	2010 OB	2010 Total	2011 IB	2011 OB	2011 Total
Royal Maternity (Regional Centre)	112	1	113(47%)	82	6	88(42%)
Altnagelvin	27	4	31(13%)	33	3	36(17%)
Antrim	35	3	38(16%)	27	0	27(13%)
Craigavon	35	3	38(16%)	41	5	46(22%)
Ulster	19	0	19(8%)	14	0	14(7%)
Total	228	11	239	197	14	211

For **2010**, 11 of 33 infants (33.3%) **of < 26 weeks' gestation**, (& 401 to 1500g birth weight), and 20 of 56 infants (35.7%) of **< 27 weeks' gestation** (& 401 to 1500g birth weight), were both born in and/or, had their first admission to, a neonatal unit **other** than the regional centre. Twenty of these infants were born in, and were admitted to, continuous care units: Craigavon (6 infants), Antrim (5 infants), Altnagelvin (4 infants) and Ulster (2 infants). In addition, one infant was born in Letterkenny and was subsequently transferred to Altnagelvin on day one of life, one infant was born in Daisy Hill and transferred to Craigavon on day one of life and one infant was born in Erne Hospital and also transferred to the regional centre on day one of life. For **2011**, 14 of 34 infants (41.2%) of **< 26 weeks' gestation**, (& 401 to 1500g birth weight), and 19 of 50 infants (38.0%) of **< 27 weeks' gestation** (& 401 to 1500g birth weight), were both born in, and/or had their first admission to, a neonatal unit **other** than the regional centre. Sixteen of these infants were born in, and were admitted to, continuous care units: Craigavon (5 infants), Antrim (2 infants), Altnagelvin (9 infants), Ulster (1 infant). In addition, one infant was born in Mater and was subsequently transferred to the regional centre on day one of life and one infant was born in Erne Hospital and also transferred to Altnagelvin on day one of life. Further details regarding location of first admission to a continuing care or regional centre by gestation and birth weight group (\leq 800g, 801 to 1,000g and > 1,000g) for the full VON cohort (excluding delivery room deaths) are provided in Appendix One, page 10.

Outcomes: survival until discharge home

Overall, there were 61 deaths giving 13.5% (61 of 450) survival for infants of 401 to 1500g birth weight. In addition, two further infants admitted to neonatal care but outside the weight range for this report also died: (22 weeks' gestation and 380g) and (29 weeks' gestation and 1574g). Table 3a and Table 3b show survival, total length of stay, mean, median infant length of stay for all infants and survivors until discharge home. Figure 1 shows the total number of infants (birth weight 401 to 1500g) admitted to neonatal care, survivors and non survivors for the time period 1999/2000 to 2011. Figure 2 illustrates the percentage survival against gestation for infants of 401 to 1500g birth weight (1999 to 2002), (2004 to 2006), (2007 to 2009) and (2010 to 2011).

Report 2010 & 2011 VLBW Infants

Table 3a Length of stay (LOS) per infant until discharge home/death by gestation for all infants admitted to neonatal care 2010 and 2011.

Gestational age	infants 2010	infants 2011	Total LOS 2010	Total LOS 2011	Mean LOS 2010	Mean LOS 2011	Median LOS 2010	Median LOS 2011
22	2	2	2	4	1	2	1	2
23	5	3	140	136	28	45	10	15
24	6	15	21	1545	4	103	2	96
25	20	14	1183	942	59	67	86	88
26	23	16	2092	1148	91	72	91	73
27	23	20	1908	1468	83	73	91	76
28	28	36	2095	2729	75	76	65	71
29	29	30	1615	1713	56	57	55	53
30	29	32	1494	1651	52	52	47	47
≥ 31	74	43	2523	1316	34	31	33	28
Total	239	211	13073	12652	55	60	47	53

Table 3b Length of stay (LOS) per infant until discharge from neonatal care by gestation for survivors 2010 and 2011.

Gestational age	infants 2010 Survivors	infants 2011 Survivors	Total LOS 2010	Total LOS 2011	Mean LOS 2010	Mean LOS 2011	Median LOS 2010	Median LOS 2011
22	0(0%)	0(0%)	-	-	-	-	-	-
23	1(20%)	1(33%)	109	119	109	119	109	119
24	0(0%)	10(67%)	-	1449	-	145	-	120
25	11(55%)	7(50%)	1115	797	101	114	97	116
26	18(78%)	12(75%)	1956	1141	109	95	103	87
27	21(91%)	19(95%)	1902	1465	91	77	91	76
28	25(89%)	35(97%)	2035	2692	81	77	65	72
29	27(93%)	30(100%)	1598	1713	59	57	58	53
30	28(97%)	31(97%)	1492	1529	53	51	47	47
≥ 31	72(97%)	41(95%)	2513	1295	35	32	34	29
Total	203(85%)	186(88%)	12720	12263	63	66	54	57

As stated on page one, this report focuses on the sub-set of infants of birth weight 401 to 1500g. Survival details for the full 2010 and 2011 VON cohorts of infants (401 to 1500g or 22⁰ to 29⁶ weeks' gestation) are provided in Appendix Two, page 11 for comparison purposes.

Figure 1 Survival for infants of birth weight 401 to 1500g.

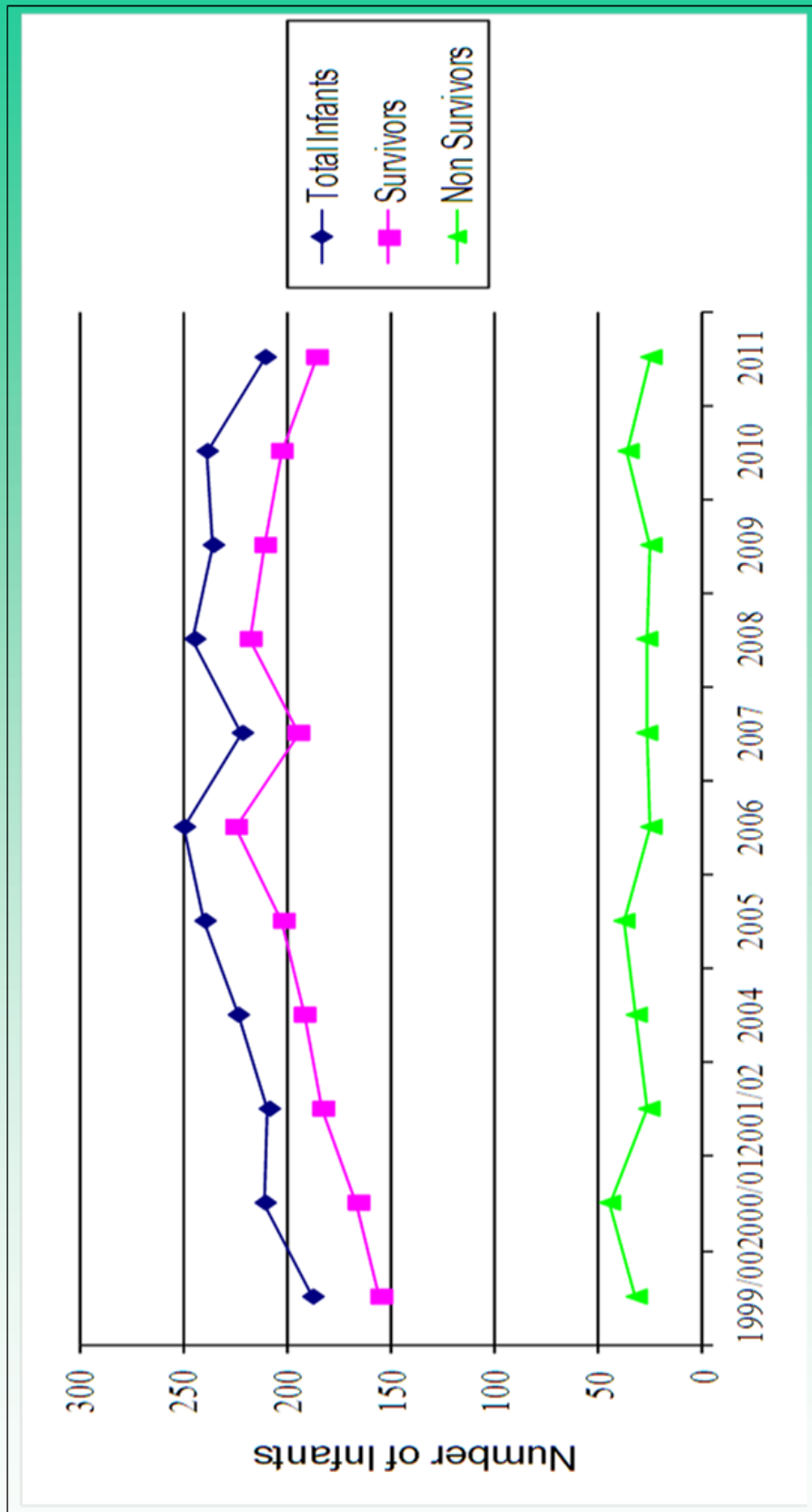


Figure 2 Percentage survival against gestation for infants of birth weight 401 to 1500g.

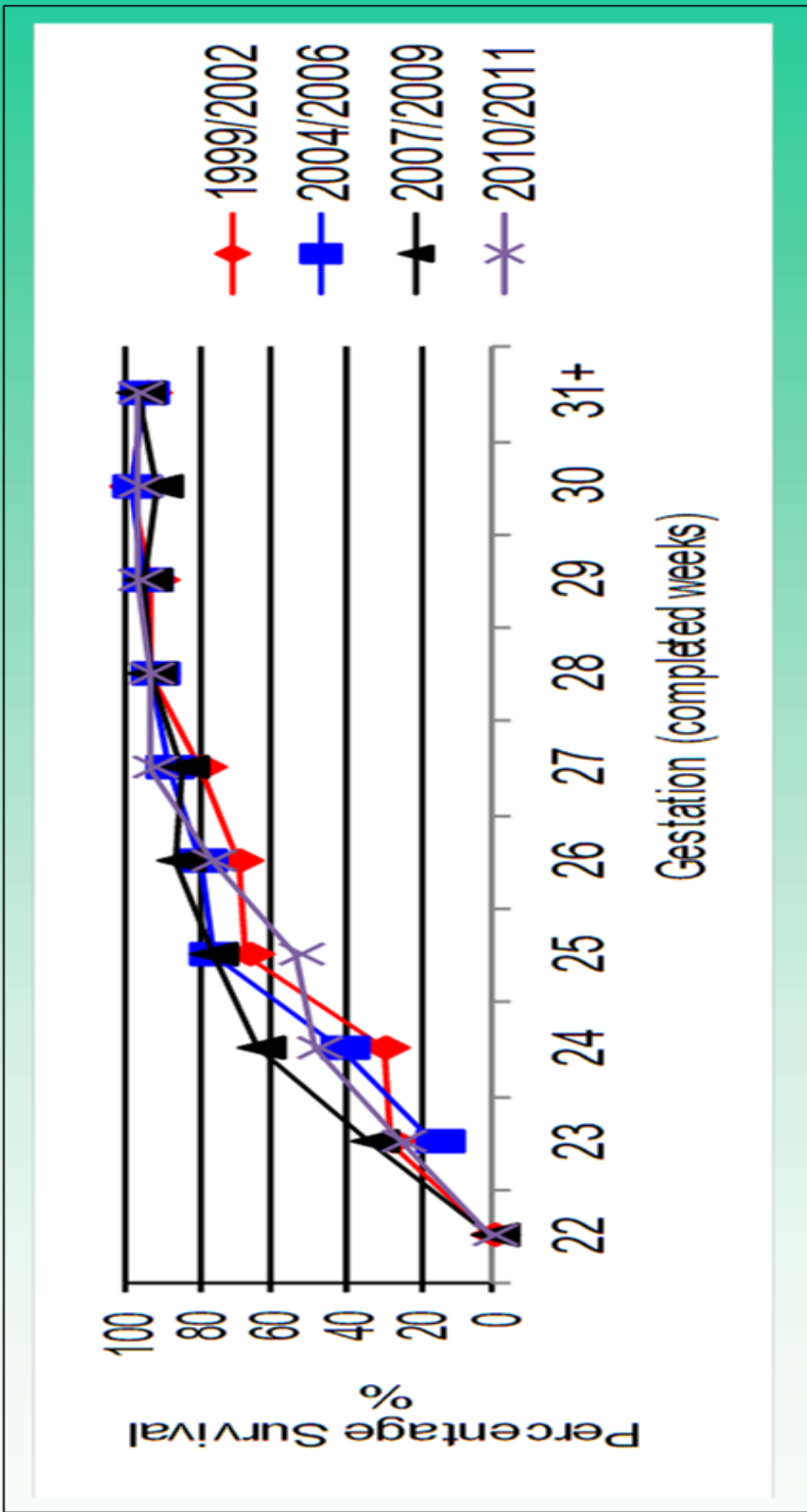


Table 3c Length of stay (LOS) per infant until discharge home by gestation for survivors to discharge without major morbidities 2010 and 2011.

Gestational age	infants 2010	infants 2011	Total LOS 2010	Total LOS 2011	Mean LOS 2010	Mean LOS 2011	Median LOS 2010	Median LOS 2011
22	0 (0%)	0(0%)	-		-		-	
23	0(0%)	0(0%)	-		-		-	
24	0(0%)	2(13%)	-	195	-	98	-	98
25	3(15%)	3(21%)	268	338	89	113	87	98
26	6(26%)	6(38%)	501	567	84	95	84	81
27	11(48%)	11(55%)	852	830	78	76	79	75
28	16(57%)	18(50%)	923	1069	58	59	57	59
29	24(83%)	24(80%)	1383	1329	58	55	55	53
30	22(76%)	25(78%)	1030	1105	47	44	44	44
≥ 31	68(92%)	40(93%)	2281	1181	34	30	32	30
Total	150(63%)	129 (61%)	7238	6614	48	51	44	47

Survival to discharge from neonatal care without major morbidities is defined as those survivors who DO NOT have any of the following morbidities: Oxygen at 36 weeks' adjusted gestation, Necrotizing Enterocolitis (NEC), NEC surgery, Retinopathy of Prematurity (ROP) stage 3 and above, ROP treatment, Periventricular-Intraventricular Haemorrhage grade 3 and above and Cystic Periventricular Leukomalacia. All morbidities are defined in accordance with the VON definitions.

In 2010 and 2011 combined, for infants of 401 to 1500g birth weight admitted to the five participating neonatal units in NI, 86.4% (389 of 450) survived to discharge from neonatal care and 62.0% (279 of 450) survived to discharge from neonatal care without major morbidities. For those infants surviving to discharge from neonatal care 71.7% (279 of 389) had no major morbidities. As expected, across 2010 and 2011 survival to discharge without major morbidities is closely associated with gestation with only 6.1% (2 of 33) surviving with no major morbidities at ≤ 24 weeks, 24.7% (18 of 73) at 25 to 26 weeks, 52.3% (56 of 107) at 27 to 28 weeks, rising to 79.2% (95 of 120) at 29 to 30 weeks and 92.3% (108 of 117) at ≥ 31 weeks' gestation.

Outcomes: Key morbidities

Table 4 details key morbidity outcomes for 2007 to 2011 for all infants of 401 to 1500g birth weight. Note: 2009 data are derived from a sub-set of the full NICORE database not a Vermont Oxford Network (VON) sub-set. All surgery data excludes infants who were transferred to Royal Belfast Hospital for Sick Children (RBHSC) for surgery and were not re-admitted to a neonatal unit.

Table 4 Key morbidity outcomes 2007 to 2011 for infants admitted to neonatal care and 401 to 1500g birth weight.

Morbidity Outcomes	2007	2008	2009	2010	2011
Congenital malformations	11/221(5%), 1nk	8/245(3%)	14/236(6%)	16/239(7%)	10/211(5%)
Early sepsis	13/221(6%), 1nk	13/245(5%)	7/231(3%), 5nk	6/239(3%)	7/211(3%)
Late sepsis (any pathogen)	64/208 (31%), 13na, 1nk	89/231(39%) 14na	104/222(47%) 14na	80/221(36%) 18na	66/204(32%) 7na
Supplemental oxygen at 36 wks adjusted gestational age (CLD)	33/139 (24%) 82na, 1nk	52/162(32%) 83na	106/175(61%) 1nk, 60na	48/159(30%) 80na	52/147(35%) 64na
Respiratory Distress Syndrome (RDS)	179/221(81%), 1nk	212/245(87%)	200/236(85%)	188/239(79%)	181/211(86%)
Pneumothorax	15/221(7%), 1nk	6/245(3%)	7/236(3%)	11/239(5%)	8/211(4%)
Patent Ductus Arteriosus (PDA)	59/221(27%), 1nk	84/245(34%)	74/236(31%)	60/239(25%)	63/211(30%)
PDA surgery	3/221(1%), 1nk	0/245(0%)	5/236(2%)	5/239(2%)	7/211(3%)
Necrotizing Enterocolitis (NEC)	17/221(8%) 1nk	19/245(8%)	18/235(8%) 1nk	15/239(6%)	12/211(6%)
NEC surgery	4/221(2%), 1nk	4/245(2%)	5/234(2%), 2nk	3/239(1%)	0/211(0%)
Focal gastrointestinal perforation	6/221(3%) 1nk	3/245(1%)	5/235(2%) 1nk	3/239(1%)	3/210(1%) 1nk
Severe Periventricular – Intraventricular Haemorrhage (Papille: Grades 3 & 4.) (Denominator - Overall Cranial imaging done)	9/197(5%) Grade 3(2) Grade 4(7)	18/219(8%) Grade 3(7) Grade 4(11)	16/209(8%) Grade 3 (8) Grade 4 (8) 1nk	21/210(10%) Grade 3 (7) Grade 4 (14)	18/197(9%) Grade 3 (7) Grade 4 (11)
Cystic Periventricular Leukomalacia	4/197(2%)	9/219(4%)	8/210(4%)	3/209 1%)	6/197(3%)
Screened for Retinopathy of Prematurity (ROP)	150/221(68%)	175/245(71%)	184/236(78%) 1nk	165/239(69%)	152/211(72%)
Severe Retinopathy of Prematurity (ROP) (Stages 3 & 4) (Denominator – Eye exams done)	13/150 (9%) Stage 3 (13) Stage 4 (0)	14/175 (8%) Stage 3 (14) Stage 4 (0)	17/184(9%), Stage 3 (15) Stage 4 (2) 1nk	6/165(4%) Stage 3 (6) Stage 4 (0)	8/152(5%) Stage 3 (8) Stage 4 (0)
Treatment for ROP	12/221(5%)	13/245(5%)	18/236(8%) 3nk	6/239(3%)	8/211(4%)
Other Major Surgery	12/221(5%) 1nk	10/245(4%)	23/236(10%)	10/239(4%)	6/211(3%)

Conclusions

1. Activity levels

The total number of infants admitted (401 to 1500g birth weight) to neonatal care in the five participating centres has dropped from a peak of 250 infants in 2006 to 211 in 2011 (Figure 1).

2. Birth details & location of initial neonatal care

The proportion of infants < 26 weeks' gestation (& 401 to 1500g birth weight) and born in, and/or had their first admission to a neonatal unit **other than** the regional centre remains high at 41.2% in 2011.

The proportion of infants < 27 weeks' gestation (& 401 to 1500g birth weight) and born in, and/or had their first admission to a neonatal unit **other than** the regional centre also remains high at 38.0% in 2011.

3. Outcomes: survival until discharge home

In 2010 and 2011 combined, for infants of 401 to 1500g birth weight admitted to the five participating neonatal units in NI, 86.4% (389 of 450) survived to discharge from neonatal care and 62.0% (279 of 450) survived to discharge from neonatal care without major morbidities. For those infants surviving to discharge from neonatal care, 71.7% (279 of 389) had no major morbidities. This is the first time NICORE has presented data on survival without major morbidity.

As expected, across 2010 and 2011 survival to discharge without major morbidities is closely associated with gestation with only 6.1% (2 of 33) surviving with no major morbidities at ≤ 24 weeks, 24.7% (18 of 73) at 25 to 26 weeks, 52.3% (56 of 107) at 27 to 28 weeks, rising to 79.2% (95 of 120) at 29 to 30 weeks and 92.3% (108 of 117) at ≥ 31 weeks.

It is important to note that table 3c is based on the VON sub-set of data. Data from Erne and Daisy Hill are not included in the VON datasets therefore morbidities such as oxygen at 36 weeks' adjusted gestation and Retinopathy of Prematurity (ROP) may be under estimated therefore survival with no major morbidities may be over estimated.

4. Outcomes: key morbidities

In 2010 and 2011, there have been slight reductions in the incidences of late sepsis (any pathogen), Chronic Lung Disease, NEC, cystic PVL and severe ROP when compared with 2009, although these are not statistically significant. Whilst the number of infants having at least one episode of late sepsis dropped from 46.8% in 2009 to 36.2% in 2010 and 32.4% in 2011, the reduction of confirmed late sepsis should remain a priority for neonatal units.

It is important to note that 2009 morbidity data are derived from the full NICORE data set and not limited to VON returns.

Recommendations

1. Clinicians in each unit should use the data on survival to assist with antenatal counselling. Clinicians should be aware that calculated survival rates are dependent on the denominator data used and can be influenced by variations in birth registration where viability is unclear and by using NICU admission data only which may be unrepresentative of the true picture for survival at very early gestations. [1, 2]
2. Reducing neonatal nosocomial infection should remain as a priority for all neonatal units in Northern Ireland. Multi-disciplinary team based quality improvement initiatives represent an evidence-based method to assist with this along with the development of evidence-based guidelines on e.g. hand hygiene, skin anti-sepsis, management of indwelling/central venous catheters and rational use of antibiotics.
3. Consideration should be given to the development of new quality improvement initiatives aimed at reducing the burden of chronic lung disease.
4. Facilities within BadgerNet™ should be used to ensure that infants at risk of ROP are screened at the appropriate time. This mechanism should be subjected to regular audit.
5. Neonatal and obstetric teams in each unit should work collaboratively to reduce the number of infants < 27 weeks' gestation born and receiving the first admission to neonatal care outside of the regional centre, where possible.
6. The survival to discharge with major morbidity data reflects the importance of follow up of these vulnerable infants. Each unit should continue working towards establishing mechanisms to assess these infants at two years of age, using standardised assessment tools, in order to define longer term neuro-developmental outcomes, which is in line with current professional recommendations. [3]

The way forward

1. Neonatal care in Northern Ireland is undergoing significant change, not least with the establishment of the new Northern Ireland Neonatal Network. This network should take on lead responsibility for collection and interpretation of key neonatal data, building upon the work and expertise available within the NICORE team.
2. The new Network will face many new challenges in the short term but priorities should include agreed pathways for the care of the extremely preterm infant, co-ordinating quality improvement initiatives aimed at reducing morbidity in survivors and establishing processes for collection of long-term follow-up data.
3. The current NICORE team will endeavour to assist the new Network in meeting these ongoing challenges.

Appendix One

Table 5a Location of first admission to CONTINUING CARE CENTRE OR REGIONAL CENTRE by gestation (completed weeks) and birth weight 2010.

Gest	≤ 800g BW						801 to 1,000g BW						>1,000g BW						Overall Infants
	ALT	ANT	CAH	RMH	ULST	ST	ALT	ANT	CAH	RMH	ULST	ST	ALT	ANT	CAH	RMH	ULST	ST	
22	0	3	0	0	0	3	-	-	-	-	-	-	-	-	-	-	-	-	3
23	1	0	0	4	0	5	-	-	-	-	-	-	-	-	-	-	-	-	5
24	1	1	0	3	0	5	0	0	0	1	0	1	-	-	-	-	-	-	6
25	1	0	2	10	0	13	1	0	1	4	1	7	0	0	0	1	0	1	21
26	1	1	2	5	0	9	0	0	0	8	0	8	0	1	2	2	1	6	23
27	1	1	0	6	0	8	1	2	1	2	0	6	2	3	0	3	1	9	23
28	0	0	0	2	1	3	1	1	0	2	0	4	5	2	3	9	3	22	29
29	-	-	-	-	-	-	1	0	2	0	0	3	5	4	8	15	2	34	37
30	-	-	-	-	-	-	-	-	-	-	-	-	3	5	6	13	2	29	29
≥31	-	-	-	-	-	-	-	-	-	-	-	-	8	16	15	26	9	74	74
Total	5	6	4	30	1	46	4	3	4	17	1	29	23	31	34	69	18	17	250

Table 5b Location of first admission to CONTINUING CARE CENTRE OR REGIONAL CENTRE by gestation (completed weeks) and birth weight 2011.

Gest	≤ 800g BW						801 to 1,000g BW						>1,000g BW						Overall Infants
	ALT	ANT	CAH	RMH	ULST	ST	ALT	ANT	CAH	RMH	ULST	ST	ALT	ANT	CAH	RMH	ULST	ST	
22	0	0	0	2	0	2	-	-	-	-	-	-	-	-	-	-	-	-	2
23	0	0	1	2	0	3	-	-	-	-	-	-	-	-	-	-	-	-	3
24	5	0	0	7	1	13	0	0	0	2	0	2	-	-	-	-	-	-	15
25	3	1	1	6	0	11	0	0	1	2	0	3	-	-	-	-	-	-	14
26	1	0	0	4	0	5	1	0	1	6	0	8	0	1	1	1	0	3	16
27	0	1	0	3	0	4	1	0	1	5	0	7	3	2	2	2	1	10	21
28	2	2	0	1	0	5	2	0	3	6	0	11	2	2	8	8	0	20	36
29	-	-	-	-	-	-	0	1	3	2	0	6	3	3	9	11	3	29	35
30	-	-	-	-	-	-	3	0	0	0	1	4	4	8	5	8	3	28	32
≥31	-	-	-	-	-	-	-	-	-	-	-	-	6	8	12	12	5	43	43
Total	11	4	2	25	1	43	7	1	9	23	1	41	18	24	37	42	12	133	217

ST = Sub Total, BW = Birth weight (g), Gest = gestational age (completed weeks).

Source: Vermont Oxford Network 2010/11 full datasets (401 to 1500g BW or 22⁰ to 29⁶ weeks' gestation).

Note: Delivery Room Deaths are excluded from the analyses.

Note: Infants born in Daisy Hill and Erne Hospital (SWAH) and subsequently transferred to a continuing Care Centre or Regional Centre will be counted in the receiving unit.

Appendix Two

Table 6a Survival for VON infants (401 to 1500g birth weight or 22⁰ to 29⁶ weeks' gestation) 2010 & 2011.

Gestational age	infants 2010	infants 2011	Survival 2010	Survival 2011	Survival No Major Morbidity 2010	Survival No Major Morbidity 2011
22	3	2	0(0%)	0(0%)	0(0%)	0(0%)
23	5	3	1(20%)	1(33%)	0(0%)	0(0%)
24	6	15	0(0%)	10(67%)	0(0%)	2(13%)
25	21	14	12(57%)	7(50%)	4(19%)	3(21%)
26	23	16	18(78%)	12(75%)	6(26%)	6(38%)
27	23	21	21(91%)	20(95%)	11(48%)	11(52%)
28	29	36	26(90%)	35(97%)	17(59%)	18(50%)
29	37	35	35(95%)	34(97%)	29(78%)	26(74%)
30	29	32	28(97%)	31(97%)	22(76%)	25(78%)
≥ 31	74	43	72(97%)	41(95%)	68(92%)	40(93%)
Total	250	217	213(85%)	191(88%)	157(63%)	131(60%)

Table 6b Survival for VON sub-set infants (401 to 1500g birth weight) 2010 & 2011.

Gestational age	infants 2010	infants 2011	Survival 2010	Survival 2011	Survival No Major Morbidity 2010	Survival No Major Morbidity 2011
22	2	2	0(0%)	0(0%)	0(0%)	0(0%)
23	5	3	1(20%)	1(33%)	0(0%)	0(0%)
24	6	15	0(0%)	10(67%)	0(0%)	2(13%)
25	20	14	11(55%)	7(50%)	3(15%)	3(21%)
26	23	16	18(78%)	12(75%)	6(26%)	6(38%)
27	23	20	21(91%)	19(95%)	11(48%)	11(55%)
28	28	36	25(89%)	35(97%)	16(57%)	18(50%)
29	29	30	27(93%)	30(100%)	24(83%)	24(80%)
30	29	32	28(97%)	31(97%)	22(76%)	25(78%)
≥ 31	74	43	72(97%)	41(95%)	68(92%)	40(93%)
Total	239	211	203(85%)	186(88%)	150(63%)	129(61%)

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