REPORT OF THE MALAYSIAN NATIONAL NEONATAL REGISTRY 2021

A STUDY OF CRITICALLY ILL BABIES IN NEONATAL INTENSIVE CARE UNITS

EDITOR

Eric Ang Boon Kuang

WITH CONTRIBUTIONS FROM

- Boo Nem Yun
- Chee Seok Chiong
- Ang Ee Lee
- Pauline Choo Poh Ling
- Farah Inaz Syed Abdullah
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Perinatal Society of Malaysia

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Important information

Disclaimer

There is a potential that data for previous years printed in this report are different from what were printed in previous reports. This is because analysis for this report is based on latest dataset in the web which may have been updated by SDP.

May 2026

CONTENTS

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Report of the Malaysian National Neonatal Registry (MNNR) 2021

1. Organization of the MNNR

1.1 Objectives

The Malaysian National Neonatal Registry was set up in 2002 to study the outcome of sick babies admitted to Neonatal Intensive Care Units (NICUs) in the country. A minimum data set and a data collection system at a national level are important to monitor mortality and morbidity of babies admitted to NICUs.

The Malaysian NNR aims:

1. To determine the frequency and distribution of critically ill neonates in Malaysia. These are useful measures of the health burden of neonatal critical illnesses and its care in the country.
2. To study the mortality and some morbidity outcomes of babies admitted to NICUs in participating hospitals.
3. To calculate the neonatal mortality rate of inborn babies.
4. To compare the outcomes between various centres.
5. To develop indicators for standard of care in various areas e.g., acceptable sepsis rate in NICUs.
6. To study, in further detail, the outcome of very low birth weight babies.
7. To stimulate and facilitate research on neonatal critical illness and its management.

1.2 Structure

The MNNR consists of a Governance Board, Steering Committee and administrative staff. The Governance Board is to monitor and to direct the functions of MNNR and it meets at least once a year.

The Steering Committee consists of nine elected members. This committee is responsible for the general running and decision-making of the Registry and for approving the use of its data.

1.3 Funding

Funding was provided via Perinatal Society of Malaysia & sponsors from industry.

2. Data Set

2.1 Registration criteria

The MNNR audit of critically ill babies admitted to Neonatal Units (NNUs) in 2021 included

A. <u>All babies admitted to a Neonatal Unit who have any of the following criteria</u>:
   1. Had a gestation of <32 weeks i.e. up to 31 weeks + 6 days
   2. Had a birth weight of 500-1500 grams
   3. Had hypoxic ischaemic encephalopathy (HIE) with or without requirement of ventilatory support

B. All neonatal deaths (i.e. newborn babies (<28days) who died in the NNU, delivery room i.e. operating theatre, labour room, and in other wards)

   - Both inborn and outborn babies were included.
   - Outborn babies who died before arrival were excluded. Babies who were admitted to the NNU at a corrected gestation of > 44/52 were not considered neonatal cases and hence were omitted from the study.

- The inclusion criteria for MNNR were modified for the years 2021, 2022, and 2023. During this period, the migration of online data entry to a new system resulted in significant limitations that rendered the database unusable. Consequently, the MNNR steering committee opted to revert to the previous online system. To address the considerable backlog in data entry, it was necessary to reduce the inclusion criteria for these three years. Previous criterias that were omitted included those babies that need respiratory support, confirmed sepsis and congenital heart diseases (unless they fulfill the 4 criterias mentioned above).

2.2 Data Collection

The CRF consisted of four sheets (of forms).

- Babies discharged or transferred out to non-paediatric wards (e.g. paediatric surgical wards) in the same hospital or to other hospitals would have only one set of CRF completed and readmission of the same babies into the NNU would require a new set of CRF.
- A baby who was transferred between neonatal and paediatric wards under the same department was considered to be the same admission and the discharge CRF was completed after complete discharge from the hospital. Hardcopy CRFs were used and data from completed CRFs were entered via the MNNR website by the respective SDPs or sent to MNNR secretariat after a defined period for data entry.

2.3 Data Verification

Missing or anomalous data was identified by manual check and then clarified with the respective centre. Further data verification was made on data entry onto the main database. Quantification of errors and the implementation of practices via website data entry to minimize errors are continually refined.

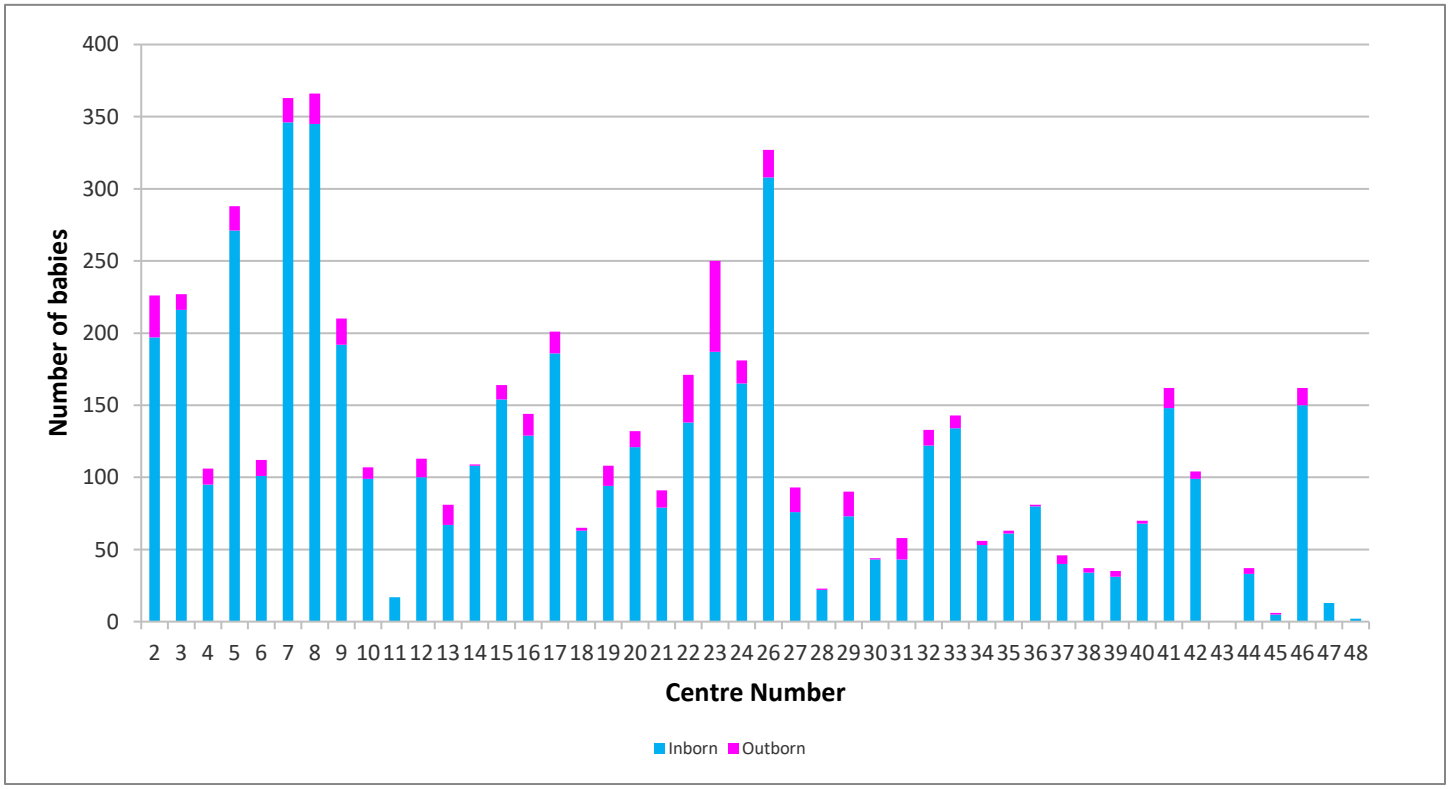
RESULTS

INTRODUCTION

- In the year 2021, the number of SDP hospitals remained the same with the year before, with 46 hospitals from the Ministry of Health, University hospitals and private hospitals contributing data to the MNNR.
- The inclusion criteria for the MNNR in 2021 was focused to just 4 criterias, to include all babies (inborn and outborn) delivered at a gestation of below 32 weeks, or birth weight of between 500 grams to 1500 grams, or with hypoxic-ischaemic encephalopathy, as well as, all neonatal deaths.
- The total number of livebirths in the 46 participating hospitals was 290,171 babies, a further reduction from 319,867 in the year 2020. Out of these babies, 31,187 (10.7%) were born preterm at less than 37 completed weeks, while 3,873 (1.3%) were born preterm less than 32 completed weeks. 4,357 ((1.5%) babies were born with a birthweight between 500 grams to 1500 grams. (Data collected from monthly census from SDP centres)
- A total of 5,617 babies fulfilled the study criteria, out of which 5,108 (90.9%) were inborn, while 509 (9.1%) were outborn babies (Table 1 and Figure 1).
- Of those who met the study criteria, 3,289 (58.6%) were born below 32 weeks of gestational age (Figure 2 and Table 2), and a total of 3,536 (63%) had birth weights of 1500 grams and below (Figure 3 and Table 3).
  There is a discrepancy in the number of babies submitted into the online system as compared to the number of babies reported by the SDP centres in the monthly census, signifying missing data that is not recoverable during data re-entry.

Figure 1

Number of babies according to place of birth



COMMENT: There were 5108 inborn babies and 509 outborn babies in the MNNR.

Table 1: Number of babies according to place of birth

Hospitals		Place of Birth		Total
		Inborn	Outborn	
2	n	197	29	226
	(%)	(87.2)	(12.8)	(100)
3	n	216	11	227
	(%)	(95.2)	(4.8)	(100)
4	n	95	11	106
	(%)	(89.6)	(10.4)	(100)
5	n	271	17	288
	(%)	(94.1)	(5.9)	(100)
6	n	101	11	112
	(%)	(90.2)	(9.8)	(100)
7	n	346	17	363
	(%)	(95.3)	(4.7)	(100)
8	n	345	21	366
	(%)	(94.3)	(5.7)	(100)
9	n	192	18	210
	(%)	(91.4)	(8.6)	(100)
10	n	99	8	107
	(%)	(92.5)	(7.5)	(100)
11	n	17	0	17
	(%)	(100.0)	(0)	(100)
12	n	100	13	113
	(%)	(88.5)	(11.5)	(100)
13	n	67	14	81
	(%)	(82.7)	(17.3)	(100)
14	n	108	1	109
	(%)	(99.1)	(0.9)	(100)
15	n	154	10	164
	(%)	(93.1)	(6.1)	(100)
16	n	129	15	144
	(%)	(89.6)	(10.4)	(100)
17	n	186	15	201
	(%)	(92.5)	(7.5)	(100)

Table 1: Number of babies according to place of birth (continued)

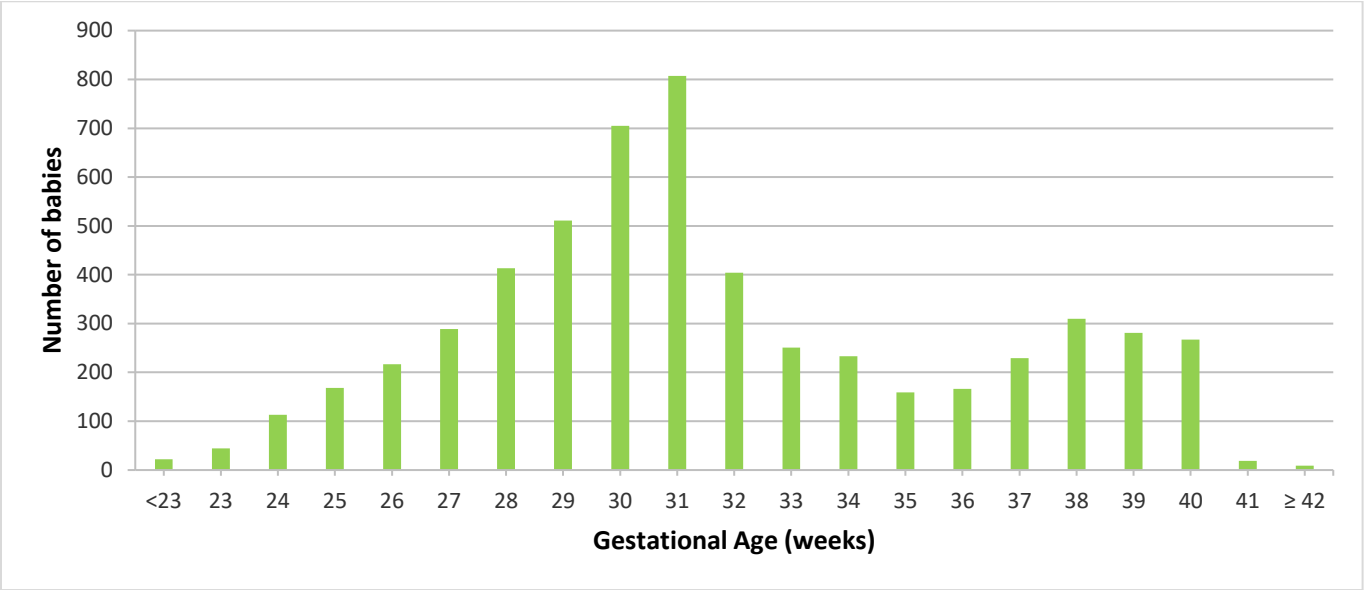
Hospitals		Place of Birth		Total
		Inborn	Outborn	
18	n	63	2	65
	(%)	(96.9)	(3.1)	(100)
19	n	94	14	108
	(%)	(87.0)	(13.0)	(100)
20	n	121	11	132
	(%)	(91.7)	(8.3)	(100)
21	n	79	12	91
	(%)	(86.8)	(13.2)	(100)
22	n	138	33	171
	(%)	(80.7)	(19.3)	(100)
23	n	187	63	250
	(%)	(74.8)	(25.2)	(100)
24	n	165	16	181
	(%)	(91.2)	(8.8)	(100)
26	n	308	19	327
	(%)	(94.2)	(5.8)	(100)
27	n	76	17	93
	(%)	(81.7)	(18.3)	(100)
28	n	22	1	23
	(%)	(95.7)	(4.3)	(100)
29	n	73	17	90
	(%)	(81.1)	(18.9)	(100)
30	n	43	1	44
	(%)	(97.7)	(2.3)	(100)
31	n	43	15	58
	(%)	(74.1)	(25.9)	(100)
32	n	122	11	133
	(%)	(91.7)	(8.3)	(100)
33	n	134	9	143
	(%)	(93.7)	(6.3)	(100)
34	n	53	3	56
	(%)	(94.6)	(5.4)	(100)
35	n	61	2	63
	(%)	(96.8)	(3.2)	(100)

Table 1: Number of babies according to place of birth (continued)

Hospitals		Place of Birth		Total
		Inborn	Outborn	
36	n	80	1	81
	(%)	(98.8)	(1.2)	(100)
37	n	40	6	46
	(%)	(87.0)	(13.0)	(100)
38	n	34	3	37
	(%)	(91.9)	(8.1)	(100)
39	n	31	4	35
	(%)	(88.6)	(11.4)	(100)
40	n	68	2	70
	(%)	(97.1)	(2.9)	(100)
41	n	148	14	162
	(%)	(91.4)	(8.6)	(100)
42	n	99	5	104
	(%)	(95.2)	(4.8)	(100)
43	n	0	0	0
	(%)	(0.0)	(0.0)	(0.0)
44	n	33	4	37
	(%)	(89.2)	(10.8)	(100)
45	n	5	1	6
	(%)	(83.3)	(16.7)	(100)
46	n	150	12	162
	(%)	(92.6)	(7.4)	(100)
47	n	13	0	13
	(%)	(100.0)	(0.0)	(100)
48	n	2	0	2
	(%)	(100.0)	(0.0)	(100)
TOTAL	**n**	**5108**	**509**	**5617**
	(%)	**(90.9)**	**(9.1)**	**(100)**

Figure 2

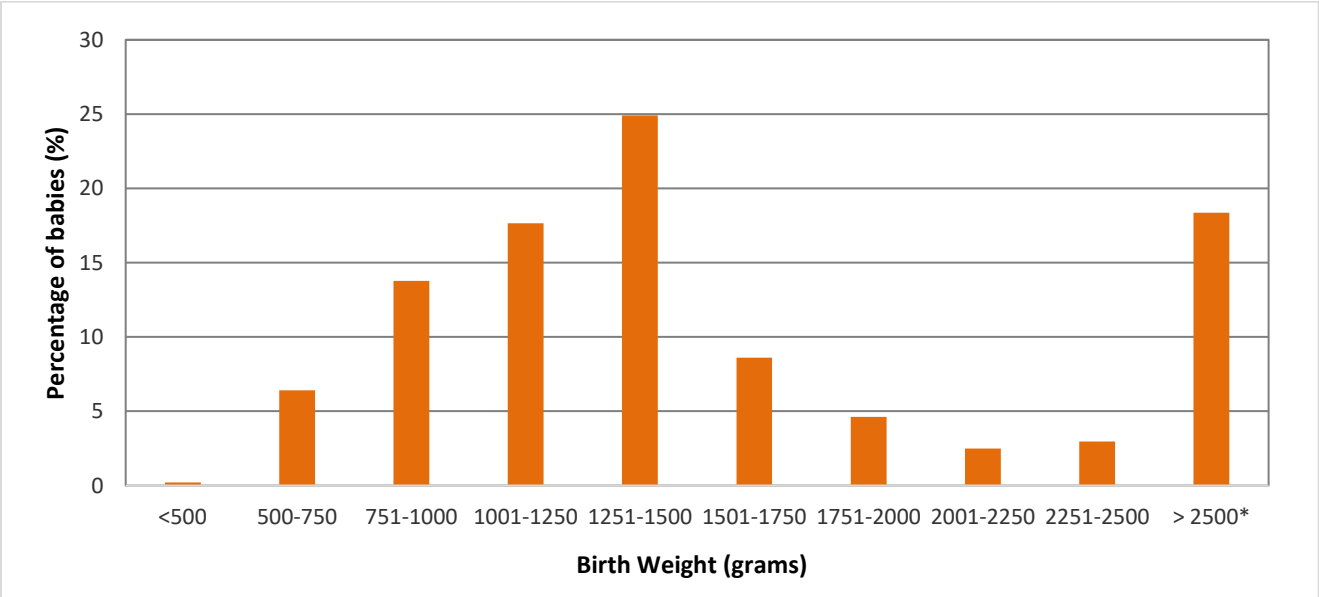
Frequency distribution of all babies in MNNR according to gestational age



COMMENT: For the categories ≥ 32 weeks, the case distribution does not include all livebirths in that respective gestational age group (See inclusion criteria).

Figure 3

Frequency distribution of all babies in MNNR according to birth weight categories



*COMMENT: * For the categories > 1500 gram birth weight, the case distribution does not include all live births in the respective categories (see inclusion criteria)*

Table 2: Frequency distribution of all babies in MNNR according to gestational age

Gestational age in completed weeks at birth	Frequency (n)	Percent (%)
< 23	22	0.4
23	44	0.8
24	113	2.0
25	168	3.0
26	217	3.9
27	289	5.1
28	413	7.4
29	511	9.1
30	705	12.6
31	807	14.4
32	404	7.2
33	251	4.5
34	233	4.1
35	159	2.8
36	166	3.0
37	229	4.1
38	310	5.5
39	281	5.0
40	267	4.8
41	19	0.3
≥ 42	9	0.2
Total included	5617	100
Total no. of babies with missing gestational age	0	
Total no. of babies	5617	

Table 3 : Frequency distribution of all babies in MNNR according to birth weight (BW) categories

Birth weight (grams)	Frequency (n)	Percent (%)
<500	11	0.2
500-750	360	6.4
751-1000	774	13.8
1001-1250	992	17.7
1251-1500	1399	24.9
1501-1750	483	8.6
1751-2000	259	4.6
2001-2250	140	2.5
2251-2500	167	3.0
> 2500	1032	18.4
Total included	5617	100.0
Total no. of babies with missing birth weight	0	
Total no. of babies	5617	

MATERNAL INTERVENTIONS

- Antenatal corticosteroids for fetal lung maturation were administered to 77.2% of mothers of babies less than 32 weeks gestation. A significantly lower proportion of mothers of outborn infants received antenatal corticosteroids, with 80.8% of inborns compared to only 50.2% of outborns under 32 weeks gestation receiving this intervention.For the respective MNNR centres, the use of antenatal corticosteroids ranged between 50% to 100% for inborn babies, and, between none (0%) to 100% for outborn infants. (Figure 4a & 4b and Table 4)
- For babies with birth weight ≤1500 grams, antenatal corticosteroids were given to the mothers of 80.6% of inborn babies and 48.1% of outborn babies (Figures 5a & 5b and Table 5).

INTERVENTIONS IN THE LABOUR ROOM

- Among inborn babies who were below 32 weeks gestational age, 58% (1748 out of 3016 babies) were given early nasal CPAP at initial resuscitation in the labour room.
- For inborn babies with birth weight less than 1500 grams, 81.1% (2537 out of 3128 babies) were wrapped with plastic at birth.

Figure 4a

Antenatal corticosteroids for all inborn babies born at < 32 weeks gestational age according to centres

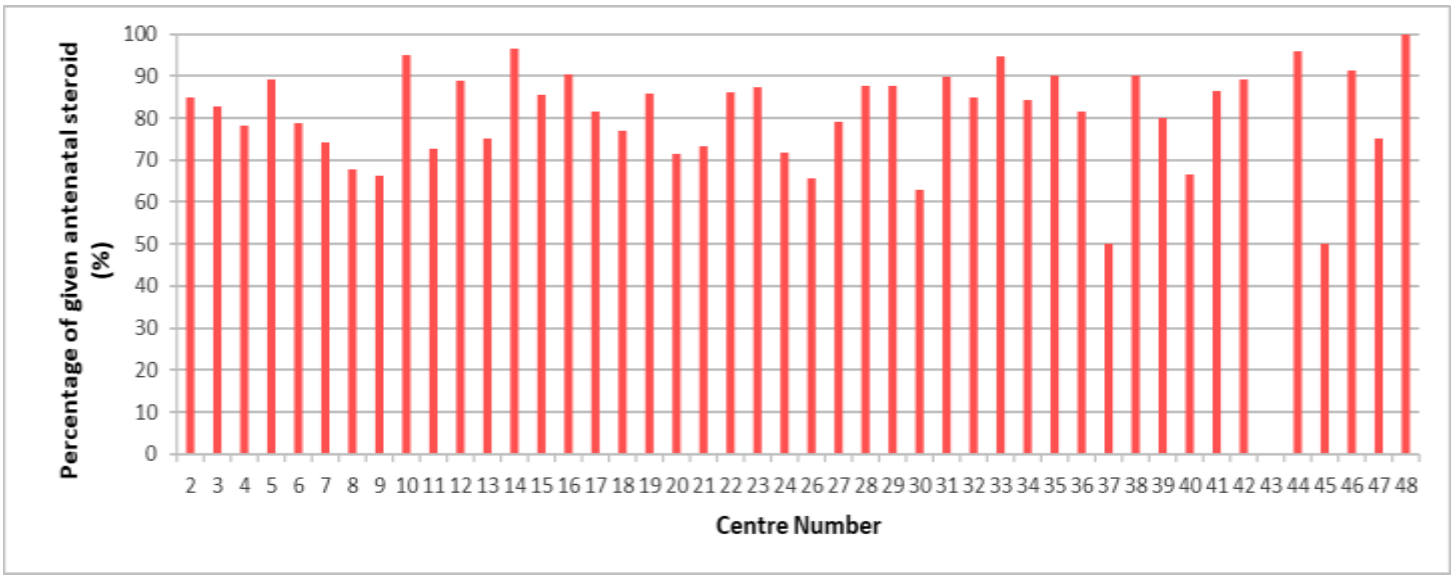


Figure 4b

Antenatal corticosteroids for all outborn babies born at < 32 weeks gestational age according to centres

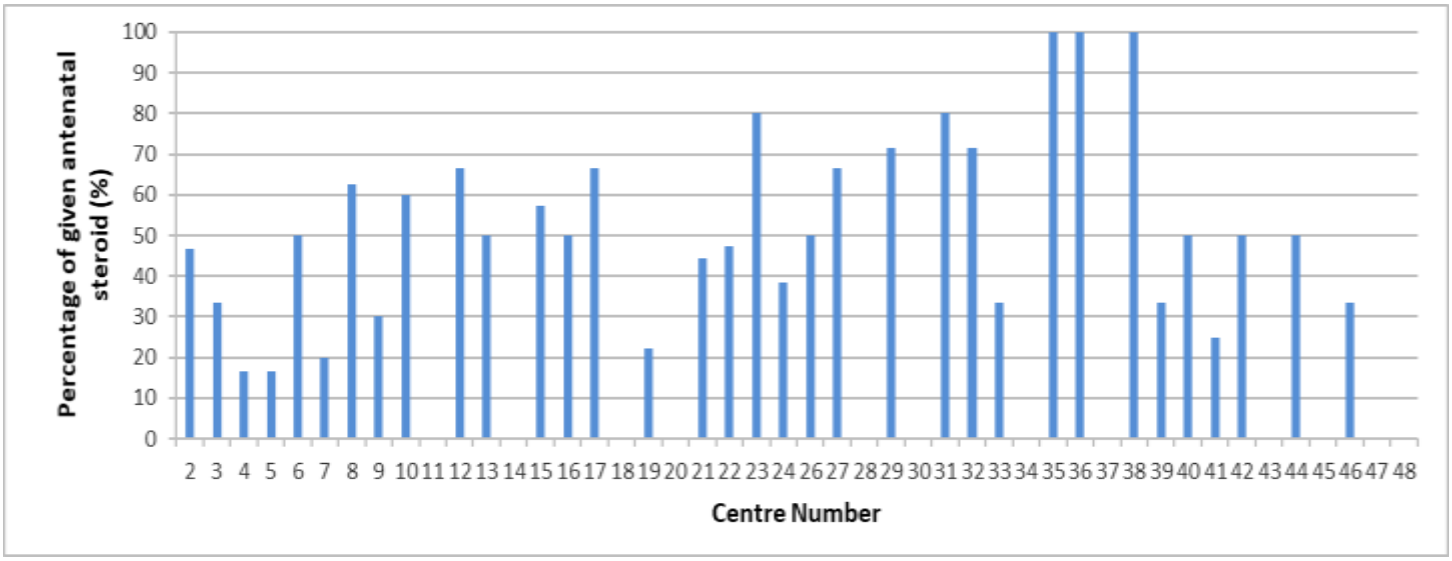


Table 4: Antenatal corticosteroids for all babies born at < 32 weeks gestational age according to centre

Hospitals	Inborn			Outborn		
	Total no of babies	Given Antenatal Steroids		Total No of Babies	Given Antenatal Steroids	
	n	N	%	n	N	%
	3016	**2436**	**80.8**	**273**	**137**	**50.2**
2	125	106	84.8	15	7	46.7
3	105	87	82.9	6	2	33.3
4	46	36	78.3	6	1	16.7
5	130	116	89.2	6	1	16.7
6	47	37	78.7	4	2	50.0
7	251	186	74.1	10	2	20.0
8	170	115	67.6	8	5	62.5
9	110	73	66.4	10	3	30.0
10	59	56	94.9	5	3	60.0

Table 4 (continued):
Antenatal corticosteroids for all babies born at < 32 weeks gestational age according to centres

Hospitals	Inborn			Outborn		
	Total no of babies	Given Antenatal Steroids		Total No of Babies	Given Antenatal Steroids	
	n	N	%	n	N	%
11	11	8	72.7	0	0	0.0
12	62	55	88.7	9	6	66.7
13	40	30	75.0	4	2	50.0
14	58	56	96.6	1	0	0.0
15	103	88	85.4	7	4	57.1
16	93	84	90.3	10	5	50.0
17	119	97	81.5	6	4	66.7
18	26	20	76.9	1	0	0.0
19	64	55	85.9	9	2	22.2
20	63	45	71.4	2	0	0.0
21	41	30	73.2	9	4	44.4
22	87	75	86.2	19	9	47.4
23	117	102	87.2	30	24	80.0
24	117	84	71.8	13	5	38.5
26	174	114	65.5	8	4	50.0
27	48	38	79.2	6	4	66.7
28	8	7	87.5	0	0	0.0
29	56	49	87.5	14	10	71.4
30	27	17	63.0	0	0	0.0

Table 4 (continued):
Antenatal corticosteroids for all babies born at < 32 weeks gestational age according to centres

Hospitals	Inborn			Outborn		
	Total no of babies	Given Antenatal Steroids		Total No of Babies	Given Antenatal Steroids	
	n	N	%	n	N	%
31	39	35	89.7	10	8	80.0
32	73	62	84.9	7	5	71.4
33	74	70	94.6	6	2	33.3
34	32	27	84.4	2	0	0.0
35	30	27	90.0	1	1	100.0
36	38	31	81.6	1	1	100.0
37	24	12	50.0	2	0	0.0
38	20	18	90.0	3	3	100.0
39	15	12	80.0	3	1	33.3
40	12	8	66.7	2	1	50.0
41	102	88	86.3	8	2	25.0
42	74	66	89.2	2	1	50.0
43	0	0	0.0	0	0	0.0
44	24	23	95.8	2	1	50.0
45	2	1	50.0	0	0	0.0
46	91	83	91.2	6	2	33.3
47	8	6	75.0	0	0	0.0
48	1	1	100.0	0	0	0.0

Figure 5a

Antenatal corticosteroids for all inborn babies born at ≤ 1500g birth weight according to centres

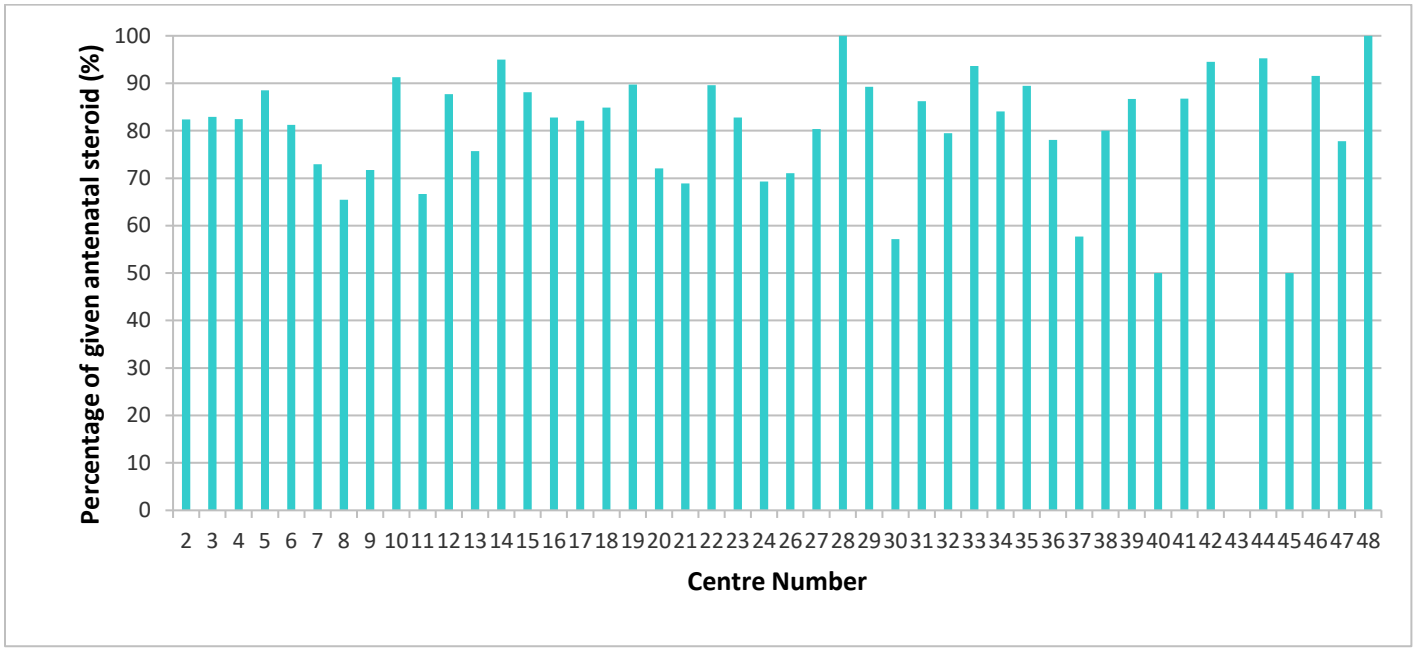


Figure 5b

Antenatal corticosteroids for all outborn babies born at ≤ 1500g birth weight according to centres

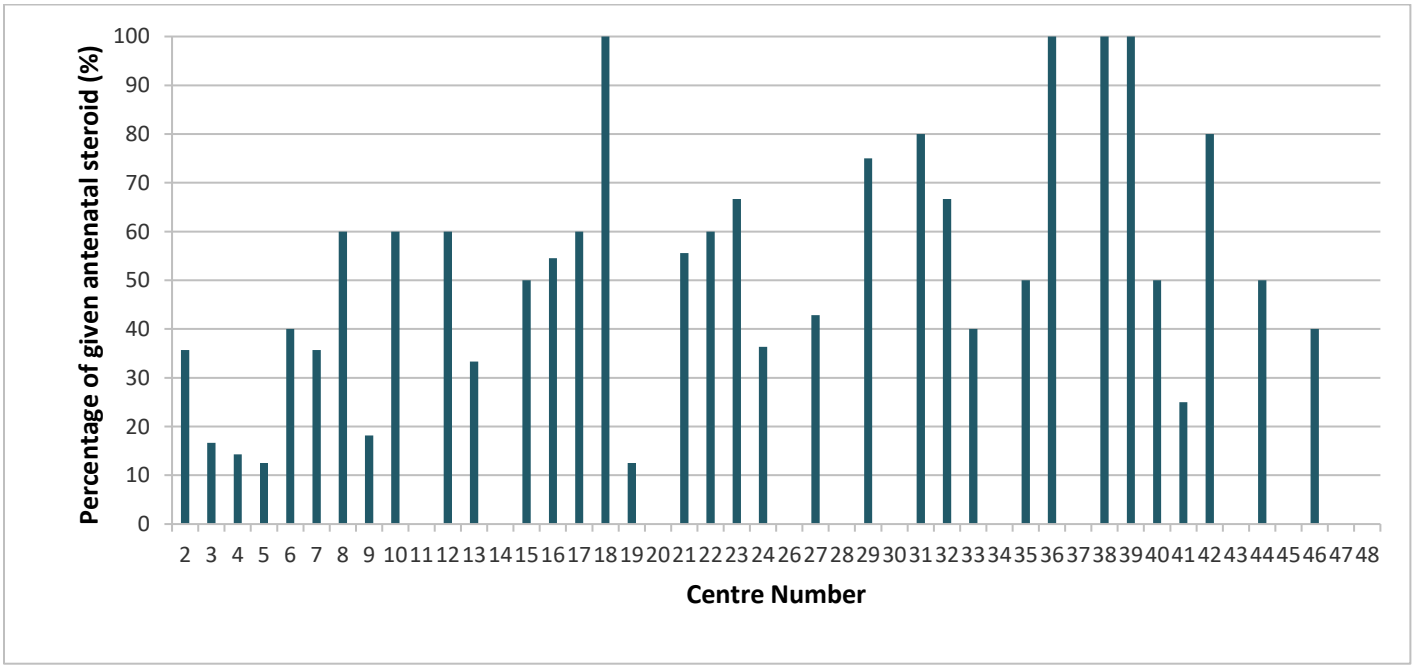


Table 5 :
Antenatal corticosteroids for all babies born at ≤ 1500 grams birth weight according to centres

Hospitals	Inborn			Outborn		
	Total no. of babies	Given antenatal steroids		Total no. of babies	Given antenatal steroids	
	n	N	%	n	N	n
	3243	**2613**	**80.6**	**293**	**141**	**48.1**
2	136	112	82.4	14	5	35.7
3	129	107	82.9	6	1	16.7
4	57	47	82.5	7	1	14.3
5	148	131	88.5	8	1	12.5
6	48	39	81.3	5	2	40.0
7	240	175	72.9	14	5	35.7
8	188	123	65.4	10	6	60.0
9	131	94	71.8	11	2	18.2
10	69	63	91.3	5	3	60.0
11	15	10	66.7	0	0	0.0
12	57	50	87.7	10	6	60.0
13	37	28	75.7	6	2	33.3
14	60	57	95.0	1	0	0.0
15	101	89	88.1	6	3	50.0
16	93	77	82.8	11	6	54.5
17	134	110	82.1	5	3	60.0
18	33	28	84.8	1	1	100.0
19	68	61	89.7	8	1	12.5

Table 5 (continued):
Antenatal corticosteroid for all babies born at ≤ 1500 grams birth weight according to centres

Hospitals	Inborn			Outborn		
	Total no. of babies	Given antenatal steroids		Total no. of babies	Given antenatal steroids	
	n	N	%	n	N	%
20	68	49	72.1	4	0	0.0
21	45	31	68.9	9	5	55.6
22	96	86	89.6	20	12	60.0
23	116	96	82.8	39	26	66.7
24	114	79	69.3	11	4	36.4
26	197	140	71.1	8	4	0.0
27	61	49	80.3	7	3	42.9
28	9	9	100.0	1	0	0.0
29	56	50	89.3	12	9	75.0
30	28	16	57.1	1	0	0.0
31	29	25	86.2	10	8	80.0
32	78	62	79.5	6	4	66.7
33	79	74	93.7	5	2	40.0
34	44	37	84.1	2	0	0.0
35	38	34	89.5	2	1	50.0
36	41	32	78.0	1	1	100.0
37	26	15	57.7	1	0	0.0
38	20	16	80.0	3	3	100.0

Table 5 (continued):
Antenatal corticosteroid for all babies born at ≤ 1500 grams birth weight according to centres

Hospitals	Inborn			Outborn		
	Total no. of babies	Given antenatal steroids		Total no. of babies	Given antenatal steroids	
	n	N	%	n	N	%
39	15	13	86.7	1	1	100.0
40	16	8	50.0	2	1	50.0
41	121	105	86.8	8	2	25.0
42	73	69	94.5	5	4	80.0
43	0	0	0.0	0	0	0.0
44	21	20	95.2	2	1	50.0
45	2	1	50.0	0	0	0.0
46	95	87	91.6	5	2	40.0
47	9	7	77.8	0	0	0.0
48	2	2	100.0	0	0	0.0

RESPIRATORY SUPPORT AND SURFACTANT THERAPY

- 92.3% (3070 out of 3289) of babies born below 32 weeks gestation; and 91.3% (3228 out of 3536) of babies with birth weight ≤1500 grams, required respiratory support.

- Exogenous surfactant therapy was given to 64% (2262 out of 3536) of babies with birth weight ≤1,500 grams, and 43.7% of these were given within 1 hour of life. 72.1% (2371 out of 3289) of babies born below 32 weeks gestational age received surfactant, and 42.6% of these were given within 1 hour of life.

RESPIRATORY DISEASES AND CHRONIC LUNG DISEASE

Chronic Lung Disease

- The rates of chronic lung disease (oxygen dependency) for all inborn babies less than 32 weeks gestation surviving to day 28 of life and 36 weeks post-conceptional age, were 65% and 64.7% respectively for babies between 22-24 weeks gestational age; 65.5% and 50.2% for babies between 25-27 weeks gestational age; and 20.3% and 13.3% for babies between 28-31 weeks gestational age.(Figure 6 and Table 6)
- For babies with oxygen dependency at 36 weeks post-conceptional age, survival to discharge were 95.5%, 94.2% and 97% for babies between 22-24 weeks, 25-27 weeks and 28-31 weeks gestational age respectively.
- The rates of chronic lung disease for inborn babies with birth weight <1500g who survived to day 28 were 61.4% for babies with birth weight <750 g, 57.1% for babies with birth weight 750-999 g, 27.8% for babies with birth weight 1000-1249 g, and 11.7% for babies with birth weight 1250-1499 g. Among these babies, those born at <32 weeks gestation, the rates of chronic lung disease for babies who survived to 36 weeks post-conceptional age were 55.9% for babies with birth weight <750 g, 46.8% for babies with birth weight 750-999 g, 19.8% for babies with birth weight 1000-1249 g, and 9.7% for babies with birth weight 1250-1499 g. For babies born at ≥32 weeks gestation, the rates of chronic lung disease for babies who survived to day 56 were 50% for babies with birth weight 750-999 g, 10% for babies with birth weight 1000-1249 g, and 3.3% for babies with birth weight 1250-1499 g. (Figure 7 and Table 7)

Figure 6

Incidence of oxygen dependency among admitted inborn babies with gestational age < 32 weeks

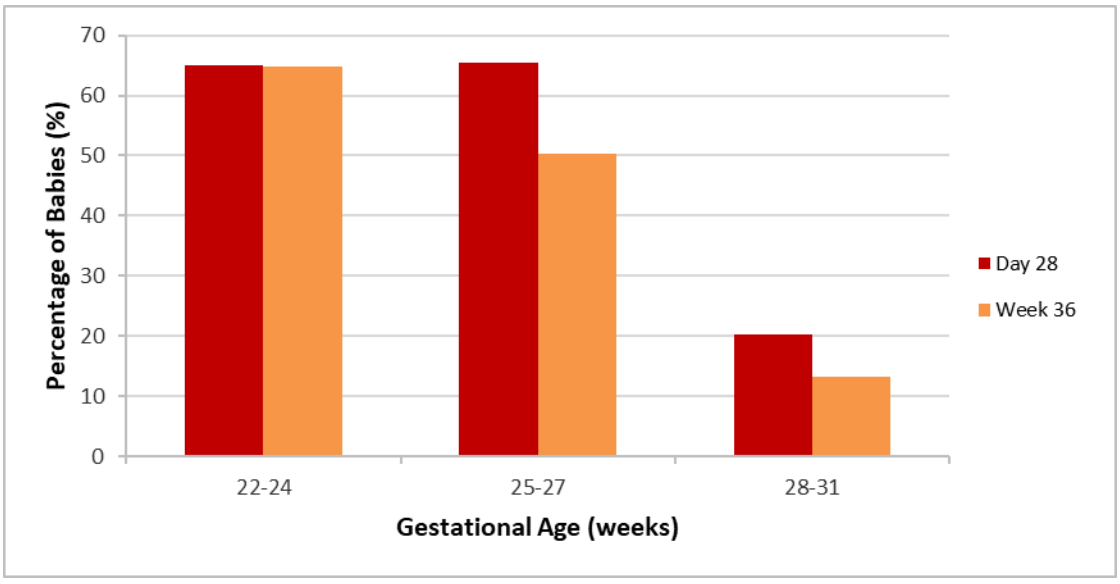


Table 6:
Incidence of oxygen dependency among admitted inborn babies with gestational age < 32 weeks

Gestational age at birth (weeks)		Total no of admitted inborn babies	Babies alive at day 28	Babies with oxygen dependency at day 28 among survivors	Babies alive at 36 weeks postmenstrual age	Babies with oxygen dependency at 36 weeks among survivors
22-24	*n*	136	40	26	34	22
	%	4.6	29.4	65.0	25.0	64.7
25-27	*n*	591	423	277	410	206
	%	20.1	71.6	65.5	69.4	50.2
28-31	*n*	2220	2048	415	2037	271
	%	75.3	92.3	20.30	91.8	13.3
Total included	*n*	2947	2511	718	2481	499
	%	100	85.2	28.6	84.2	20.1
Total babies		2947				

Figure 7

Incidence of oxygen dependency among admitted inborn babies with birth weight < 1500 grams

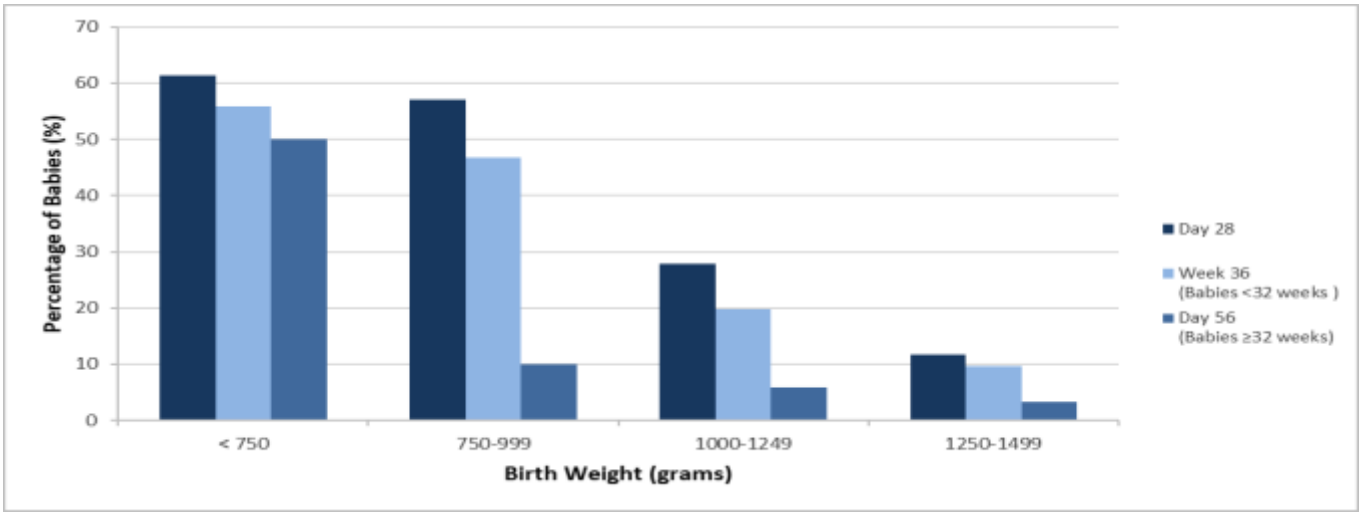


Table 7:
Incidence of oxygen dependency among admitted inborn babies with birth weight < 1500 grams

Birth Weight (grams)		Total no of admitted inborn babies	Babies alive at 28	Babies with oxygen dependency at day 28 among survivors	Week 36 (Babies <32 weeks)		Day 56 (Babies ≥32 weeks)	
					Babies alive at 36 weeks postmenstrual age	Babies with oxygen dependency at 36 weeks among survivors	Babies alive at day 56	Babies with oxygen dependency at day 56 among survivors
< 750	*n*	288	127	78	111	62	4	2
	%	9.4	44.1	61.4	39.8	55.9	44.4	50.0
750-999	*n*	640	503	287	462	216	30	3
	%	20.9	78.6	57.1	76.6	46.8	81.1	10.0
1000 – 1249	*n*	914	817	227	643	127	172	10
	%	29.9	89.4	27.8	88.9	19.8	90.1	5.8
1250 - 1499	*n*	1218	1151	135	630	61	516	17
	%	39.8	94.5	11.7	93.9	9.7	94.3	3.3
Total Included	*n*	3060	2598	727	1846	466	722	32
	%	100	84.9	28.0	76.9	25.2	92.1	4.4
Total babies		3060						

CARDIOVASCULAR COMPLICATIONS

Patent Ductus Arteriosus

- Patent ductus arteriosus (PDA) was diagnosed in 1117 (37.9%) inborn babies with gestational age <32 weeks admitted to the NICUs. Overall, 98% of these babies has echocardiogram to confirm the diagnosis. Indomethacin, ibuprofen and paracetamol were administered to 1.3%, 11.6% and 50.6% of these babies respectively, 2.3% of them underwent PDA ligation. (Table 8)
- PDA was diagnosed in 1136 (37.1%) inborn babies with birth weight <1500g admitted to the NICUs. Indomethacin, ibuprofen and paracetamol were administered to 1.3%, 11.3% and 33.4% of these babies respectively, 2.4% of them underwent PDA ligation. (Table 9)

Table 8

Treatment of patent ductus arteriosus (PDA) in admitted inborn babies in the MNNR by gestational age categories

Gestation (weeks)	Total Inborn	PDA Diagnosed		Confirmed by ECHO		Treatment							
						Indomethacin		Ibuprofen		Paracetamol		Ligation	
	n	n	%	n	%	n	%	n	%	n	%	n	%
22-24	136	50	36.8	50	100.0	3	6.0	8	16.0	25	50.0	1	2.0
25 - 27	591	350	59.2	343	98.0	6	1.7	67	19.1	217	62.0	17	4.9
28 -31	2220	717	32.3	702	97.9	6	0.8	55	7.7	323	45.0	8	1.1
Total	2947	1117	37.9	1095	98.0	15	1.3	130	11.6	565	50.6	26	2.3

Table 9

Treatment of patent ductus arteriosus (PDA) in admitted inborn babies by birth weight categories

Birth Weight (grams)	Total Inborn	PDA Diagnosed		Confirmed by ECHO		Treatment							
						Indomethacin		Ibuprofen		Paracetamol		Ligation	
	n	n	%	n	%	n	%	n	%	n	%	n	%
< 750	288	136	47.2	134	98.5	4	2.9	15	11.0	70	51.5	2	1.5
750 - 999	640	348	54.4	338	97.1	4	1.1	66	19.0	206	59.2	17	4.9
1000- 1249	914	358	39.2	348	97.2	6	1.7	28	7.8	163	45.5	5	1.4
1250 - 1499	1218	294	24.1	292	99.3	1	0.3	19	6.5	113	38.4	3	1.0
Total	3060	1136	37.1	1112	97.9	15	1.3	128	11.3	379	33.4	27	2.4

RETINOPATHY OF PREMATURITY

- For inborn babies born at gestational age <32 weeks and survived to 6 weeks of age, 2023 (81.3%) babies were screened for retinopathy of prematurity (ROP) before discharge. Among these babies, 1641 (81.1%) did not have ROP; 323 (16.0%) had ROP stage 1 or 2; 53 (2.6%) had ROP stage 3; 2 (0.1%) had ROP stage 4 or 5; and 4(0.2%) had aggressive posterior ROP (APROP). The incidence rates of severe ROP (stage 3, 4, 5 and APROP) in those surviving to 6 weeks were 23.3%, 8.8%, 1.1% in babies with gestational age of 22-24 weeks, 25-27 weeks and 28-31 weeks respectively. A total of 44 babies had laser therapy, 1 had cryotherapy and 8 babies were treated with anti-vascular endothelial growth factor (anti-VEGF) injection. No babies required a vitrectomy. (Figure 10 and Table 10)
- For inborn babies born with birth weight <1500 g and survived to 6 weeks of age, 2089 (81.1%) were screened for ROP before discharge. Among these babies, 1712 (82.0%) did not have ROP; 317 (15.2%) had stage ROP 1 or 2; 52 (2.5%) had ROP stage 3; 2 (0.1%) had ROP stage 4 or 5; and 6 (0.3%) had APROP. The incidence of severe ROP (stage 3, 4, 5 and APROP) were 16.7%, 4.6%, 2.0%, and 0.3%, in babies with birth weight <750 g, 750-999 g, 1000-1249 g and 1250-1499 g, respectively. A total of 45 babies underwent laser therapy, 1 cryotherapy and 8 babies had anti-VEGF injection. No babies required vitrectomy (Figure 11 and Table 11)
- In addition to the above, there were 6 outborn babies who were treated with laser therapy, and 2 with anti-VGEF injections. All were below 32 weeks and <1500g in birth weight.

Figure 10

Incidence of retinopathy of prematurity (ROP) in admitted inborn babies by gestational age categories

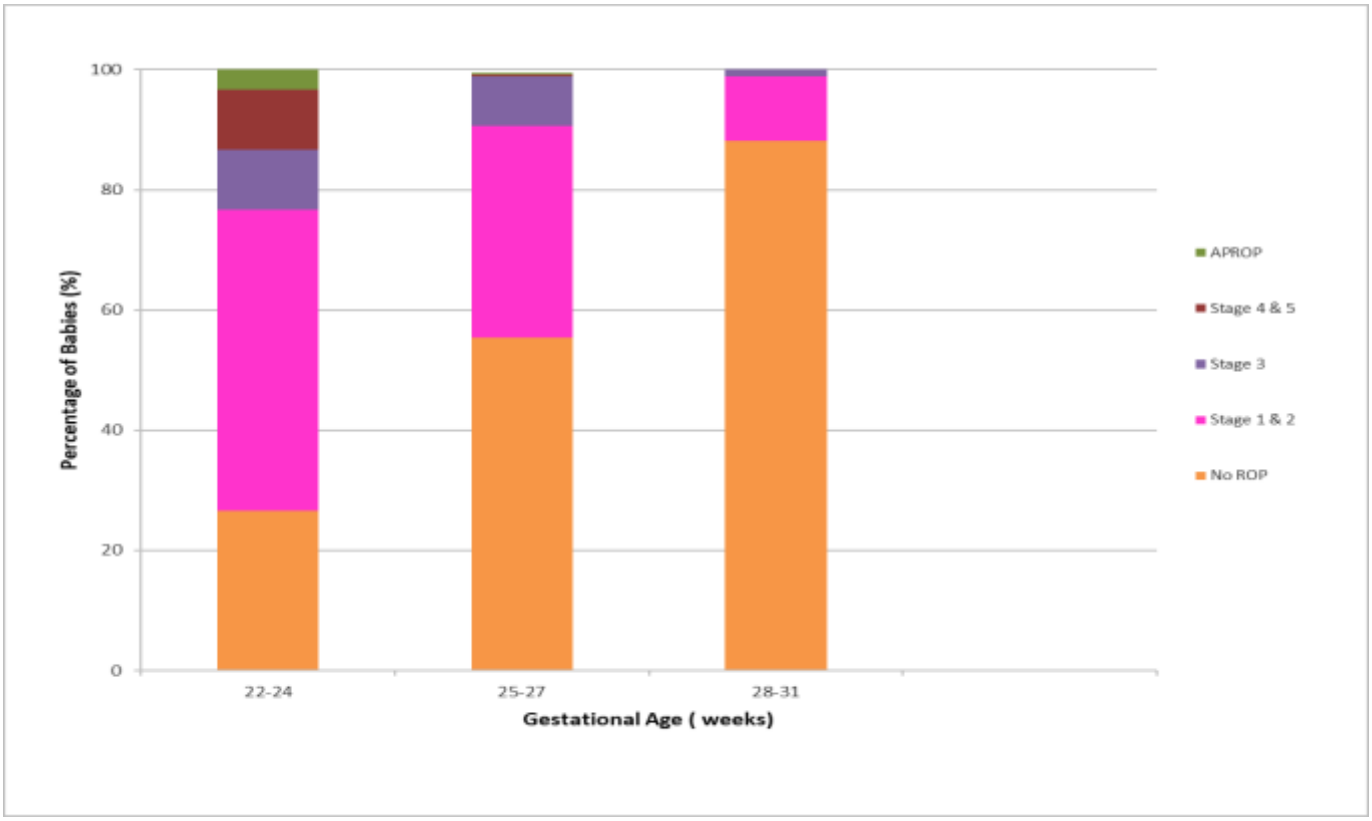


Table 10:
Incidence of retinopathy of prematurity (ROP) in admitted inborn babies in the MNNR by gestational age categories

Gestational age at birth (weeks)	Total number of admitted inborn babies	No. of babies alive at 6 weeks	No. of babies with eye examination		Retinopathy of prematurity									
					No ROP		ROP Stage 1 or 2		ROP Stage 3		ROP Stage 4 or 5		APROP	
	n	*n*	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	n	%
22-24	136	37	30	81.1	8	26.7	15	50.0	3	10.0	1	3.3	3	10.0
25-27	591	415	386	93.0	215	55.7	137	35.5	32	8.3	1	0.3	1	0.3
28-31	2220	2037	1607	78.9	1418	88.2	171	10.6	18	1.1	0	0.0	0	0.0
Total Included	2947	2489	2023	81.3	1641	81.1	323	16.0	53	2.6	2	0.1	4	0.2

Gestational age at birth (weeks)	Therapy			
	Laser	Cryotherapy	Anti-VEGF	Vitrectomy
22-24	7	0	3	0
25-27	29	0	3	0
28-31	8	1	2	0
Total Included	44	1	8	0

Comment: "Number of babies with eye examination" refers to those screened during the ward admission

Figure 11

Incidence of retinopathy of prematurity (ROP) in admitted inborn babies by birth weight categories

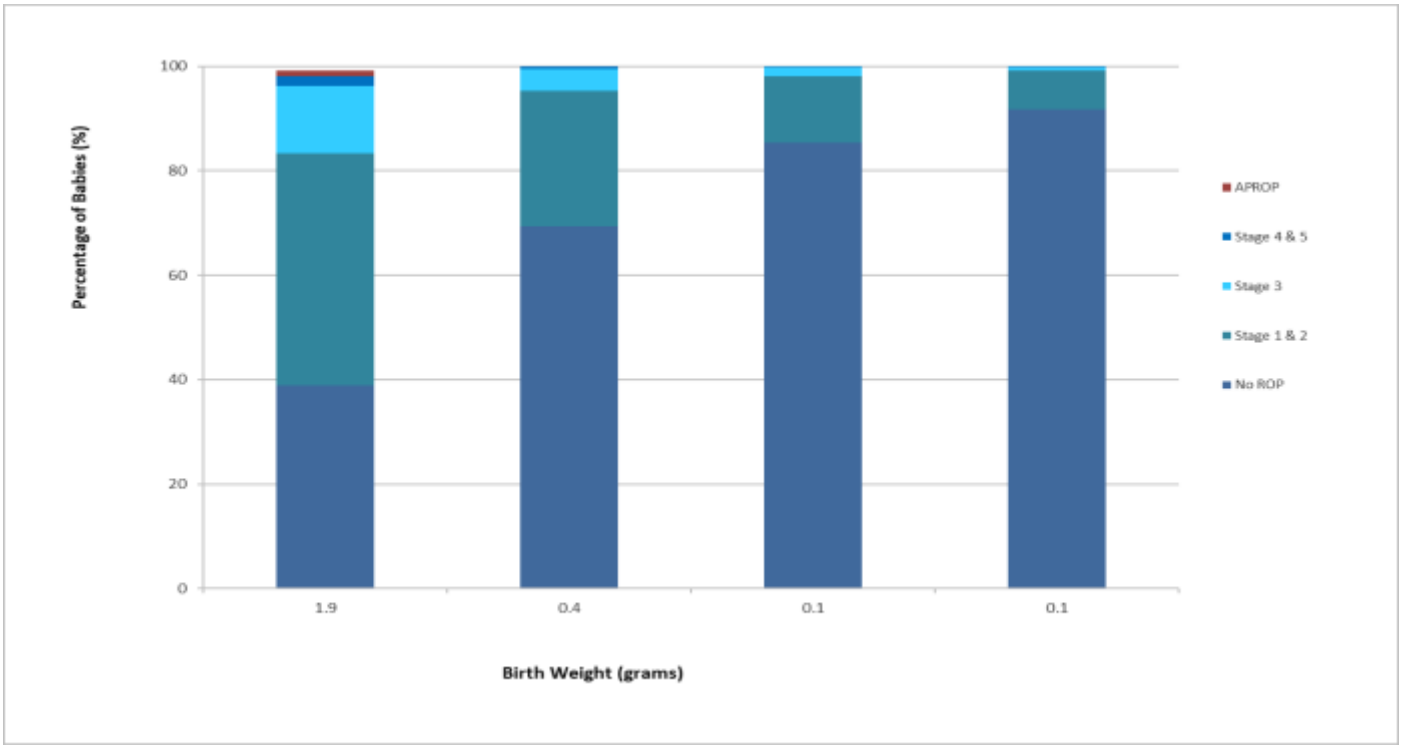


Table 11 :
Incidence of retinopathy of prematurity (ROP) in admitted inborn babies in the MNNR by birth weight categories

Birth weight (grams)	Total no of admitted inborn babies	No. of babies alive at 6 weeks	No. of babies with eye examination		Retinopathy of prematurity									
					No ROP		ROP Stage 1 or 2		ROP Stage 3		ROP Stage 4 or 5		APROP	
	n	*n*	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	n	%
< 750	288	118	108	91.5	42	38.9	48	44.4	14	13.0	2	1.9	2	1.9
750-999	640	497	453	91.1	314	69.3	118	26.0	19	4.2	0	0.0	2	0.4
1000-1249	914	816	717	87.9	612	85.4	91	12.7	13	1.8	0	0.0	1	0.1
1250-1499	1218	1146	811	70.8	744	91.7	60	7.4	6	0.7	0	0.0	1	0.1
Total included	3060	2577	2089	81.1	1712	82.0	317	15.2	52	2.5	2	0.1	6	0.3

Gestational age at birth (weeks)	Therapy			
	Laser	Cryotherapy	Anti-VEGF	Vitrectomy
< 750	16	0	4	0
750 - 999	17	0	3	0
1000- 1249	9	1	0	0
1250 - 1499	3	0	1	0
Total included	45	1	8	0

Comment: "Number of babies with eye examination" refers to those screened during the ward admission

INTRAVENTRICULAR HAEMORRHAGE

- A total of 2827 (95.9%) inborn babies with gestational age <32 weeks underwent cranial ultrasound examination for intraventricular haemorrhage (IVH). Among these babies, 1667 (59.0%) did not have IVH, 916 (32.4%) had grade 1 or 2 IVH, 154 (5.4%) had grade 3 IVH, and 90 (3.2%) had grade 4 IVH. The incidence rates of severe IVH (grade 3 or 4) were 34.4%, 18.5%, and 4.9% in babies with gestational age of 22-24 weeks, 25-27 weeks, and 28-31 weeks, respectively. 1 baby had ventriculo-peritoneal (VP) shunt inserted. (Figure 12 and Table 12)
- There were 2926 (95.6%) inborn babies with birth weight <1500 g who underwent cranial ultrasound examination. Among these babies, 1786 (61.0%) did not have IVH, 904 (30.9%) had grade 1 or 2, 150 (5.1%) had grade 3, and 86 (2.9%) had grade 4 IVH. The incidence rates of severe IVH (grade 3 or 4) were 24.1%, 14.1%, 6.7%, and 2.7% in babies with birth weights <750 g, 750-999 g, 1000-1249 g, and 1250-1499 g, respectively. 2 babies had VP shunt inserted. (Figure 13 and Table 13)

Figure 12

Incidence of intraventricular haemorrhage (IVH) in admitted inborn babies < 32 weeks gestational age

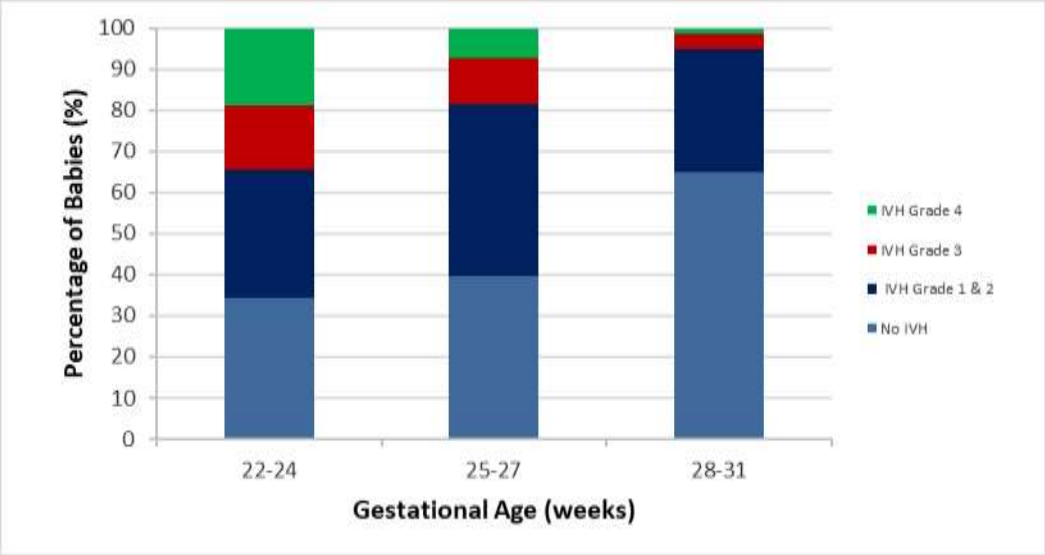


Table 12 :
Incidence of intraventricular haemorrhage (IVH) in admitted inborn babies < 32 weeks gestational age

Gestational age (completed weeks)		Total no. of admitted inborn babies	Babies with cranial US	NO IVH	IVH Grade 1 or Grade 2	IVH Grade 3	IVH Grade 4
22-24	**N**	136	96	33	30	15	18
	%	4.6	70.6	34.4	31.3	15.6	18.8
25-27	**n**	591	561	223	234	63	41
	%	20.1	94.9	39.8	41.7	11.2	7.3
28-31	**N**	2220	2170	1411	652	76	31
	%	75.3	97.7	65.0	30.0	3.5	1.4
Total included	**N**	2947	2827	1667	916	154	90
	%	100	95.9	59.0	32.4	5.4	3.2
Total babies	2947						

Figure 13

Incidence of intraventricular haemorrhage (IVH) in admitted inborn babies < 1500 grams birth weight

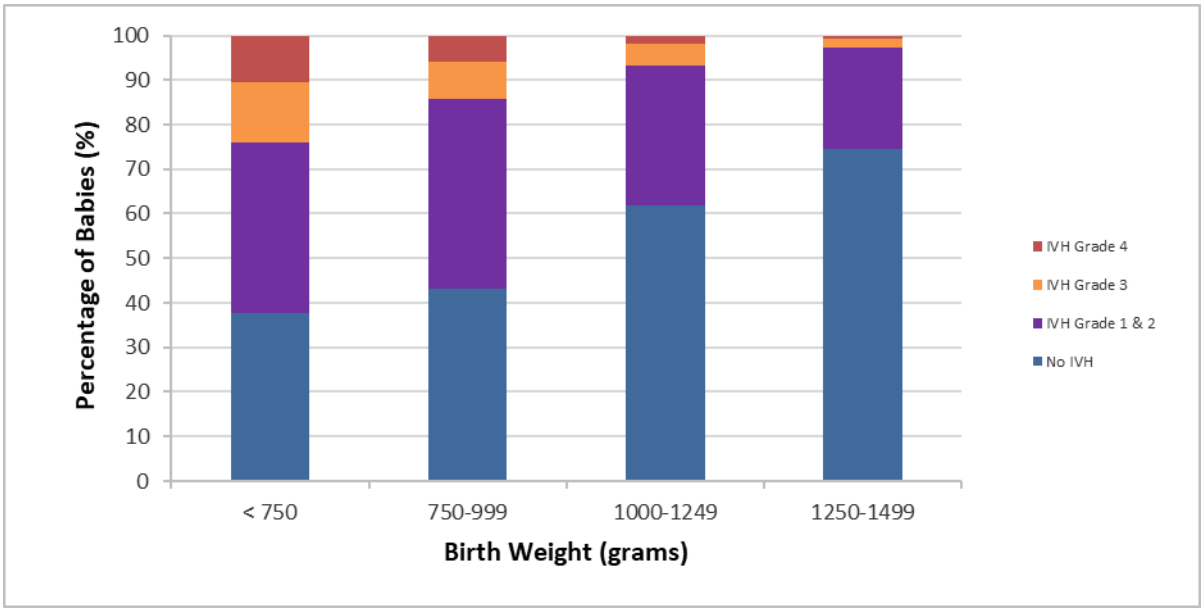


Table 13 :
Incidence of intraventricular haemorrhage (IVH) in admitted inborn babies <1500 grams birth weight

Birth weight (grams)		Total no. of admitted inborn babies	Babies with Cranial US	NO IVH	IVH Grade 1 or Grade 2	IVH Grade 3	IVH Grade 4
< 750	n	288	237	89	91	32	25
	%	9.4	82.3	37.6	38.4	13.5	10.5
750-999	n	640	616	265	264	51	36
	%	20.9	96.3	43.0	42.9	8.3	5.8
1000-1249	n	914	897	554	283	42	18
	%	29.9	98.1	61.8	31.5	4.7	2.0
1250-1499	n	1218	1176	878	266	25	7
	%	39.8	96.6	74.7	22.6	2.1	0.6
Total included	n	3060	2926	1786	904	150	86
	%	100	95.6	61.0	30.9	5.1	2.9
Total babies	3060						

NECROTIZING ENTEROCOLITIS

- A total of 179 (6.1%) of the inborn babies with gestational age <32 weeks, developed necrotizing enterocolitis (NEC)(Stage 2 and above modified Bell's criteria) and 55 (30.7%) of them required surgery. The incidence rates of NEC for babies with gestational age of 22-24 weeks, 25-27 weeks, and 28-31 weeks were 6.6%, 8.6%, and 5.4%, respectively. (Figure 14 and Table 14)
- For inborn babies with birth weight <1500g, 201(6.6%) developed NEC (Stage 2 and above modified Bell's criteria) and 65 (32.3%) required surgery. The incidence rates of NEC for babies with birth weights <750 g, 750-999 g, 1000-1249 g, and 1250-1499 g, were 8.3%, 10.0%, 6.8%, and 4.2%, respectively. (Figure 15 and Table 15)

Figure 14
Incidence of necrotizing enterocolitis (NEC) in admitted inborn babies according to gestational age categories

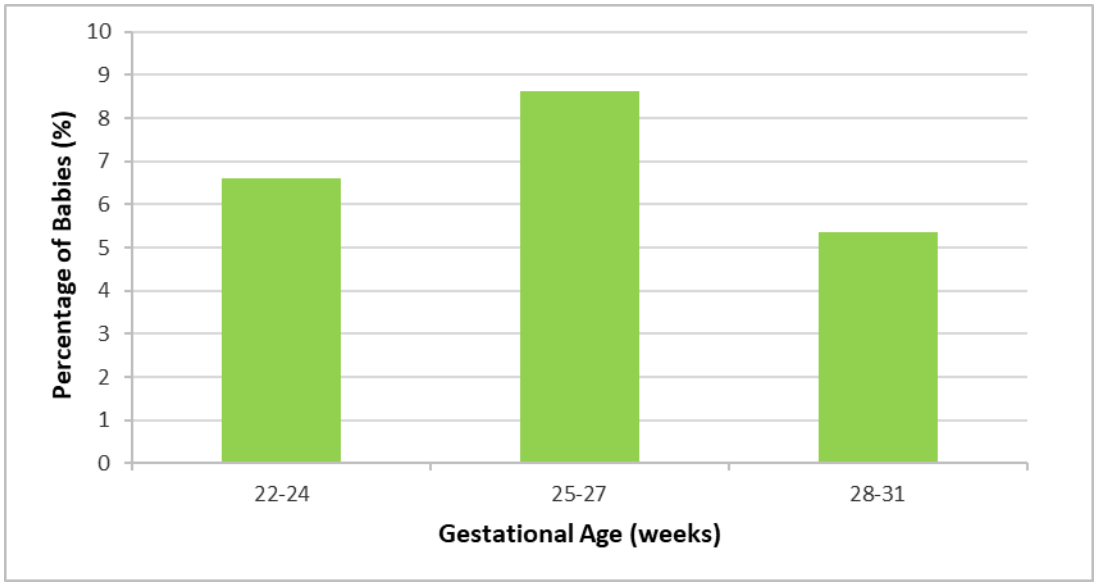


Table 14 :
Incidence and treatment of necrotizing enterocolitis (NEC) in admitted inborn babies according to gestational age categories

Gestational age (weeks)	Total number of admitted inborn babies	Babies with NEC		With Surgical treatment	
	n	*n*	*%*	*n*	*%*
22-24	136	9	6.6	3	33.3
25-27	591	51	8.6	18	35.3
28-31	2220	119	5.4	34	28.6
Total Included	2947	179	6.1	55	30.7
Total no. of missing (GA)	0				
Overall Total babies	2947				

Comment: NEC refers to those with at least Stage 2 modified Bell's criteria

Figure 15

Incidence of necrotizing enterocolitis (NEC) in admitted inborn babies according to birth weight categories

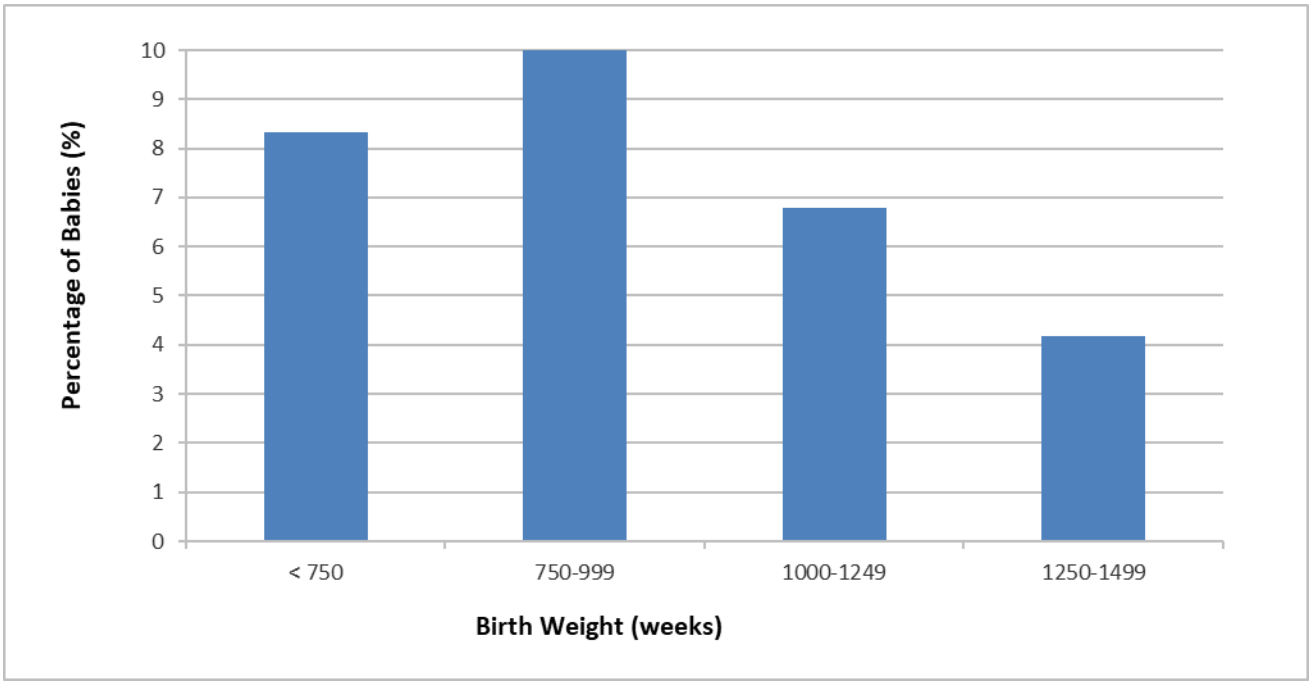


Table 15 :
Incidence and treatment of necrotizing enterocolitis (NEC) in admitted inborn babies according to birth weight categories

Birth weight (grams)	Total number admitted of inborn babies	Babies with NEC		With Surgical treatment	
	n	*n*	*%*	*n*	*%*
< 750	288	24	8.3	9	37.5
750-999	640	64	10.0	18	28.1
1000-1249	914	62	6.8	21	33.9
1250 – 1499	1218	51	4.2	17	33.3
Total included	3060	201	6.6	65	32.3
Total no. of missing (BW)	0				
Overall total babies	3060				

Comment: NEC refers to those with at least Stage 2 modified Bell's criteria

NEONATAL SEPSIS

- The incidence rate of early onset sepsis (blood culture positive) among admitted inborn babies with gestational age <32 weeks, was 1.5%. The incidence rates were 1.5%, 2.5%, and 1.2% in babies with gestational age 22-24 weeks, 25-27 weeks, and 28-31 weeks, respectively (Figure 16 and Table 16)
- 199 (7.4%) of inborn babies with gestational age <32 weeks who survived more than 3 days, had one or more episodes of blood culture positive late onset sepsis. Among these babies, the incidence rates of late onset sepsis were 22.2%, 15.0%, and 5.3% for babies with gestational age of 22-24 weeks, 25-27 weeks, and 28-31 weeks, respectively. (Figure 17 and Table 17)
- 211 (7.6%) of inborn babies with birth weights <1500 g who survived more than 3 days, had one or more episodes of blood culture positive late onset sepsis. Among these babies, the incidence rates were 16.9%, 11.6%, 8.2% and 3.8% for birth weight groups <750 g, 750-999 g, 1000-1249 g, and 1250-1499 g, respectively. (Figure 18 and Table 18)

Figure 16

Incidence of blood culture positive early onset sepsis in admitted inborn babies by gestational age categories

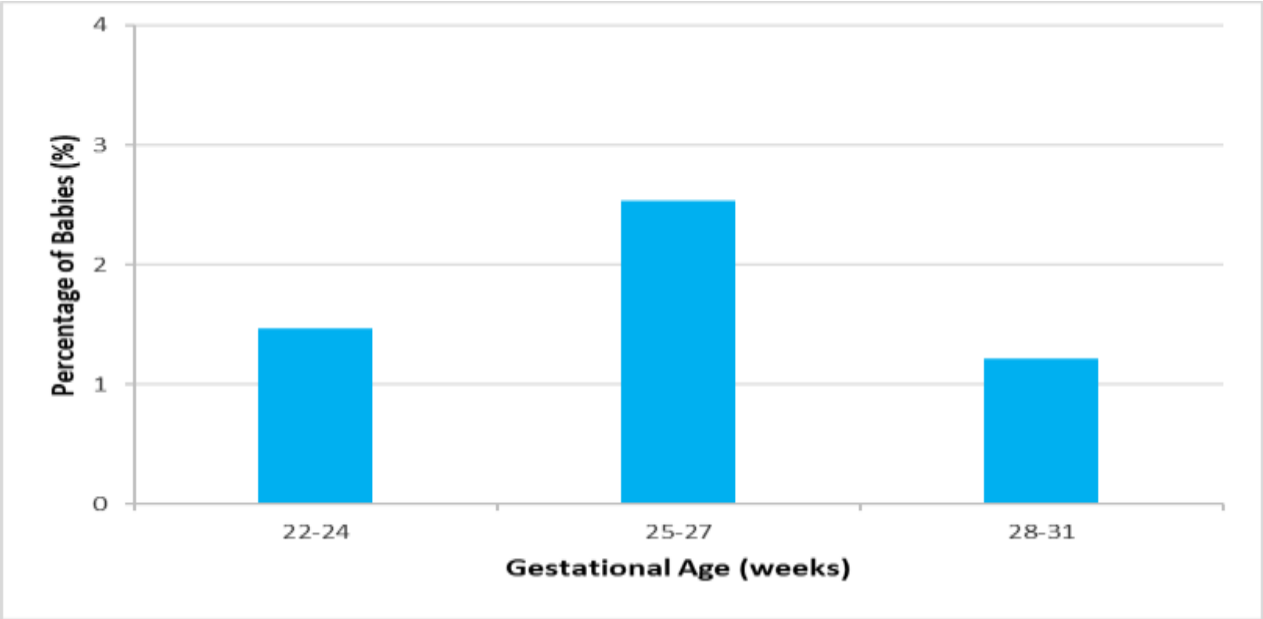


Table 16 :
Incidence of blood culture positive early onset sepsis in admitted inborn babies by gestational age categories

Gestational age at birth (completed weeks)	Total number of admitted inborn babies	No. of babies with early infection	
	n	*n*	%
22-24	136	2	1.5
25-27	591	15	2.5
28-31	2220	27	1.2
Total included	2947	44	1.5
Total no. of missing (GA)	0		
Total babies	2947		

Figure 17

Incidence of blood culture positive late onset sepsis in admitted inborn babies by gestational age categories

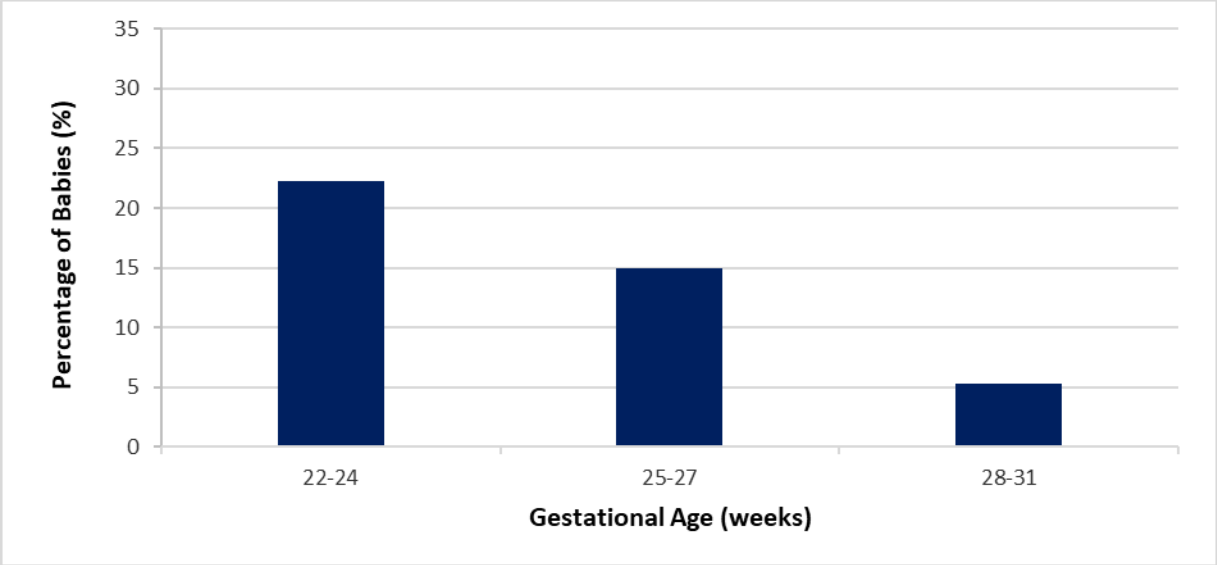


Table 17:
Incidence of blood culture positive late onset sepsis in admitted inborn babies by gestational age categories

Gestational age (weeks)	Total number of admitted inborn babies	No. of babies who survived beyond day 3 after birth	No. of babies (survived more than 3 days) with at least one episode of late onset sepsis	
	n	*n*	n	%
22-24	136	63	14	22.2
25-27	620	487	73	15.0
28-31	2388	2,130	112	5.3
Total included	3144	2,680	199	7.4
Total no. of missing (GA)	0			
Total babies	3144			

Figure 18

Incidence of blood culture positive late onset sepsis in admitted inborn babies by birth weight categories

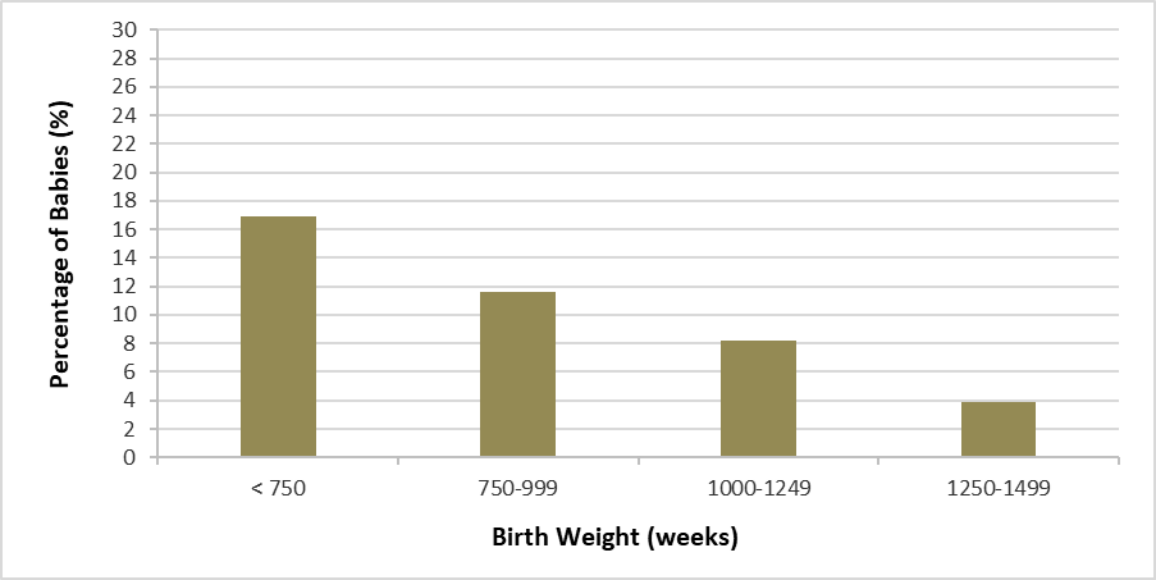


Table 18 :
Incidence of blood culture positive late onset sepsis in admitted inborn babies by birth weight categories

Birth weight (grams)	Total number of admitted inborn babies	No. of babies who survived beyond day 3 after birth	No. of babies (survived more than 3 days) with at least one episode of late onset sepsis	
	n	*n*	n	%
< 750	288	177	30	16.9
750-999	640	561	65	11.6
1000-1249	914	864	71	8.2
1250 - 1499	1218	1172	45	3.8
Total included	3060	2,774	211	7.6
Total no. of missing (BW)	0			
Overall total babies	3060			

SURVIVAL AND MORBIDITIES (FOR PRETERM BABIES <32 WEEKS OR BIRTH WEIGHT 500 GRAMS TO 1500 GRAMS)

- The survival rates of very preterm babies, both inborn and outborn, included in the MNNR according to gestational age were 13.6% for 23 weeks, 27.4% for 24 weeks, 53.0% for 25 weeks, 60.4% for 26 weeks, 75.4% for 27 weeks, 82.1% for 28 weeks, 88.6% for 29 weeks, 92.5% for 30 weeks, and 94.3% for 31 weeks. (Figure 19 and Table 19)
- The survival rates of babies, according to birth weight categories, included in the MNNR were 0.0% for < 500 grams, 36.4% for 500-750 grams, 74.5% for 751-1000 grams, 87.8% for 1001-1250 grams, and 93.4%% for 1251-1500 grams,. (Figure 20 and Table 20).

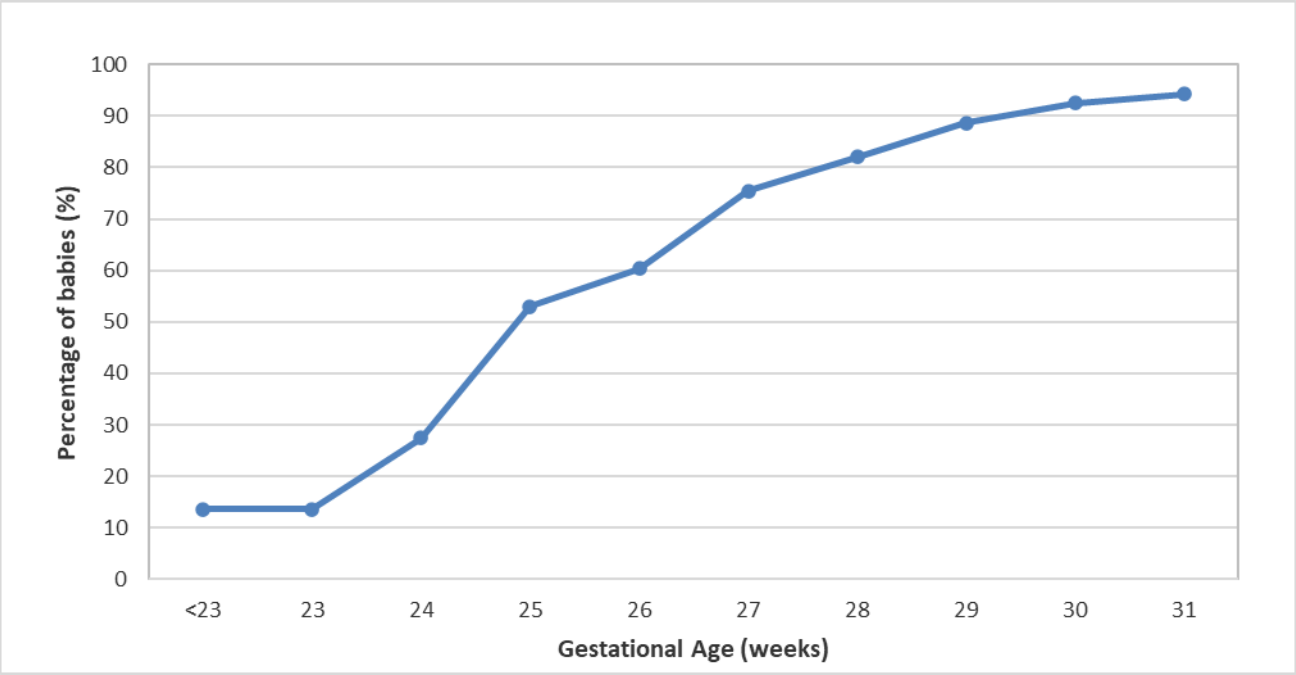
- The number of inborn survivors with 6 major morbidities prior to discharge were analysed; with the morbidities including:
    - Patent ductus arteriosus (PDA) requiring surgical ligation
    - Stage 3, 4 or 5 retinopathy of prematurity (ROP) or Aggressive posterior retinopathy of prematurity (APROP)
    - Oxygen dependency at 36 weeks post-conceptional age
    - Blood culture positive sepsis
    - Stage 2 and above necrotizing enterocolitis (NEC) on modified Bell's criteria
    - Intraventricular haemorrhage Grade 3 or 4

- Among survivors with gestational age of 22-24 weeks, 33.3% had 1 morbidity, 21.2% had 2 morbidities, 18.2% had 3 morbidities, 6.1% had 4 morbiditites and none had more than 4 morbidities. 21.2% did not have any of these morbidities.
- Among survivors with gestational age of 25-27 weeks, 41.7% had 1 morbidity, 17.7% had 2 morbidities, 4.3% had 3 morbidities, 1.0% had 4 morbidities, 0.3% had 5 morbidities, and none had 6 morbidities. 35.1% did not have any of these morbidities.
- Among survivors with gestational age of 28-31 weeks, 17.7% had 1 morbidity, 4.2% had 2 morbidities, 0.4% had 3 morbidities, and none had more than 3 morbidities. 77.7% did not have any of these morbidities. (Table 21a)

- Among survivors with birth weight <750 g, 37.7% had 1 morbidity, 20.8% had 2 morbidities, 7.5% had 3 morbidities, 3.8% had 4 morbidities, and none had more than 4 morbidities. 30.2% did not have any of these morbidities.
- Among survivors with birth weight 750-999 g, 36.0% had 1 morbidity, 15.4% had 2 morbidities, 2.9% had 3 morbidities, 0.4% had 4 morbidities, 0.2% had 5 morbidities, and none had 6 morbidities. 45.0% did not have any of these morbidities.
- Among survivors with birth weight 1000-1249 g, 21.9% had 1 morbidity, 6.1% had 2 morbidities, 0.7% had 3 morbidities, and none had more than 3 morbidities. 71.3% did not have any of these morbidities.
- Among survivors with birth weight 1250-1499 g, 11.9% had 1 morbidity, 1.9% had 2 morbidities, 0.2% had 3 morbidities, and none had more than 3 morbidities. 86.0% did not have any of these morbidities. (Table 21b)

Figure 19

Survival to discharge of all live births admitted to MNNR hospitals according to gestational age



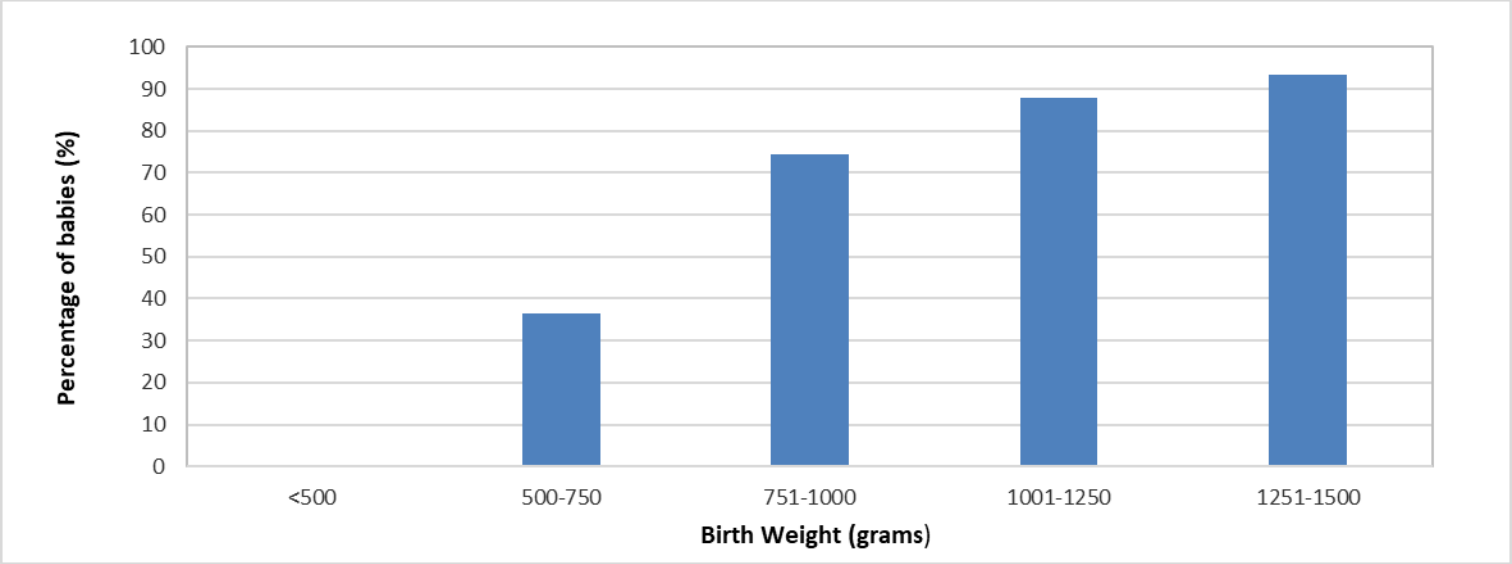
*COMMENT: * For the category ≥ 32 weeks gestation, calculated survival rate does not include all live births in that category (see inclusion criteria).*

Table 19 :
Survival to discharge of all live births admitted to MNNR hospitals according to gestational age

Gestational age (completed weeks)	Total number of inborn & outborn babies	Number of survivors	% survival
<23	22	3	13.6
23	44	6	13.6
24	113	31	27.4
25	168	89	53.0
26	217	131	60.4
27	289	218	75.4
28	413	339	82.1
29	511	453	88.6
30	705	652	92.5
31	807	761	94.3
Total included	3289	2683	81.6
Total no. of missing (GA)	0		
Total babies	3289		

Figure 20

Survival to discharge of all babies admitted to MNNR hospitals according to birth weight categories



*COMMENT: * For the category > 1500 gram birth weight, calculated survival rate does not include all live births in that category (see inclusion criteria).*

Table 20 :
Survival to discharge of all babies admitted to MNNR hospitals according to birth weight categories

Birth weight (grams)	Total number of inborn & outborn babies	Number of survivors	% survival
<500	11	0	0.0
500-750	360	131	36.4
751-1000	774	577	74.5
1001-1250	992	871	87.8
1251-1500	1399	1307	93.4
Total included	3536	2886	81.6
Total no. of missing (BW)	0		
Overall Total babies	3536		

*COMMENT: * For the category > 1500 gram birth weight, calculated survival rate does not include all live births in that category (see inclusion criteria).*

Table 21a

Gestational age specific survival with significant morbidity(ies) in admitted inborn babies

Gestaional age at birth		Total no. of babies	Survived	No. with any one morbidity prior to discharge	No. with any two morbidities prior to discharge	No. with any three morbidities prior to discharge	No. with any four morbidities prior to discharge	No. with any five morbidities prior to discharge	No. with six morbidities prior to discharge	No. with no morbidity prior to discharge
(completed weeks)		N %	n %	n %	n %	n %	n %	n %	n %	n %
22-24	**n** **%**	136 4.6	33 24.3	11 33.3	7 21.2	6 18.2	2 6.1	0 0.0	0 0.0	7 21.2
25-27	**n** **%**	591 20.1	396 67.0	165 41.7	70 17.7	17 4.3	4 1.0	1 0.3	0 0.0	139 35.1
28-31	**n** **%**	2220 75.3	2023 91.1	358 17.7	84 4.2	9 0.4	1 0.0	0 0.0	0 0.0	1571 77.7
Total babies <32 weeks included	**N** **%**	2947 100.0	2452 83.2	534 21.8	161 6.6	32 1.3	7 0.3	1 0.0	0 0.0	1717 70.0

Morbidities

i. Patent ductus arteriosus (PDA) requiring surgery

ii. Stage 3, 4 or 5 retinopathy of prematurity (ROP) or APROP

iii. Necrotising enterocolitis (NEC)

iv. Oxygen dependency at 36 weeks

v. Blood culture positive sepsis

vi. Intraventricular haemorrhage (IVH) stage 3 or 4

Table 21b

Birth weight specific survival with significant morbidity(ies) in admitted inborn babies

Birth weight (grams)		Total no. of babies N %	Survived n %	No. with any one morbidity prior to discharge n %	No. with any two morbidities prior to discharge n %	No. with any three morbidities prior to discharge n %	No. with any four morbidities prior to discharge n %	No. with any five morbidities prior to discharge n %	No. with six morbidities prior to discharge n %	No. with no morbidity prior to discharge n %
< 750	**n**	288	106	40	22	8	4	0	0	32
	%	9.4	36.8	37.7	20.8	7.5	3.8	0.0	0.0	30.2
750-999	**n**	640	480	173	74	14	2	1	0	216
	%	20.9	75.0	36.0	15.4	2.9	0.4	0.2	0.0	45.0
1000-1249	**n**	914	809	177	49	6	0	0	0	577
	%	29.9	88.5	21.9	6.1	0.7	0.0	0.0	0.0	71.3
1250-1499	**n**	1218	1139	135	22	2	0	0	0	980
	%	39.8	93.5	11.9	1.9	0.2	0.0	0.0	0.0	86.0
Total babies < 1500 grams included	**N**	3060	2534	525	167	30	6	1	0	1805
	%	100.0	76.9	20.7	6.6	1.2	0.2	0.0	0.0	71.2

Morbidities
i. Patent ductus arteriosus (PDA) requiring surgery
ii. Stage 3, 4 or 5 retinopathy of prematurity (ROP) or APROP
iii. Necrotising enterocolitis (NEC)
iv. Oxygen dependency at 36 weeks
v. Blood culture positive sepsis
vi. Intraventricular haemorrhage (IVH) stage 3 or 4

THERAPEUTIC HYPOTHERMIA

- 883 babies born at ≥35 weeks gestational age, were diagnosed with hypoxic-ischaemic encephalopathy (HIE); 803 were inborn babies and 80 were outborn babies. Mild HIE was diagnosed in 434 babies, 307 had moderate HIE and 142 had severe HIE. 581 babies with HIE were given hypothermia therapy. Mortality rates for babies with moderate and severe HIE were 3.3% and 47.9% respectively.

APPENDICES

(Adapted from Paediatric Services Operational Policy, Ministry of Health Malaysia, 2024, pg 44-45)

Level I (Neonatal care in the postnatal wards)

Provide care for the following infants placed together with their mothers and regarded as inpatients:
a. Stable term newborn infants
b. Infants born 35-37 weeks' gestation who remain physiologically stable
c. Infants receiving phototherapy for mild neonatal jaundice, on glucose monitoring, for completion of antibiotics

Level II (Special care nursery)

Provide care for the following infants:
a. Born at > 32 weeks' gestation and weight > 1500g who have physiologic immaturity.
b. Moderately ill infants with problems that are expected to resolve rapidly and are not anticipated to need subspecialty services on an urgent basis.
c. Infants with mild to moderate respiratory illness on non-invasive ventilation (CPAP or HFNC). Conventional ventilation may be provided for a brief duration until transfer to a NICU.
d. Infants with management of common neonatal conditions e.g. neonatal jaundice, Infants with risk of sepsis.
e. Post intensive care convalescing infants
f. Infants with chronic NIV or oxygen dependency.
g. Infants needing surgical nursing.
Level II facilities and capabilities should take into consideration geographical constraints.

Level III (NICU)

Provide sustained life support for the following infants:
a. Born before 32 weeks gestation and weight less than 1500g
b. Infants born at all gestational ages and birth weights with critical illness requiring sustained life support, such as:
i. Respiratory support including invasive ventilation (conventional and high-frequency ventilation), non-invasive ventilation (CPAP, HFNC), inhaled nitric oxide
ii. Therapeutic hypothermia for neonatal encephalopathy
c. Infants require access to paediatric medical subspecialists, paediatric surgeons, paediatric anaesthesiologists, paediatric ophthalmologists, etc.

Level IV (Regional NICU)

Level III capabilities plus:
a. Located within an institution with the capability to provide on-site surgical repair of complex congenital or acquired conditions.
b. Has a range of paediatric medical subspecialists, paediatric surgical subspecialists, and paediatric anaesthesiologists at the site.

Appendix 2 Data Definitions

DATA DEFINITIONS AND CRITERIA

Centre Name*:* Name of participating hospital

Date of Admission (dd/mm/yy): Date of first admission to the participating site

State if it is a new case, or a readmission and to specify the referring centre (*Referral from :*) if relevant.

Case Status:

'New case': First time admission to the NNU concerned will be considered as a new case.

'Readmission': Subsequent admission of the same baby to the same NNU within 44 weeks postconceptional age.

'Previously admitted to another SDP': Case transferred from SDP hospital to another SDP hospital for first time.

State if it is admitted to neonatal ward/ admitted to neonatal ward as an abandoned baby.

SECTION 1: Patient Particulars

1. ***Name of mother***: Name as in hospital record
2. ***Name of baby (optional)***: Name as in hospital record, if relevant
3. ***RN of baby****:* Registration Number at participating hospital. If the baby dies in Labour room and has no RN, then use the mother's RN.
4. ***a) Mother's I/C Number****:* MyKad number or Other ID document no. If "Other" please specify type of document.
   b) Baby's MyKid number: add number if available
5. ***a) Date of Birth****:* dd/mm/yy ***b) Time of Birth*****:** To state 24-hour format (mandatory for death cases) Estimate time of death if patient died at home and time accurately not known as in home delivery
6. ***Ethnic group***: Malay / Chinese / Indian / Orang Asli / Bumiputra Sabah / Bumiputra Sarawak / Other Malaysian (e.g. Punjabi, Eurasian or Serani) / Non-citizen (specific country). If Bumiputra Sabah or Bumiputra Sarawak, please specify the indigenous group.
7. ***Maternal Age****:* Age in completed years.
8. ***GPA***: Gravida, Para, Abortion (of current pregnancy before delivery of this child). To state number of ectopic pregnancies (Ectopic pregnancy also considered as an abortion).
9. ***Maternal Diabetes:*** State 'yes' or 'no' if mother had diabetes (regardless of whether it is gestational or pre-gestational) State 'unknown' if so
10. ***Maternal Hypertension:*** State 'yes' or 'no' if mother had hypertension (regardless of whether it is chronic or pregnancy induced) State 'unknown' if so

11. ***Maternal Chorioamnionitis:*** State 'yes' or 'no' if mother had chorioamnionitis. State 'unknown' if so.
12. ***Maternal Eclampsia:*** State 'yes' or 'no'. State 'unknown' if so.
13. ***Maternal Anaemia:*** State 'yes', 'no' or 'unknown'. Mother's Hb level < 11 g/dL or noted to have anaemia of pregnancy by O&G.
14. ***Maternal abruptio placenta:*** State 'yes' or 'no'.
15. ***Maternal bleeding placenta praevia:*** State 'yes' or 'no'.
16. ***Cord prolapse:*** State 'yes' or 'no'.
17. ***Maternal obesity*** - BMI > 30 at booking weight during 1st trimester. State 'yes' or 'no.
18. ***Other current maternal illness*** – State 'yes' or 'no. Examples of other current illness are SLE, renal disease, cancer, epilepsy, cardiovascular disease, mental disorder, etc.

SECTION 2: Birth History

19. ***Antenatal steroids****:* Corticosteroids given antenatal via any route to the mother at a time likely to enhance fetal lung maturation. Excludes steroids given for other reasons. State 'yes' if this has been given (regardless of number of doses or when it was given) or 'no' if this has not been given. If yes, state whether ONE or TWO doses given. State 'unknown' if so
20. ***Antenatal magnesium sulphate:*** Antenatal magnesium sulphate given to mother prior to preterm birth for fetal neuroprotection.
21. ***Intrapartum antibiotics****:* Antibiotic treatment is provided to the mother within the period mother is in labour, with the intent of preventing infection of the fetus. This includes the prophylactic use of parenteral penicillin or ampicillin. State 'Yes' if systematic antibiotics (enteral or parenteral) were given to mothers in the 24 hours prior to delivery. State 'unknown' if so
22. ***Birth weight (grams)****:* The weight of the baby immediately following delivery recorded in grams to the nearest gram and measured within the first hour of life.
23. **a)** ***Gestation (weeks)****:* Best estimate of gestational age at birth given in full weeks. Preferences among estimates should be:

    1) obstetric estimate according to delivering obstetrician. (Ultrasound date selected if done earlier than 25 weeks and there is a discrepancy with the Last Menstrual Period (LMP) dates. Otherwise, use LMP dates.

    2) New expanded Ballard scoring. If there is no definite estimate but baby referred to as term baby, enter 40. Preferably insert the exact gestation for term infants – i.e. ranging from 37-41 weeks

    3) LMP, Ultrasound, Ballard score or unknown. Choose only one – the option on which you based the baby's gestational age.

24. ***Growth status****:* based on Intrauterine Growth Curves (Composite Male / Female) chart in page 4 of the CRF. SGA<10th centile; AGA 10-90th centile; LGA >90th centile). (Autoplot planned but presently still use the growth charts to plot)

25. ***Gender***: Indicate Male, Female or Ambiguous/Indeterminate.

26. ***Place of birth****:*

Inborn – born in the same hospital as the participating site. If born within the wards of participating hospital also considered as inborn. (unless in ambulance – born before arrival BBA as outborn)

Outborn – Born in another place (includes BBA) and transferred after birth to NNU of the participating site. Includes those born in hospital compound but not wards.

- Home
- Health Clinic
- Government Hospital with specialist – General/District
- Government Hospital without specialist
- University Hospital
- Private Hospital/maternity home<50 beds with/without specialist
- Private Hospital/maternity home>50 beds
- Alternative Birthing Centre (ABC) – Urban/Rural
- Enroute / During transport (including delivery in ambulance within own hospital grounds)
- Others _ _ (please specify)
- Unknown

27. ***Multiplicity****:* To indicate as singleton, twins, triplets or others i.e. quadruplets, etc. If the baby is other than singleton, specify birth order e.g. if baby is twin 1 – fill in "01". For triplet three, fill "03". This together with mother's IC no. will act as unique identifier.

28. ***Final Mode of Delivery****:* Tick as relevant. All caesarians are considered as such without differentiation into upper or lower segment. For breech presentation in caesarian sections, tick Caesarian only.
Tick as 'emergency' if there is a reason for the Caesarian section that has an emergency indication, not whether it is listed as 'semi emergency' or 'emergency' in the OT list.

29. ***Apgar Score at 1 min and 5 min:*** A numerical score of the condition of newborn at 1 min and 5 min after birth based on heart rate, colour, respiratory effort, muscle tone and reflex irritability. Enter the Apgar score at 1 min & at 5 min as noted in the labour and delivery record. Please score even if the baby was intubated by 5 minutes of life. Only tick 'unknown' if truly so and not because it was not scored once baby intubated. Apgar score can be '0' at 1 minute and 5 minutes.

30. ***Initial Resuscitation (for inborn babies only):*** Tick 'Yes' for all intervention that apply at birth for inborn cases only
    a) Oxygen
    b) Early CPAP
    c) Bag-mask ventilation
    d) Endotracheal Tube Ventilation

e) Cardiac Compression
f) Adrenaline

31. a) Plastic wrap at birth: Yes /No (for < 1500 gm)
b) If yes: was baby wrapped without drying at birth: Yes /No

c) Admission Temperature: Indicate the first temperature (axillary) on admission to one decimal point in degree Celsius. Mandatory field for admission to Neonatal Ward. Does not include babies who die in delivery room.

SECTION 3: Neonatal Events

32. Respiratory support: Tick 'Yes' if any respiratory support was given

a) CPAP – Continuous Positive Airway Pressure.

b) High flow nasal cannula (HFNC)

c) Conventional Ventilation – intermittent positive pressure ventilation through an endotracheal tube a conventional ventilator (IMV rate < 240/min) at any time after leaving the delivery room.

d) HFJV/ HFOV – High frequency ventilation

e) Nitric oxide – delivered as a gas via a ventilator at any time after leaving the delivery room.

33. Surfactant: A dose of any type of exogenous surfactant was used to treat the baby. Indicate whether exogenous surfactant given or not. If 'yes' indicate whether given at < 1 hour, 1 -2 hours or > 2 hours postnatal age.

34. Parenteral Nutrition: Intravenous infusion of a nutrient solution consisting of a minimum of dextrose and protein but generally providing a complete nutrient infusion including electrolytes, calcium, phosphorus, zinc, trace elements, vitamins and fat. Nutrition given intravenously. Parenteral nutrition must include amino acids with or without fats, hence plain dextrose saline infusion in not parenteral nutrition.

SECTION 4: Problems / Diagnoses

Mandatory fields are included for some diagnoses/procedures that are very important in the care of VLBW and sick infants. Definitions of these conditions are as shown below (AFTER SECTION 5). Other diagnoses or problems not given in the list can be referred to 'WHO 1992 ICD-10; Volume 1 document' and to be written in the space provided under '*Others'.*

NA in the CRF means data is not applicable or not available. There should not be too many 'Not available' data

SECTION 5: Outcome

***49a. Date of discharge/transfer/death**:* Enter the exact date

49b. Time of death: State as 24-hour format – used to auto calculate age at discharge. Mandatory for death cases – give best-estimated time if of death if exact time not known.

50. Weight (grams) and growth status on discharge/ death:

a) Weight in grams. For weight on death is the last weight taken when the baby was alive

b) Indicate growth status as per Intrauterine Growth Curves (Composite Male / Female)

51. Total Duration of hospital stay (Neonatal/Paeds Care): State to next complete day i.e. < 24 hours is 1 day and 10 days 6 hours is 11 days.

52. ***Home oxygen therapy***: State if baby discharged home with oxygen. Also Includes non-invasive ventilation e.g. CPAP/HFNC

***53. Outcome**:* Alive or Dead – Alive at discharge or died before discharge.

***If child alive, state Place of discharge to*:** Home, Other Non-Paeds Ward, Social Welfare home 'Still hospitalised as of 1st birthday' or 'Transferred to other hospitals'. If transferred to other hospitals, specify the name of hospital transferred to.

If a case is transferred to another hospital in the MNNR network, complete the CRF up to current status and send photocopy of the form with the baby to assist the referral hospital in obtaining the patient particulars and birth history. The referring hospital still need to key in the original form into the system. The referral centre will open and complete a new CRF and this will be analysed together with the CRF of the referring hospital.

Post- transfer disposition: **If the case is transferred to another hospital out of the NNR network,** the referring unit **must get the final 'outcome' of the baby** from the unit that the case was referred to. Click "still in the ward" if patient is still hospitalized in the non-NNR hospital at close out. **ROP findings after discharge can also be updated in the ROP section.**

If child died, tick 'Yes' or 'No' whether the infant died within 12 hours or less from the time of admission to the NICU.

Place of Death: Labour Room/OT, In Transit Neonatal Unit or others, specify.

SUPPLEMENTARY FORM

Filled whenever there is neonatal death in accordance to the Modified Wigglesworth Classification of Perinatal Mortality:

An additional data to that collected in the main CRF for neonatal deaths.

1. ***Centre' Name:*** State name of reporting hospitals
2. ***Name:*** State mother's name
3. ***RN of baby:*** RN at participating hospital. If the baby dies in Labour Room and has no RN, use mother's RN.
4. ***Mother's new IC number or passport:*** whichever applicable

Immediate Cause of Death (Modified Wigglesworth):

(Adapted *from Garis panduan Penggunaan Format PNM 1/97 (Pindaan 2000) bagi Melapor Kematian Perinatal*, Jun 2000, Bahagian Pembangunan Kesihatan Keluarga, Kementarian Kesihatan Malaysia)

a. Lethal Congenital Malformation (LCM)/defect
Severe or lethal malformation that contribute to death. If 'Yes', tick specifically the cause of death.

b. If no LCM, is Gestation < 37 weeks?

c. Gestation < 37 weeks (Preterm death without LCM) due to: This includes only livebirths less than 37 weeks gestation after excluding LCM. Tick the immediate secondary cause of death e.g. severe IVH, pulmonary haemorrhage, acute intrapartum event ("asphyxia"). Tick "extreme prematurity" in the subcategory only for babies less than 28 weeks only who died and no immediate secondary cause of death eg. as in palliative care

Gestation ≥ 37 weeks (did the baby had an was there an Asphyxial condition? All term babies who die from birth asphyxia or meconium aspiration syndrome or PPHN.

d. If term and no asphyxia conditions, was there Infection?
This refers to term babies (> 37 weeks gestation) whose primary cause of death is an infection. Some examples include meningitis, group B streptococcal infection, intrauterine infections etc.

e. If term and infection present, tick organism

f. If term and infection absent, are they any other specific causes of death?
Specify any other cause of death not included in the above classification. This includes kernicterus, haemorrhagic shock /inborn error of metabolism/pneumothorax/ pulmonary haemorrhage. Use ICD 10 code

g. Unknown

Where cause of death is not known.

DEFINITIONS OF CERTAIN SPECIFIED DIAGNOSES

(Modified from ICD 10)

Diagnosis	Definition
Respiratory	
Meconium aspiration syndrome	Tick 'yes' if all 5 criteria are satisfied: a. Presence of meconium-stained amniotic fluid at birth b. Respiratory distress onset within 1 hour of birth. Respiratory distress defined as presence of one of the following signs: tachypnoea, grunting, nasal flaring, or intercostal retraction. c. PaO_2 < 50 mmHg in room air, central cyanosis in room air or requirement for supplemental O_2 to maintain a PaO_2 > 50 mmHg d. Abnormal CXR compatible with meconium aspiration: Findings may include coarse irregular or nodular pulmonary densities, areas of diminished aeration or consolidation alternating with area of hyperinflation, or generalized hyperinflation. e. Absence of culture proven early onset bacterial sepsis or pneumonia (i.e. negative blood culture within 72 hours of birth).
Pulmonary haemorrhage	Originating in the perinatal period (as diagnosed clinically by pink or red frothy liquid draining from mouth or arising from the trachea between the vocal cord or suctioned through the endotracheal tube. (Diagnosis may also be made on autopsy finding of haemorrhage in the lungs).
Congenital Pneumonia	Infection of the lungs acquired prepartum, intrapartum, at birth or after birth. (Diagnosed with / without cultures). Diagnosis made clinically and supported by CXR findings.
Nosocomial pneumonia	Infection of the lungs acquired after admission to the ward.

Community acquired pneumonia	Infection of the lungs acquired after discharge home
Transient Tachypnoea of Newborn	Benign disease of near-term, term or large premature infants with respiratory distress shortly after delivery resolving within 3 days.
Pulmonary Interstitial Emphysema	Dissection of air into the perivascular tissues of lung from alveolar overdistention or overdistention of smaller airways evident on CXR as linear or cast like lucencies with a history of requiring increasing ventilatory support
Respiratory distress syndrome (RDS).	Defined as: within the first 24 hours of life, A. PaO_2 < 50mmHg in room air, central cyanosis in room air, or a requirement for supplemental O_2 to maintain a PaO_2 > 50mmHg AND B. A chest radiograph consistent with RDS (low lung volumes and reticulogranular appearance to lung fields, with or without air bronchograms)
Pneumothorax	Presence of extrapleural air diagnosed by chest radiograph or needle aspiration (thoracocentesis). For infants who had thoracic surgery and a chest tube placed at the time of surgery OR if free air was only present on a CXR taken immediately after thoracic surgery and was not treated with a chest tube, tick **'No'**. For infants who had thoracic surgery and then later developed extra pleural air diagnosed by CXR or needle thoracocentesis, tick **'Yes'**. **Indicate whether pneumothorax developed during CPAP, Conventional ventilation or HFV.**
Supplemental oxygen & BPD Tick "yes" if the baby received continuous oxygen concentration > 21% for at least 28 continuous days (note not "till 28 days of life"). Otherwise tick "no". For babies < 32 weeks – state if O_2 / any form of CPAP or ventilatory support required at 36 weeks corrected gestation.	Receipt of continuous enriched oxygen concentration > 21% by oxyhood, nasal cannula, nasal catheter, facemask or still requiring nCPAP or other forms of respiratory support by Day 28 and 36 weeks or day 56. 'Continuous' means that the patient is receiving oxygen throughout the time period and not just in brief episodes as needed i.e. during feeds. 'Blow-by' oxygen dose not counted unless it is the mode of oxygen administration used in a transport situation. Do not score oxygen given as part of a hyperoxia test.

For babies ≥ 32 weeks - state if O_2 / any form of CPAP or ventilatory support required at Day 56.	
Cardiovascular a. Persistent Pulmonary Hypertension (PPHN) b. Heart failure	Definitive diagnosis of PPHN is made by echocardiography. In the absence of echo confirmation, pre and postductal pulse oxymetry difference of > 10% can be used. Preductal pulse oxymetry done on the right hand and post ductal pulse oxymetry done on lower limbs. Failure of the heart to pump characterized by tachypnea, tachycardia, feeding difficulties, hepatic enlargement, and cardiomegaly.
Patent ductus arteriosus (PDA) Only applies for pre term < 37 weeks GA only	Clinical evidence of left to right PDA shunt documented by continuous murmur, hyperdynamic precordium, bounding pulses, wide pulse pressure congestive heart failure, increased pulmonary vasculature or cardiomegaly by CXR, and/or increased O_2 requirement or ECHO evidence of PDA with documentation of left to right ductal shunting. If ticked 'Yes', indicate whether ECHO was done and whether pharmacological closure (indomethacine/ibuprofen/paracetamol) or ligation was given or not.
Necrotising enterocolitis (NEC) (Stage 2 and above) If 'yes' and managed surgically, tick 'Surgical Treatment' NEC present before admission to your centre? (applies to outborn babies)	***Definition for NEC stage 2 and above :*** 1 Diagnosis at surgery or post mortem, or 2 **Radiological diagnosis, a clinical history plus** • pneumatosis intestinalis, or • portal vein gas, 3 Clinical diagnosis, a clinical history plus abdominal wall cellulitis and palpable abdominal mass. NEC according to Bell's criteria stage 2 or higher **Stage 1:** Suspect (History of perinatal stress, systemic signs of ill health i.e. temperature instability, lethargy, apnoea, GIT manifestations i.e. poor feeding, increased volume of gastric aspirate, vomiting, mild abdominal distension, faecal occult blood with no anal fissure). **Stage 2:** Confirmed (Any features of stage 1 plus persistent occult or gastrointestinal bleeding, marked abdominal distension, abdominal radiograph, intestinal distension, bowel wall oedema, unchanging bowel loops, pneumatosis intestinalis, portal vein gas).

	Stage 3: Advanced (Any features of stages 1 or 2 plus: deterioration in vital signs, evidence of shock or severe sepsis, or marked gastrointestinal haemorrhage, or abdominal radiograph shows any features of stage 2 plus pneumoperitoneum).
Retinopathy of prematurity (ROP) Maximum stage of ROP in left/right eye as defined by the International Committee on ROP (ICROP). Score according to the grade of ROP assigned on an eye exam done by an ophthalmologist (e.g. threshold). If there is no explicit grade listed, then score according to the descriptions given by the ICROP. (e.g. threshold). Tick 'Yes' if a retinal exam was done. State exact date of first screening and post conceptional age at screening. Specify only the worst stage**. Also tick if PLUS disease present** State if laser, cryotherapy, intravitreal anti VEGF or vitrectomy was done. If screening was not done, state 'No' and indicates whether an appointment for retinal examination was given, if applicable. State "date of appointment" or "date of first screening" section and postconceptional age will be autocalculated ROP present prior to admission? (applies to outborn babies) To trace back the outcome of ROP screening on first screening if done after Tick "Not applicable" if does not fulfill criteria	Criteria for screening for ROP are for babies with birth weight < or equal 1500 grams OR gestational < 32 weeks, as well as all preterm babies whose clinical course places them at increased risk for ROP as determined by the attending doctor. If an indirect ophthalmologic examination was performed at any time, enter the worst stage documented: No ROP : No Evidence of ROP Stage 1 : Demarcation Line Prethreshold ROP ("Prethresh") Threshold ROP ("Thresh") Stage 4 : Partial Retinal Detachment Stage 5 : Total retinal detachment PLUS disease : dilated veins and tortuous arteries, papillary rigidity (must also include stages other than No ROP)
Intraventricular haemorrhage (IVH)	If ultrasound of brain done, enter the worst grade: **Grade 1:** Subependymal germinal matrix (GM)

Tick 'Yes' if IVH is seen and enter the worst grade before or on 28 days of life. State if VP shunt/reservoir was inserted Tick 'No; if no IVH before or day 28 Tick 'Not Applicable' for term infant Tick "Ultrasound not done" if it was not done.	haemorrhage only **Grade 2:** IVH without ventricular dilation **Grade 3:** IVH with ventricular dilation **Grade 4:** IVH with parenchymal involvement
Central venous line a. Central line - yes or no Date of insertion Date of removal (autocalculate) b. CLABSI	If more than one central line, use data of the central line with the longest duration Central line defined as: (1) Umbilical catheters. (2) Percutaneously inserted central catheters. (3) Surgically placed Broviac catheter that terminates at or close to the heart or in one of the great vessels. Aorta, superior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, inferior vena cava, external iliac veins and common femoral veins are considered great vessels for this study. CLABSI defined as clinical sepsis with positive blood culture in patient with **ALL** of the following: a. central line in place for at least 48 hours, or within 48 hours after removal b. no other apparent source of infection c. two positive cultures of the same organism from different sites if the organism is a common skin organism (to differentiate from skin contaminant)
Confirmed sepsis Tick 'Yes'if there is evidence of confirmed sepsis. Do not include presumed or clinical sepsis. State whether the onset of first confirmed sepsis was On or before 72 hours of life OR after 72 hours of life. State the organism cultured: • Group B streptococcus • MRSA • CONS (see definition) • Staphylococcus aureus	***Confirmed sepsis*** Clinical evidence of sepsis plus blood culture-proven infection. For CONS: Place a tick if the infant has ALL 3 of the following: 1. CONS is recovered from a blood culture obtained from either a central line, or a peripheral blood sample AND 2. Signs of generalized infection (such as apnoea, temperature instability, feeding intolerance, worsening respiratory distress or haemodynamic instability) AND 3. Treatment with 5 or more days of IV antibiotics after the above cultures were

• Klebsiella • Pseudomonas • Acinetobacter • Fungal (see definition) • Others, specify • ESBL organisms	obtained. If the patient died, was discharged, or transferred prior to completion of 5 days or more of IV antibiotics, this condition would still be met if the intention were to treat for 5 or more days. Do not place a tick if any or all of the above are not true. <u>For FUNGAL infection</u>: Place a tick only if a fungus recovered from a blood culture obtained from either a central line or peripheral blood sample after day 3 of life.
Neonatal meningitis Tick 'yes' (if CSF biochem or cytology suggestive even if CSF C&S is negative) or 'no' If yes, State if CSF Culture positive **- Yes / No** State the organism cultured: • Group B streptococcus • MRSA • CONS (see definition) • Staphylococcus aureus • Klebsiella • Pseudomonas • Acinetobacter • Fungal (see definition) • Others, specify • ESBL organisms	Signs of clinical sepsis and evidence of meningeal infection as shown in cerebrospinal fluid findings (i.e. cytology, biochemistry or microbiologic findings).
Hypoxic ischaemic encephalopathy (HIE) **Applies only to gestation ≥ 35 weeks**	HIE requires the presence of all 3 of the following criteria: 1. Presence of a clinically recognized encephalopathy within 72 hours of birth. Encephalopathy is defined as the presence of 3 or more of the following findings within 72 hours after birth:

	a. Abnormal level of consciousness: hyperalertness, lethargy, stupor or coma b. Abnormal muscle tone: hypertonia, hypotonia or flaccidity c. Abnormal deep tendon reflexes: increased, depressed or absent d. Seizures: subtle, multifocal or focal clonic e. Abnormal Moro reflex: exaggerated, incomplete or absent f. Abnormal suck: weak or absent g. Abnormal respiratory pattern: periodic, ataxic or apnoeic h. Oculomotor or papillary abnormalities: skew deviation, absent or reduced Doll's eye or fixed unreactive pupils **AND** 2. Three or more supporting findings from the following list: a. Arterial cord pH<7.00 b. Apgar score at 5 minutes of 5 or less c. Evidence of multi-organ system dysfunction – dysfunction of one or more of the following systems within 72 hours of birth d. Evidence of foetal distress on antepartum monitoring: persistent late decelerations, reversal of end-diastolic flow on Doppler flow studies of the umbilical artery or a biophysical profile of 2 or less e. Evidence of CT, MRI, technetium or ultrasound brain scan performed within 7 days of birth of diffuse or multifocal ischaemia or of cerebral oedema. f. Abnormal EEG: low amplitude and frequency, periodic, paroxysmal or isoelectric. **AND** 3. The absence of an infectious cause, a congenital malformation of the brain or an inborn error of metabolism, which could explain the encephalopathy.

HIE severity If the infants diagnosed with HIE, record the worst stage observed during the first 7 days following birth based on the infant's level of consciousness and response to arousal maneuvers such as persistent gentle shaking, pinching, shining a light or ringing of a bell: Tick "none" if there is no HIE Tick '"Mild, Moderate, Severe " according to the definition Tick "none" if there is no HIE Tick '"Mild, Moderate, Severe " according to the definition Highest Thompson Score before 6 hours of life Cooling therapy Seizures in HIE cases	*HIE severity* a. Mild (normal or hyperalert) – infants in this category are alert or hyperalert with either a normal or exaggerated response to arousal. No seizures (Sarnat Stage 1) b. Moderate (lethargic or stupor) – infants in this category are arousable but have a diminished response to arousal maneuvers. Such babies frequently have seizures (Sarnat Stage 2) c. Severe (deep stupor or coma) – infants in this category are not arousable in response to arousal maneuvers. (Sarnat Stage 3) Insert highest score Yes/ No if yes , completed 72 hours yes no If yes : cooling blanket or cap / passive cooling plus or minus gel pack / both Yes / No
Major Congenital Abnormalities Tick 'Yes ' if major congenital anomaly is present even if it is an isolated one (i.e. only one abnormality) If Yes, state: 1. 'Known Syndrome', 2. 'Not a Recognised Syndrome' 3. 'Isolated major abnormality' If the syndrome is known, tick the specify syndromes or specify it. Types of Abnormalities: **Tick all major abnormalities found for recognisable syndrome, non-recognisable ones or isolated major congenital abnormality**	A major congenital abnormality is defined as any abnormality of prenatal origin that if uncorrected or uncorrectable, significantly impairs normal physical or social function or reduce normal life expectancy Any abnormalities of prenatal origin that are present at birth, and do not have surgical, medical or cosmetic importance at the time of examination during the newborn period is a minor congenital abnormality and NOT included in this registry. Examples include isolated findings such as 'low-set ears', sacral dimple or single transverse palmar crease". For congenital heart disease, Type Operation yes or no Age of operation _____ (days)

Appendix 3 Census Forms

Malaysian National Neonatal Registry

Unit C-10-09,
Dataran Emerald,
Jalan PS11 Prima Selayang,
68100, Batu Caves,
Selangor

Tel/Fax: 03-61281100

i. Hospital:					
ii. Month:		iii. Year:			
iv. Total Births:		v. Live Births:		vi. Still Births:	

SECTION 1: DELIVERIES VERSUS BIRTH WEIGHT

Birth Weight (grams)	No. of Still Births	No. of Live Births	No. Admitted to Neonatal Unit	No. who died in delivery room
< 500				
500				
501 - 600				
601 - 700				
701 - 800				
801 - 900				
901 - 999				
1000				
1001 - 1250				
1251 - 1499				
1500				
1501 - 2000				
2001 - 2500				
> 2500				
TOTAL				

SECTION 2: BIRTH VERSUS GESTATION WEEKS

Gestation (weeks)	No. of Still Births	No. of Live Births	No. Admitted to Neonatal Unit	No. who died in delivery room
<22				
22-24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37-40				
> 40				
TOTAL				

SECTION 3: BIRTH VERSUS MODE OF DELIVERY

Mode of Delivery	No. of Still Births	No. of Live Births	No. Admitted to Neonatal Unit	No. who died in delivery room
SVD				
Breech				
Forceps				
Ventouse				
LSCS Elective				
LSCS Emergency				
TOTAL :				

SECTION 4: BIRTHS VERSUS ETHNIC GROUP

Ethnic Group	No. of Still Births	No. of Live Births	No. Admitted to Neonatal Unit	No. who died in delivery room
Melay				
Chinese				
Indian				
Orang Asli				
Bumiputera Sabah specify ethnic group: _____				
Bumiputera Sarawak specify ethnic group: _____				
Foreigner				
Other Malaysian: _____				
TOTAL :				

1. Remarks:	
2. Name of Site Coordinator:	
3. Chop:	
4. Date:	☐☐ / ☐☐ / ☐☐

i. Birth census should be sent together with the tracking forms and the completed CRFs of discharges for the month by the end of the following month.

ii. Sample of tracking form are as follows

MALAYSIAN NATIONAL NEONATAL REGISTRY (CRF 2021)

Centre Name:	◯ New Case ◯ Readmission ◯ Transfer from another SDP Hospital or IJN:	**MNNR No (Office use):** ____ / ____
Date of Admission: (dd/mm/yy)		**Centre:** ____

Admitted to neonatal ward: ◯ Yes → (Proceed to complete ALL sections in this CRF) ◯ No → (Proceed to complete Section 1, 2 [without No.30], 4[No.47 only] and 5)

☐ Abandoned baby → (if this box is ticked, item No.1, No.3a & 3b, No.5 to No.20 are not mandatory)

Instruction: Where check boxes ☐ are provided, ticked (√) one or more boxes. Where radio buttons ◯ are provided, ticked (√) one box only.

* **RN of baby:**	

SECTION 1 : PATIENT PARTICULARS & MATERNAL HISTORY

* **1. Name of mother:**	
2. Name of baby (Optional):	
* **3a. Mother's I/C number:**	MyKad: ☐☐☐☐☐☐ – ☐☐ – ☐☐☐☐ Other ID document No: Specify document type (if others): ◯ Passport ◯ Armed Force ID ◯ Driver's License ◯ Old IC ◯ Hospital RN ◯ Father's I/C ◯ Work Permit Number ◯ Police ID Card ◯ Immigration Permit ◯ Other, specify:.....
3b. Baby's MyKid number:	☐☐☐☐☐☐ – ☐☐ – ☐☐☐☐
* **4a. Date of birth of baby:** (dd/mm/yy)	☐☐ / ☐☐ / ☐☐☐☐ **4b. Time of birth**: (24 hour format. Enter the best estimated time of birth if the exact time unknown) ☐☐☐☐
* **5. Ethnic group of Mother:**	◯ Malay ◯ Indian ◯ Bumiputra Sabah, specify:..... ◯ Other, Malaysian ◯ Chinese ◯ Orang Asli ◯ Bumiputra Sarawak, specify:..... ◯ Non-citizen, specify country.....
* **6. Maternal age:**	☐☐

* **7. GPA:** (current pregnancy before delivery of this child)	*Gravida: ☐☐	*Parity: ☐☐	*Abortion: ☐☐

* **8. Maternal diabetes (including gestational diabetes):**	◯ Yes	◯ No	◯ Unknown
* **9. Maternal hypertension, chronic pregnancy included:**	◯ Yes	◯ No	◯ Unknown
* **10. Maternal Eclampsia:**	◯ Yes	◯ No	◯ Unknown
* **11. Maternal Chorioamnionitis:**	◯ Yes	◯ No	◯ Unknown
* **12. Maternal Anaemia:** (<11g/dL)	◯ Yes	◯ No	◯ Unknown
* **13. Maternal abruption placenta:**	◯ Yes	◯ No	◯ Unknown
* **14. Maternal bleeding placenta praevia:**	◯ Yes	◯ No	◯ Unknown
* **15. Cord prolapse:**	◯ Yes	◯ No	◯ Unknown
* **16. Maternal obesity:**	◯ Yes	◯ No	◯ Unknown
* **17. Other current maternal illness:**	◯ Yes If yes,specify :		◯ No

SECTION 2 : BIRTH HISTORY

* **18. Antenatal steroid:**	◯ Yes → ◯ 1 dose ◯ 2 doses ◯ No ◯ Unknown
* **19. Antenatal magnesium sulphate:**	◯ Yes ◯ No ◯ Unknown
* **20. Intrapartum antibiotic:**	◯ Yes ◯ No ◯ Unknown
* **21. Birth weight:**	☐☐☐☐ (gram)
* **22. Gestation:**	☐☐ (weeks)
* **23. Growth status:**	◯ SGA ◯ AGA ◯ LGA
* **24. Gender:**	◯ Male ◯ Female ◯ Ambiguous / Indeterminate
* **25. Place of birth:**	◯ Inborn ◯ Outborn → ◯ Home, ◯ Health Clinic, ◯ Private Hospital, ◯ Government hospital with specialist (◯ District ◯ General), ◯ Government hospital without specialist, ◯ University hospital, ◯ Enroute / during transport, ◯ Maternity home with specialist, ◯ Maternity home without specialist, ◯ Alternative Birthing centre (ABC) (◯ Urban ◯ Rural), ◯ Others / specify....., ◯ Unknown
* **26. Multiplicity:**	◯ Singleton ◯ Twin ◯ Triplet ◯ Other, specify..... Specify birth order if not a singleton: ☐☐
* **27. Final Mode of delivery:**	◯ Vaginal delivery → ◯ SVD ◯ Breech ◯ Instrumental → ☐ Vacuum ☐ Forceps ◯ Caesarean section → ◯ Elective ◯ Emergency ◯ Others, specify..... ◯ Unknown

SECTION 2 : BIRTH HISTORY (continue)

* 28. Apgar score at 1 min and 5 min (0-10)	a) Score at 1 min:	☐ Unknown	b) Score at 5 min: (Please score even if the baby is intubated)	☐ Unknown	
* 29. Initial resuscitation: (applicable for inborn only)	a) Oxygen:	◯ Yes ◯ No	d) Endotracheal tube vent:	◯ Yes ◯ No	
	b) Early CPAP :	◯ Yes ◯ No	e) Cardiac compression:	◯ Yes ◯ No	
	c) Bag and mask ventilation:	◯ Yes ◯ No	f) Adrenaline:	◯ Yes ◯ No	
* 30. a) Plastic wrap at birth (for <1500 gm)		◯ Yes ◯ No			
b) If yes : was baby wrapped without drying at birth		◯ Yes ◯ No			
c) Admission temperature: (mandatory if admitted to Neonatal ward)		☐☐ . ☐ (°C)			

SECTION 3: NEONATAL EVENT

* 31. Respiratory support: If < 12 hours = state 0.5 days If > 12 to 24 hours = state 1 day If > 24 hours = state to next completed days Complete entry a) to e) for each type of respiratory support given	◯ Yes →	a) CPAP/bilevel CPAP	◯ Yes ◯ No → ii) Total duration of CPAP/bilevel CPAP at your centre: ☐☐ . ☐ Day (s)
		b) High flow nasal cannula (HFNC):	◯ Yes ◯ No → i) Total duration of HFNC at your centre: ☐☐ . ☐ Day (s)
		c) Conventional ventilation:	◯ Yes ◯ No → i) Total duration of Conventional ventilation at your centre : ☐☐ . ☐ Day (s)
		d) HFJV/HFOV:	◯ Yes ◯ No → i) Total duration of HFJV/HFOV at your centre: ☐☐ . ☐ Day (s)
		e) Nitric Oxide:	◯ Yes ◯ No → i) Total duration of Nitric Oxide at your centre: ☐☐ . ☐ Day (s)
	◯ No		
* 32. Surfactant:	◯ Yes →	◯ < 1 hr	◯ 1-2 hrs ◯ > 2 hrs
	◯ No		
* 33. Parenteral nutrition:	◯ Yes	◯ No	

SECTION 4: PROBLEMS/ DIAGNOSES

* 34. Respiratory:	☐ Meconium aspiration syndrome ☐ Pulmonary haemorrhage ☐ Congenital pneumonia ☐ Community acquired pneumonia ☐ Transient tachypnoea of newborn ☐ Pulmonary interstitial emphysema ☐ Nosocomial pneumonia	
* 35. RDS:	◯ Yes ◯ No	
* 36. Pneumothorax:	◯ Yes → Pneumothorax developed during: ◯ Spontaneous ◯ CPAP ◯ CMV ◯ HFV ◯ No	
* 37. Supplemental oxygen and BPD:	a) Is baby on > 21% oxygen continuously for 28 days or more? ◯ Yes ◯ No	
	b) If Yes (i) for < 32 weeks GA, baby still on oxygen, CPAP or other forms of respiratory at 36 weeks	◯ Yes ◯ No
	(ii) for >= 32 weeks GA, baby still on oxygen, CPAP or other forms of respiratory support at at day 56	◯ Yes ◯ No
* 38. CVS:	*38a. PPHN : ◯ Yes ◯ No *38b. Heart Failure : ◯ Yes ◯ No	
* 39. PDA: (Only for < 37 weeks GA)	◯ Yes → a) ECHO done: ◯ Yes ◯ No	
	◯ No b) Pharmacological closure ◯ Yes ◯ No → If Yes then to choose ☐ Indomethacin ☐ Ibuprofen ☐ Paracetamol	
	c) Ligation: ◯ Yes ◯ No	
* 40. NEC (stage 2 and above):	◯ Yes → a) surgical treatment: ◯ Yes ◯ No	
	◯ No b) NEC present before admission to your centre: (for outborn baby only) ◯ Yes ◯ No	
* 41. ROP Retinal Exam Done < 32 weeks OR ≤ 1500g - option 'Not Applicable' will be auto blocked ≥ 32 weeks AND > 1500g: option 'Yes' & 'No' will be auto blocked	◯ Yes → (If yes, worst stage of ROP): a) Date of first screening: ☐☐ / ☐☐ / ☐☐	
	b) Post conceptional age at 1st screening : ☐☐ (autocalculate)	
	c) ◯ No ROP ◯ Stage 1 ◯ Prethresh ◯ Thresh ◯ Stage 4 ◯ Stage 5 ◯ APROP ☐ PLUS disease	
	d) Laser Therapy: ◯ Yes ◯ No	
	e) Cryotherapy: ◯ Yes ◯ No	
	f) AntiVEGF: ◯ Yes ◯ No	
	g) Vitrectomy ◯ Yes ◯ No	
	h) ROP present prior to admission? (for outborn baby only) ◯ Yes ◯ No	
	◯ No → Appointment given: ◯ Yes ◯ No	
	◯ Not Applicable Date of appointment: ☐☐ / ☐☐ / ☐☐	

SECTION 4: PROBLEMS/ DIAGNOSES (continue)

*** 42a. IVH:**
< 37 weeks - option 'Not Applicable' will be auto blocked

- ◯ Yes — *If yes, worst grade:* → ◯ Grade 1 ◯ Grade 2 ◯ Grade 3 ◯ Grade 4
  - ☐ VP shunt/reservoir insertion
- ◯ No
- ◯ Not applicable (term infant)
- ◯ Ultrasound not done

*** 42b. Cystic Periventricular Leukomalacia**

◯ Yes ◯ No

*** 43a. Central Venous Line**
(applies to the catheter in situ for the longest duration)

i. ◯ Yes ◯ No

ii. Date of insertion: ☐☐ / ☐☐ / ☐☐

Date of removal: ☐☐ / ☐☐ / ☐☐

Duration of central line (autocaloulate) : _____days

*** 43b. CLABSI**

◯ Yes ◯ No

*** 44. Confirmed sepsis:**

(Blood culture positive only)

◯ Yes ◯ No

☐ ≤ 72 hours of life

I) **Type of organism** (can tick more than one)

☐ Group B Streptococcus	☐ Staphylococcus aureus	☐ Acinetobacter	☐ ESBL organisms
☐ MRSA	☐ Klebsiella	☐ Fungal	☐ E. Coli
☐ CONS	☐ Pseudomonas	☐ Serratia	☐ Others, specify: .....

☐ > 72 hours of life

II) **Type of organism** (can tick more than one)

☐ Group B Streptococcus	☐ Staphylococcus aureus	☐ Acinetobacter	☐ ESBL organisms
☐ MRSA	☐ Klebsiella	☐ Fungal	☐ E. Coli
☐ CONS	☐ Pseudomonas	☐ Serratia	☐ Others, specify:.....

*** 45. Neonatal meningitis:**

◯ Yes ◯ No

CSF Culture positive : ◯ Yes ◯ No

I) If Yes, type of organism: (can tick more than one)

☐ Group B Streptococcus	☐ Staphylococcus aureus	☐ Acinetobacter	☐ ESBL organisms
☐ MRSA	☐ Klebsiella	☐ Fungal	☐ E.Coli
☐ CONS	☐ Pseudomonas	☐ Others, specify:.....	

*** 46. HIE:**
(Only for ≥ 35 weeks GA)

If None option chosen leave b,c and d blank

a) HIE severity	◯ None ◯ Mild ◯ Moderate ◯ Severe
b) Highest Thompson	☐☐
c) Cooling therapy :	◯ Yes ◯ No If yes; then to choose ☐ Cooling blanket or cap ☐ Passive cooling ± gel pack ☐ Both
d) Seizures in HIE cases:	◯ Yes ◯ No

*** 47. Congenital anomalies:**

*** 47a. Major congenital anomalies :**

◯ Yes ◯ No

- ◯ Syndrome (known)
  - ☐ Down
  - ☐ Edward
  - ☐ Patau
  - ☐ Others, specify (Refer to ICD 10):
- ◯ Not a recognized syndrome
- ◯ Isolated major abnormality

***47b. Types of abnormalities (check all that are present. Applies to all including 'known syndromes', 'not a recognized syndrome' or isolated major abnormality'**

- ☐ CNS →
  - ◯ Hydrocephalus
  - ◯ Hydrancephaly
  - ◯ Holoprosencephaly
  - ◯ Others (Refer to ICD 10) : _____
- ☐ Neural Tube Defect →
  - ◯ Myelomeningocoele
  - ◯ Anencephaly
  - ◯ Encephalocoele
  - ◯ Others (Refer to ICD 10) : _____
- ☐ CVS → Please see (page 4)
- ☐ Skeletal dysplasia
- ☐ Respiratory
  - ☐ CDH
- ☐ GIT
- ☐ Hydrops
- ☐ Renal
- ☐ Others, specify (Refer ICD10):
- ☐ None of the above

SECTION 4: PROBLEMS/ DIAGNOSES (continue)

* 47c.

☐ CVS

Tick all present

○ Duct dependent lesion →
- ☐ TGA
- ☐ TOF or PA with VSD
- ☐ Pulmonary atresia (PA) with Intact ventricular septum
- ☐ Complex cyanotic heart with PA
- ☐ Critical PS
- ☐ Hypoplastic left heart syndrome
- ☐ Interrupted aortic arch
- ☐ Coarctation of aorta
- ☐ Critical AS
- ☐ Tricuspid atresia
- ☐ Others, specify.....

○ Non duct dependent lesion →
- ☐ TAPVD
- ☐ ASD
- ☐ VSD
- ☐ AVSD
- ☐ PDA (for term infant)
- ☐ Others, specify.....

Date of echo diagnosis: Date done: ____/____/____ auto calculate age (days)

Intervention →
- ○ Nil done
- ○ Surgery — Date done: ____/____/____ auto calculate age (days)
- ○ Catheterization — Date done: ____/____/____ auto calculate age (days)
- ○ Died before operation
- ○ Palliative
- ○ For review later

Name of procedure: _____

SECTION 5: OUTCOME

*48a. **Date of discharge / transfer / death:** (dd/mm/yy)	☐☐/☐☐/☐☐	**48b. Time of Death:** (24 hour format) (mandatory for death cases) ☐☐☐☐ (enter the best estimated time of death if the exact time is unknown)
* 49. **Weight and growth status on discharge:**	**a) Weight:**	☐☐☐☐ (grams)
	b) Growth status:	○ SGA ○ AGA ○ LGA
* 50. **Total duration of hospital stay (neonatal/ paeds care):**	☐☐☐ (in completed days) (auto calculate)	
* 51. **Home oxygen therapy:**	○ Yes ○ No	
* 52. **Outcome:**		

○ Alive →

Place discharged to:
- ○ Home
- ○ Social welfare home
- ○ Other wards within hospital
- ○ Still hospitalized as of 1st birthday
- ○ Transfer to other hospitals →

a) Name of hospital:	
b) Reason for transfer:	○ Growth/ stepdown care ○ Acute medical/ diagnostic services ○ Social/Logistic reason ○ Lack of NICU bed ○ Other, specify: ..... ○ Chronic/ Palliative care ○ Surgery
c) Post transfer disposition: (Please fill this section if place transferred is not part of the NNR Network)	○ Home ○ Transferred again to another hospital ○ Death ○ Readmitted to your hospital ○ Still in ward

○ Dead →

Place of death:
- ○ Labour room/OT
- ○ Neonatal unit
- ○ In transit
- ○ Others, specify: .....

Name : _____ **Signature:** _____ **Date:** ☐☐☐ **(dd/mm/yy)**

MALAYSIAN NATIONAL NEONATAL REGISTRY

Supplementary Form

Instruction:
1) For term babies please fill in according to the most pertinent underlying cause of death.
2) For preterm babies please fill in according to the most immediate cause of death.

1. Centre Name:				Office use: Centre:	/
2. Name:		**3. RN:**			
4. Mother's I/C Number:	**New IC:**		**Passport:**		

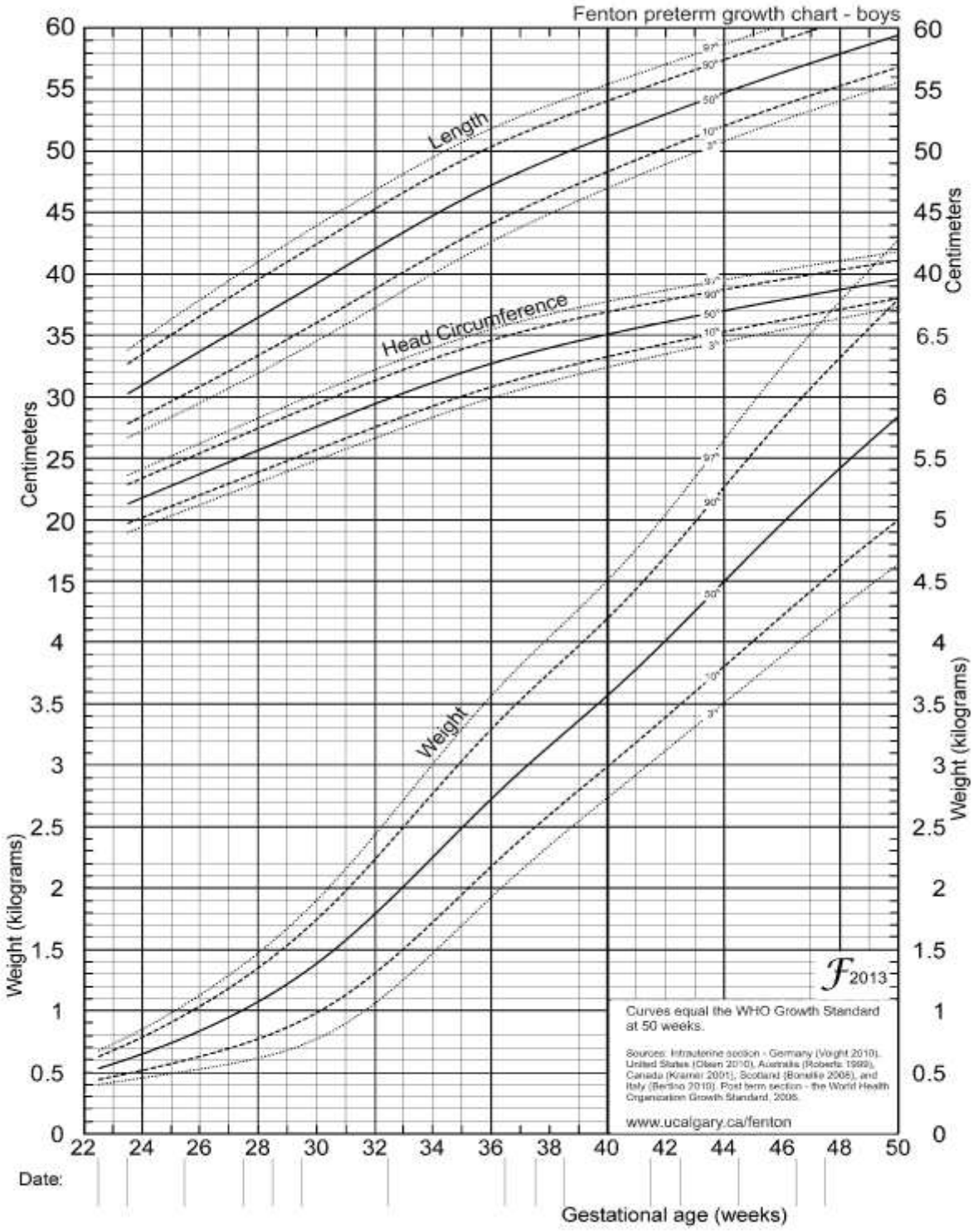
Immediate cause of death (Modified Wigglesworth): Tick relevant button to reach correct classification

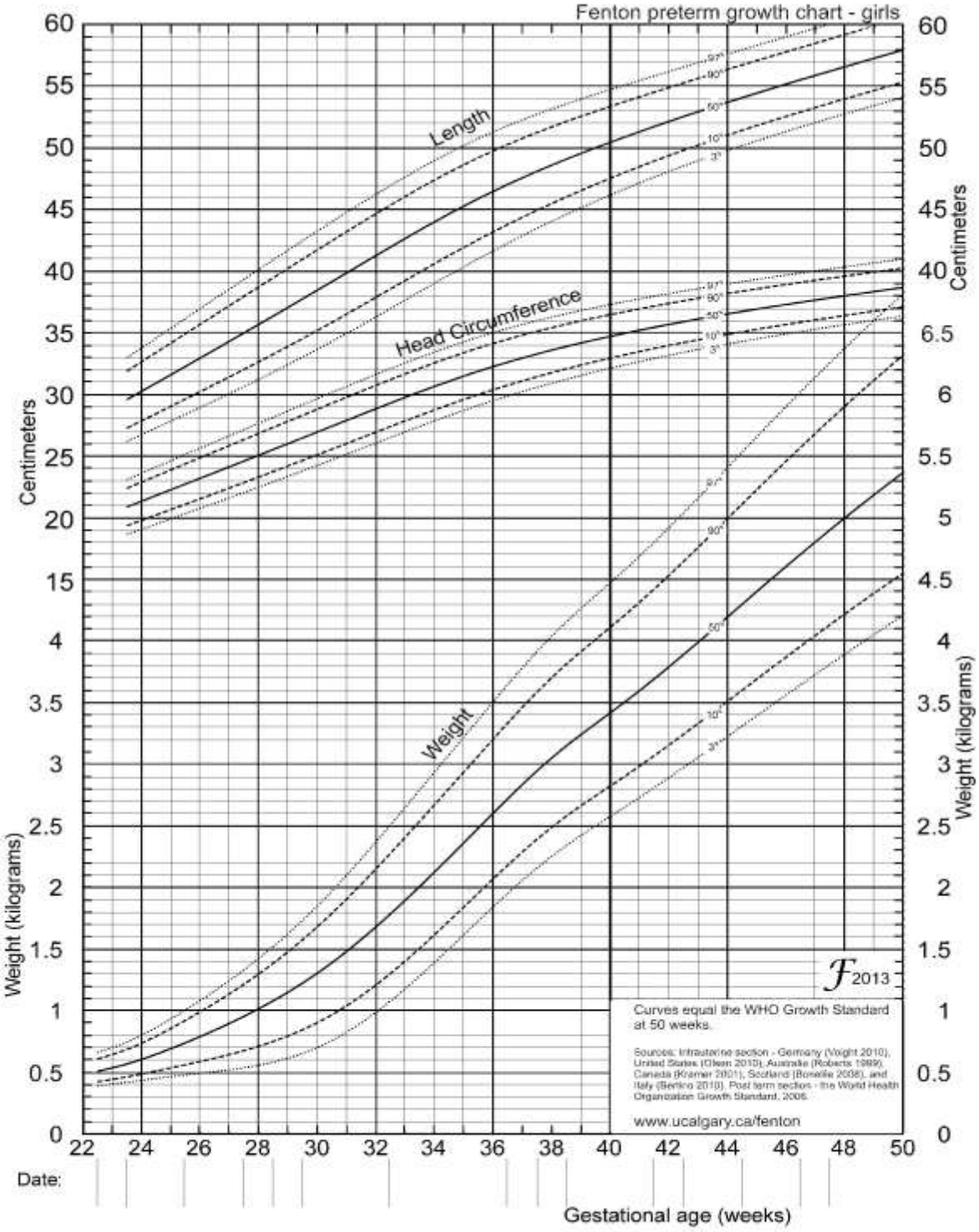
NEONATAL DEATH
(Is there any LCM?)

Note: LCM = Lethal Congenital Malformation

- ○ LCM present
  - a) Lethal congenital malformation/defect, specify:
    - ○ Neural tube defects
      - ○ Anencephaly
      - ○ Encephalocoele
      - ○ Others, specify ..... (Refer to ICD 10):
    - ○ CVS
      - ○ Complex Heart Disease
      - ○ Acyanotic
    - ○ CNS
      - ○ Hydranoephaly
      - ○ Holoprosencephaly
      - ○ Others, specify ..... (Refer to ICD 10):
    - ○ Recognisable syndrome
      - ○ Edward
      - ○ Patau
      - ○ Others, specify ..... (Refer to ICD 10):
    - ○ Not recognisable syndrome
    - ○ Skeletal dysplasia
    - ○ Respiratory (eg. lung hypoplasia)
    - ○ GIT
    - ○ Hydrops foetalis
    - ○ Renal
    - ○ Others, specify: .....
- ○ LCM absent
  - b) (Is gestation <37 weeks?)
    - ○ Yes
      - c) Gestation <37weeks (Preterm Death without LCM) due to:
        - ○ IVH
        - ○ Septicaemia
        - ○ PDA in failure
        - ○ Pulmonary hemorrhage
        - ○ NEC
        - ○ Pneumonia
        - ○ PIE / BPD
        - ○ Pneumothorax
        - ○ Extreme prematurity
        - ○ Acute intrapartum event
        - ○ Severe RDS
        - ○ Others (specify)
    - ○ No
      - Gestation ≥37 weeks (Did the baby have an asphyxial condition?)
        - ○ d) Asphyxial condition absent (Did the baby die from infection?)
          - ○ e) If term and infection present
            - ○ Group B streptococcal septicaemia
            - ○ Meningitis
            - ○ Congenital pneumonia
            - ○ Congenital Infection
            - ○ Others, specify .....
          - ○ If term and infection absent (Are there any other specific causes of death?)
            - ○ f) Other specific causes of death:
              - ○ Kernicterus / severe neonatal jaundice
              - ○ Haemorrhagic disease of newborn / Vitamin K deficiency
              - ○ Intracranial bleed / SAH
              - ○ Pneumothorax
              - ○ Pulmonary hemorrhage
              - ○ IEM
              - ○ MAS
              - ○ Surgical, specify: .....
              - ○ Others, specify: .....
            - ○ Unknown cause
        - ○ Asphyxial condition present

Name : _____ **Signature:** _____ **Date:** | | | | | | | | (dd/mm/yy)


Fenton preterm growth chart - boys
Length
Head Circumference
Weight
97°
90°
50°
10°
3°
Centimeters
Weight (kilograms)
Date:
Gestational age (weeks)
F2013
Curves equal the WHO Growth Standard at 50 weeks.
Sources: Intrauterine section - Germany (Voigt 2010), United States (Olsen 2010), Australia (Roberts 1999), Canada (Kramer 2001), Scotland (Bonellie 2008), and Italy (Bertino 2010). Post term section - the World Health Organization Growth Standard, 2006.
www.ucalgary.ca/fenton


Fenton preterm growth chart - girls
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