REPORT OF THE MALAYSIAN NATIONAL NEONATAL REGISTRY 2020

'A STUDY OF CRITICALLY ILL BABIES IN NEONATAL INTENSIVE CARE UNITS'

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▶ **WITH CONTRIBUTIONS FROM**

- *Boo Nem Yun* • *Chee Seok Chiong*
- *Ang Ee Lee* • *Pauline Choo Poh Ling*
- *Farah Inaz Syed Abdullah*
- *Azanna Ahmad Kamar* • *Wong Ann Cheng*
- *Eric Ang Boon Kuang*

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.

June 2023

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Report of the Malaysian National Neonatal Registry (MNNR) 2020

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.

A Registry Manager assisted by a clinical research assistant heads the administrative staff at the Neonatal Registry Unit (NRU). Statistical support is provided by the CRC.

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) included

A. All babies admitted to a Neonatal Unit who have any of the following criteria:
   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. Required respiratory support (ventilated or required CPAP or humidified high flow nasal cannula)
   4. Had hypoxic ischaemic encephalopathy (HIE) with or without requirement of ventilatory support
   5. With confirmed sepsis i.e. positive blood culture
   6. With congenital heart disease

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.

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 were continually refined.

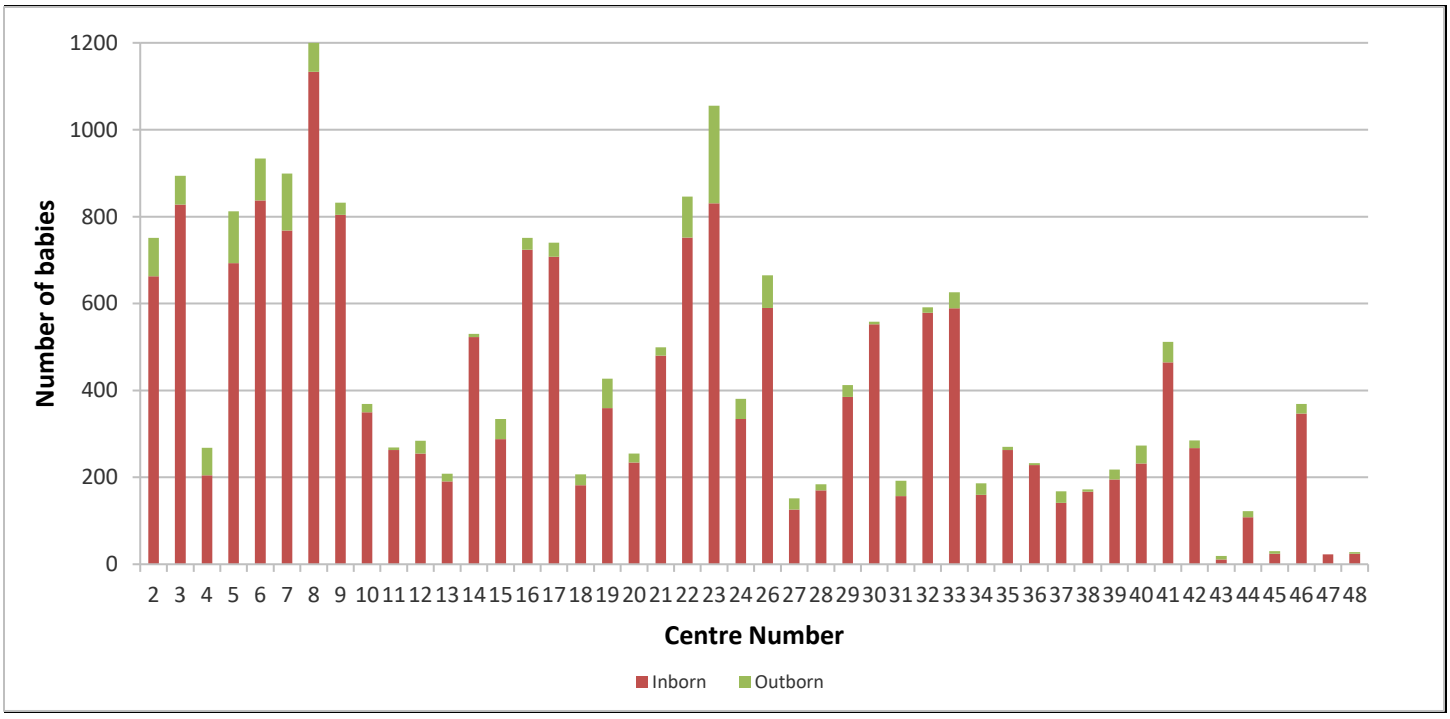
RESULTS

INTRODUCTION

- In 2020 the inclusion criteria for the MNNR registry included all babies (inborn and outborn babies) delivered at a gestation of below 32 weeks, or with a birth weight of between 500 grams to 1500 grams, or required respiratory support, or with hypoxic-ischaemic encephalopathy, confirmed sepsis; those with congenital heart disease, as well as, all neonatal deaths.
- Two more hospitals participated in this study in 2020 making a total of 46.
- Although the number of hospitals increased from 44 to 46 in 2020, total livebirths in the participating hospitals decreased from 331,055 in 2019 to 319,867 in 2020.
- A total of 10.7% of livebirths were delivered preterm at less than 37 completed weeks with 77.6% delivered at late preterm gestation between 34 to 36 completed weeks.
- A total of 20,033 babies fulfilled the study criteria, out of which 18,208 (90.9%) were inborn, while 1,825(9.1%) were outborn babies as shown in Table 1 and Figure 1 below.
- Of those who met the study criteria, 3,524 (17.6%) babies were born below 32 weeks of gestational age (Figure 2 and Table 2), and a total of 3,768 (18.8%) babies had birth weights of 1500g and below (Figure 3 and Table 3).

Figure 1

Number of babies according to place of birth



COMMENT: There were 18208 inborn babies and 1825 outborn babies in the MNNR.

Table 1: Number of babies according to place of birth

Hospitals		Place of Birth		Total
		Inborn	Outborn	
2	n	663	88	751
	(%)	(88.3)	(11.7)	(100)
3	n	828	66	894
	(%)	(92.6)	(7.4)	(100)
4	n	205	63	268
	(%)	(76.5)	(23.5)	(100)
5	n	693	119	812
	(%)	(85.3)	(14.7)	(100)
6	n	837	97	934
	(%)	(89.6)	(10.4)	(100)
7	n	768	131	899
	(%)	(85.4)	(14.6)	(100)
8	n	1133	67	1200
	(%)	(94.4)	(5.6)	(100)
9	n	804	28	832
	(%)	(96.6)	(3.4)	(100)
10	n	350	19	369
	(%)	(94.9)	(5.1)	(100)
11	n	263	6	269
	(%)	(97.8)	(2.2)	(100)
12	n	255	29	284
	(%)	(89.8)	(10.2)	(100)
13	n	191	17	208
	(%)	(91.8)	(8.2)	(100)
14	n	523	7	530
	(%)	(98.7)	(1.3)	(100)
15	n	288	46	334
	(%)	(86.2)	(13.8)	(100)
16	n	724	27	751
	(%)	(96.4)	(3.6)	(100)
17	n	708	32	740
	(%)	(95.7)	(4.3)	(100)

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

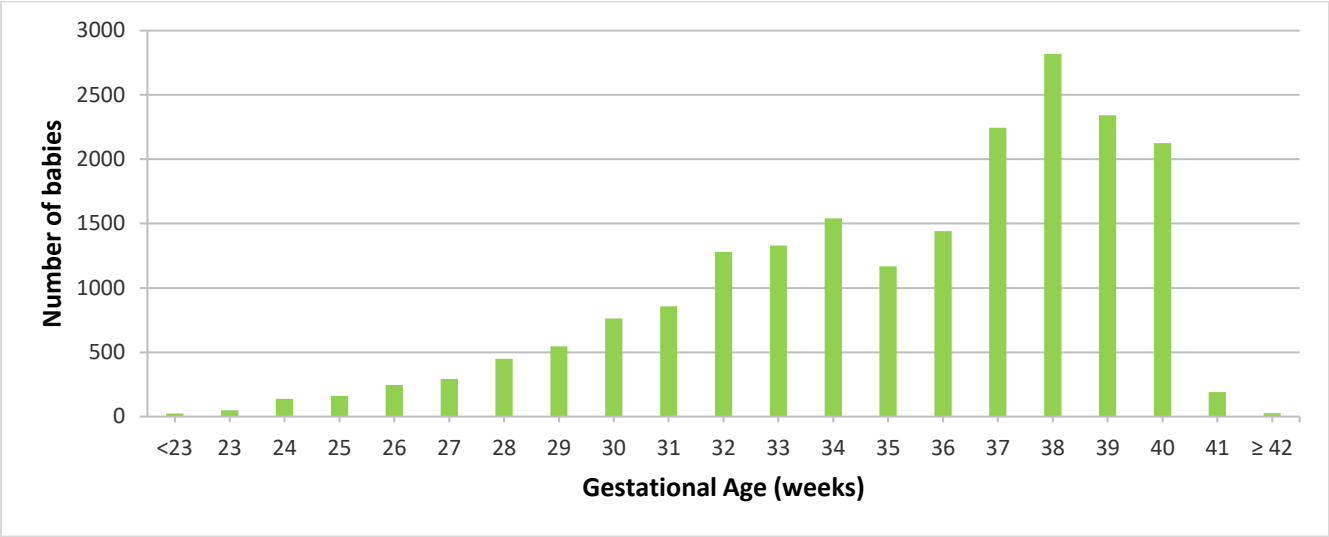
Hospitals		Place of Birth		Total
		Inborn	Outborn	
18	n	182	25	207
	(%)	(87.9)	(12.1)	(100)
19	n	359	68	427
	(%)	(84.1)	(15.9)	(100)
20	n	234	21	255
	(%)	(91.8)	(8.2)	(100)
21	n	480	19	499
	(%)	(96.2)	(3.8)	(100)
22	n	752	94	846
	(%)	(88.9)	(11.1)	(100)
23	n	831	224	1055
	(%)	(78.8)	(21.2)	(100)
24	n	334	47	381
	(%)	(87.7)	(12.3)	(100)
26	n	590	75	665
	(%)	(88.7)	(11.3)	(100)
27	n	126	26	152
	(%)	(82.9)	(17.1)	(100)
28	n	170	14	184
	(%)	(92.4)	(7.6)	(100)
29	n	385	27	412
	(%)	(93.4)	(6.6)	(100)
30	n	552	6	558
	(%)	(98.9)	(1.1)	(100)
31	n	157	35	192
	(%)	(81.8)	(18.2)	(100)
32	n	579	12	591
	(%)	(98.0)	(2.0)	(100)
33	n	589	37	626
	(%)	(94.1	(5.9)	(100)
34	n	160	26	186
	(%)	(86.0)	(14.0)	(100)
35	n	263	7	270
	(%)	(97.4)	(2.6)	(100)

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

Hospitals		Place of Birth		Total
		Inborn	Outborn	
36	n	228	5	233
	(%)	(97.9)	(2.1)	(100)
37	n	141	27	168
	(%)	(83.9)	(16.1)	(100)
38	n	167	5	172
	(%)	(97.1)	(2.9)	(100)
39	n	195	23	218
	(%)	(89.4)	(10.6)	(100)
40	n	232	41	273
	(%)	(85.0)	(15.0)	(100)
41	n	465	47	512
	(%)	(90.8)	(9.2)	(100)
42	n	267	18	285
	(%)	(93.7)	(6.3)	(100)
43	n	11	8	19
	(%)	(57.9)	(42.1)	(100)
44	n	108	14	122
	(%)	(88.5)	(11.5)	(100)
45	n	24	6	30
	(%)	(80.0)	(20.0)	(100)
46	n	347	22	369
	(%)	(94.0)	(6.0)	(100)
47	n	23	0	23
	(%)	(100)	(0)	(100)
48	n	24	4	28
	(%)	(85.7)	(14.3)	(100)
TOTAL	**n**	**18208**	**1825**	**20033**
	(%)	**(90.9)**	**(9.1)**	**(100)**

Figure 2

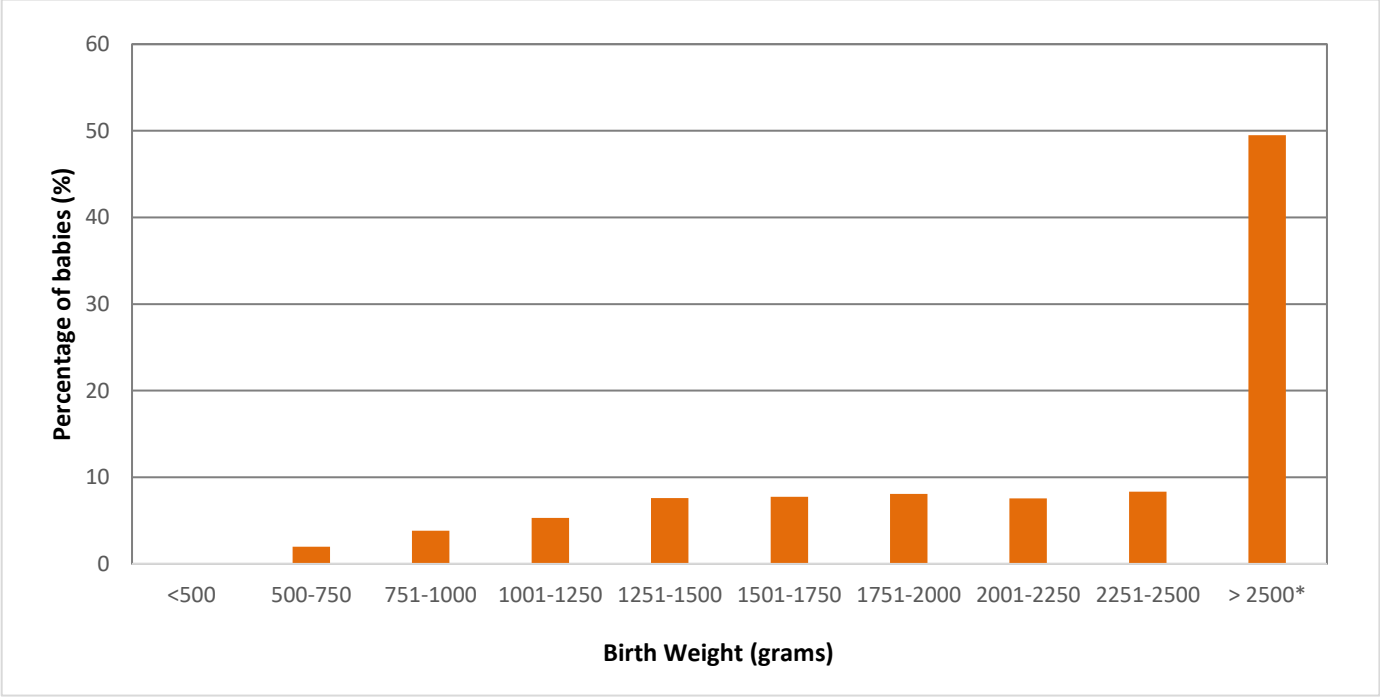
Frequency distribution of all babies in MNNR according to gestational age



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, calculated percentages do 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	24	0.1
23	49	0.2
24	137	0.7
25	161	0.8
26	245	1.2
27	293	1.5
28	450	2.2
29	545	2.7
30	762	3.8
31	858	4.3
32	1281	6.4
33	1330	6.6
34	1540	7.7
35	1169	5.8
36	1441	7.2
37	2244	11.2
38	2819	14.1
39	2343	11.7
40	2125	10.6
41	191	1.0
≥ 42	26	0.1
Total included	20033	100
Total no. of babies with missing gestational age	0	
Total no. of babies	20033	

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

Birth weight (grams)	Frequency (n)	Percent (%)
<500	19	0.1
500-750	397	2.0
751-1000	771	3.8
1001-1250	1061	5.3
1251-1500	1520	7.6
1501-1750	1550	7.7
1751-2000	1621	8.1
2001-2250	1513	7.6
2251-2500	1668	8.3
> 2500	9913	49.5
Total included	20033	100
Total no. of babies with missing birth weight	0	
Total no. of babies	20033	

MATERNAL INTERVENTIONS

- Antenatal corticosteroids for fetal lung maturation were administered to 77.2% of mothers of babies less than 32 weeks gestation. A high proportion of outborns did not receive antenatal corticosteroids with 80.4% of inborns compared to 41.7% of outborns less than 32 weeks gestation received this intervention. For the respective MNNR centres, the use of antenatal corticosteroids ranged between 23.5% to 100% for inborn babies, and, between none (0%) to 85.7% for outborn infants. (Figure 4a & 4b and Table 4)
- For babies with birth weight ≤1500 grams, antenatal corticosteroids were given to the mothers of 75.7%. The mothers of 79.1% of inborn babies and 38.4% of outborn babies received antenatal corticosteroids. (Figures 5a & 5b and Table 5)

INTERVENTIONS IN THE LABOUR ROOM

- Among inborn babies who were below 32 weeks gestational age, 56.4% (1825 out of 3234 babies) were given early nasal CPAP at initial resuscitation in the labour room.
- For inborn babies with birth weight less than 1000 grams, 87.7% (893 out of 1018 babies) were wrapped with plastic at birth.

Figure 4a

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

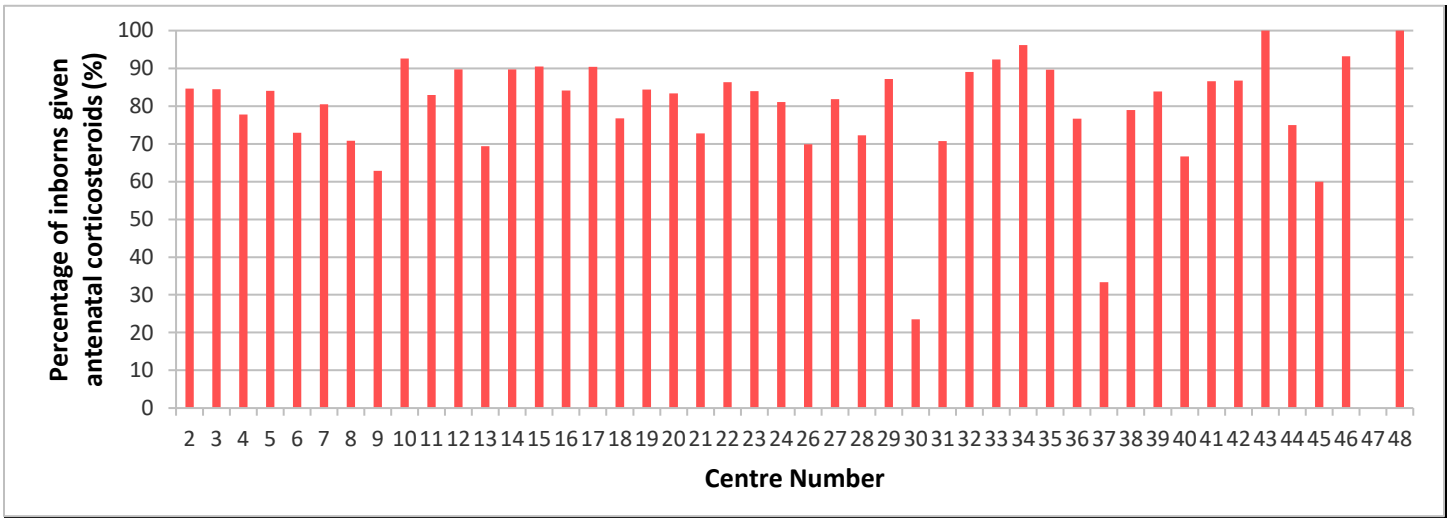


Figure 4b

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

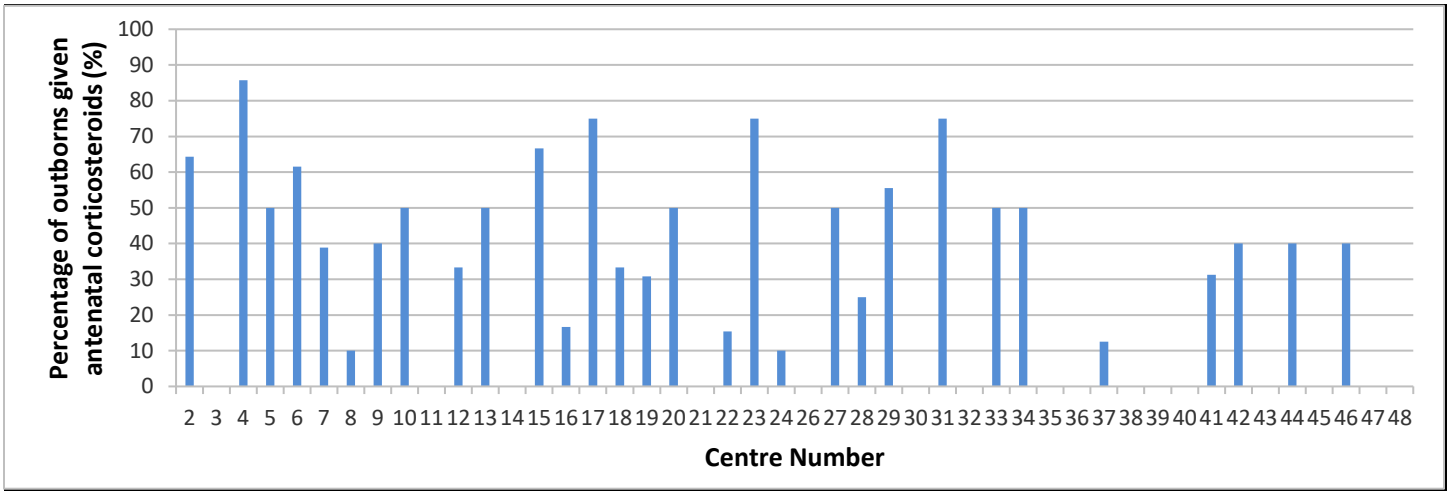


Table 4: Antenatal corticosteroids for all babies born at < 32 weeks gestational age according to centre

Hospitals	Inborn			Outborn		
	Total no of babies	Given Antenatal Steroids		Total No of Babies	Given Antenatal Steroids	
	n	N	%	n	N	%
	3234	**2600**	**80.4**	**290**	**121**	**41.7**
2	130	110	84.6	14	9	64.3
3	135	114	84.4	7	0	0.0
4	36	28	77.8	7	6	85.7
5	150	126	84.0	14	7	50.0
6	96	70	72.9	13	8	61.5
7	195	157	80.5	18	7	38.9
8	178	126	70.8	10	1	10.0
9	105	66	62.9	5	2	40.0
10	54	50	92.6	6	3	50.0

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	41	34	82.9	2	0	0.0
12	68	61	89.7	3	1	33.3
13	62	43	69.4	6	3	50.0
14	78	70	89.7	1	0	0.0
15	84	76	90.5	6	4	66.7
16	107	90	84.1	6	1	16.7
17	115	104	90.4	4	3	75.0
18	43	33	76.7	3	1	33.3
19	77	65	84.4	13	4	30.8
20	12	10	83.3	6	3	50.0
21	44	32	72.7	0	0	0.0
22	95	82	86.3	13	2	15.4
23	131	110	84.0	28	21	75.0
24	116	94	81.0	10	1	10.0
26	189	132	69.8	15	6	0.0
27	44	36	81.8	4	2	50.0
28	18	13	72.2	4	1	25.0
29	78	68	87.2	9	5	55.6
30	34	8	23.5	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	65	46	70.8	4	3	75.0
32	91	81	89.0	2	0	0.0
33	78	72	92.3	6	3	50.0
34	26	25	96.2	2	1	50.0
35	29	26	89.7	1	0	0.0
36	30	23	76.7	1	0	0.0
37	36	12	33.3	8	1	12.5
38	19	15	78.9	0	0	0.0
39	31	26	83.9	2	0	0.0
40	33	22	66.7	5	1	0.0
41	112	97	86.6	16	5	31.3
42	83	72	86.7	5	2	40.0
43	1	1	100.0	0	0	0.0
44	20	15	75.0	5	2	40.0
45	5	3	60.0	0	0	0.0
46	59	55	93.2	5	2	40.0
47	0	0	0.0	0	0	0.0
48	1	1	100.0	1	0	0.0

Figure 5a

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

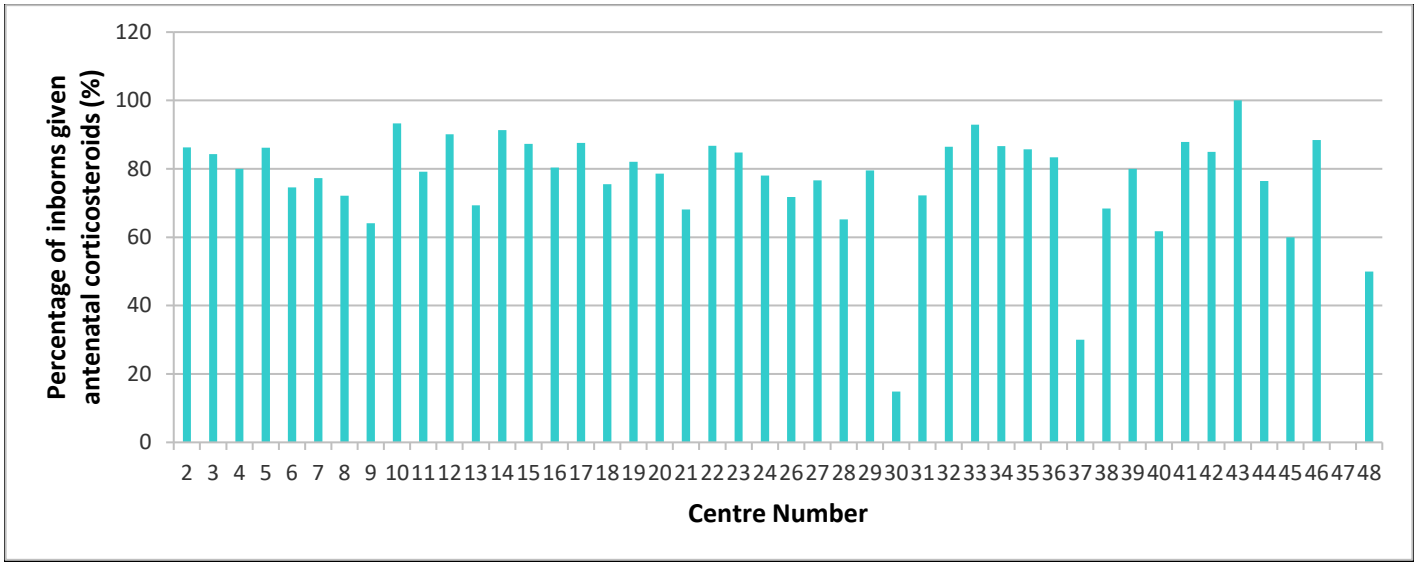


Figure 5b

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

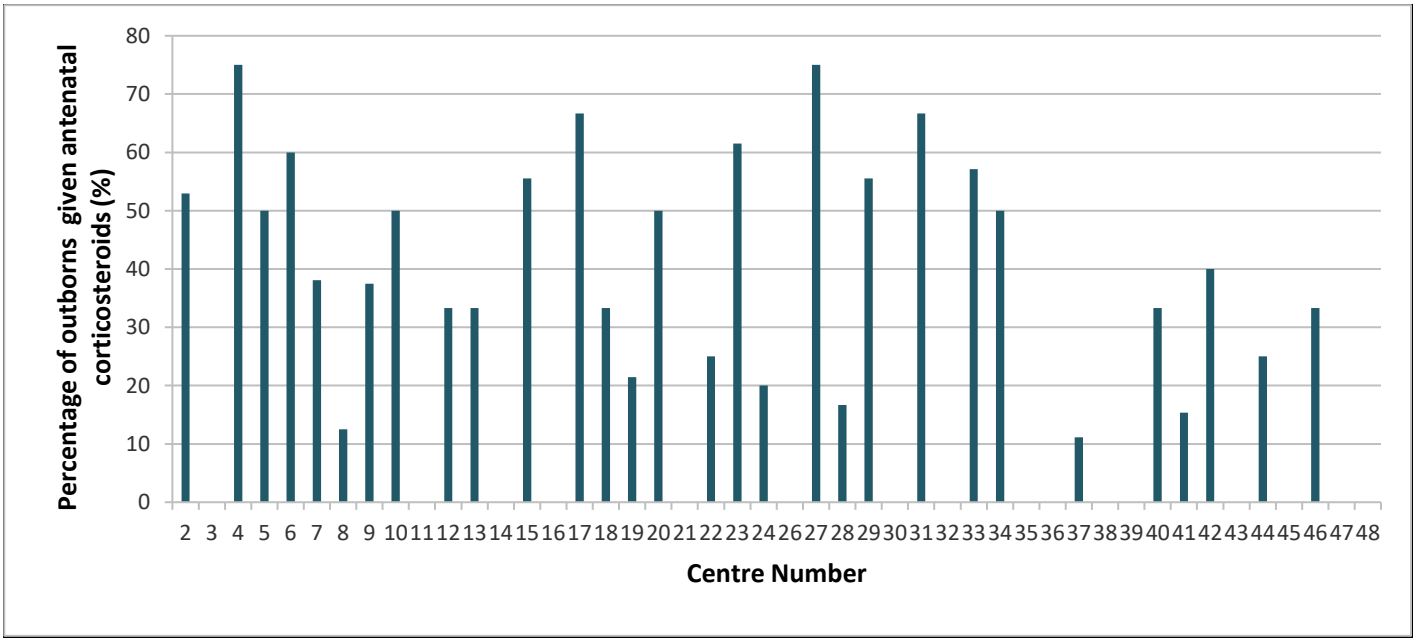


Table 5 :
Antenatal corticosteroids for all babies born at ≤ 1500 grams birth weight according to centres

Hospitals	Inborn			Outborn		
	Total no. of babies	Given antenatal steroids		Total no. of babies	Given antenatal steroids	
	n	N	%	n	N	n
	3453	**2733**	**79.1**	**315**	**121**	**38.4**
2	131	113	86.3	17	9	52.9
3	140	118	84.3	8	0	0.0
4	35	28	80.0	8	6	75.0
5	174	150	86.2	14	7	50.0
6	118	88	74.6	15	9	60.0
7	207	160	77.3	21	8	38.1
8	194	140	72.2	8	1	12.5
9	117	75	64.1	8	3	37.5
10	60	56	93.3	6	3	50.0
11	48	38	79.2	2	0	0.0
12	71	64	90.1	3	1	33.3
13	62	43	69.4	6	2	33.3
14	81	74	91.4	1	0	0.0
15	79	69	87.3	9	5	55.6
16	107	86	80.4	6	0	0.0
17	105	92	87.6	3	2	66.7
18	45	34	75.6	3	1	33.3
19	95	78	82.1	14	3	21.4

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

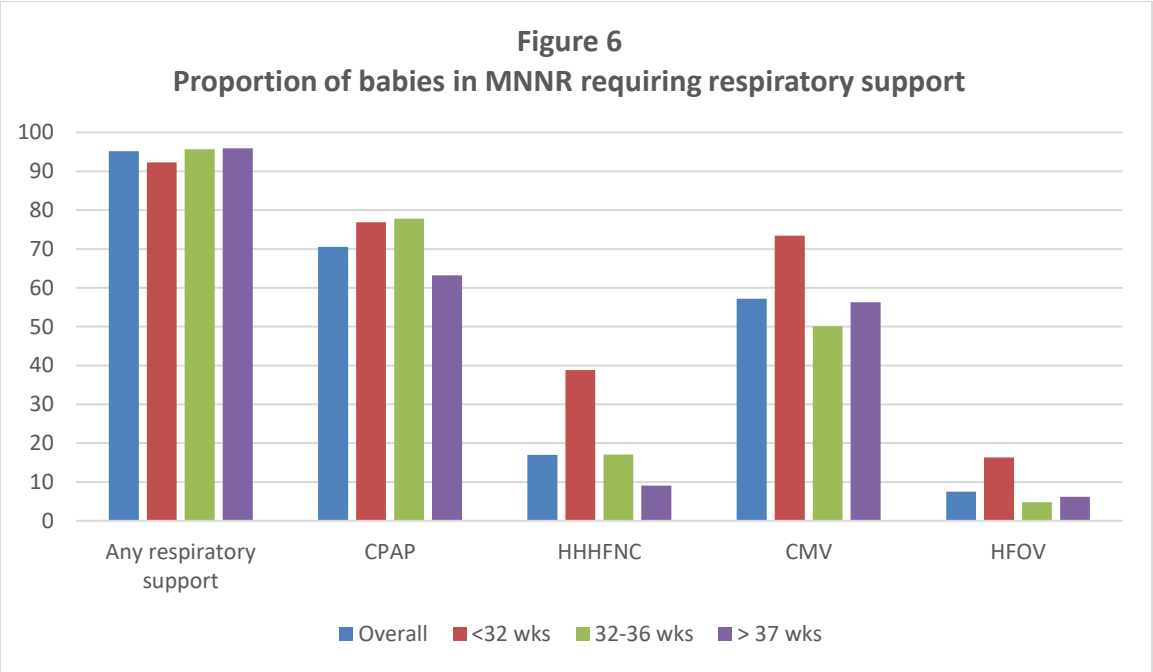
Hospitals	Inborn			Outborn		
	Total no. of babies	Given antenatal steroids		Total no. of babies	Given antenatal steroids	
	n	N	%	n	N	%
20	14	11	78.6	4	2	50.0
21	47	32	68.1	2	0	0.0
22	106	92	86.8	16	4	25.0
23	138	117	84.8	26	16	61.5
24	123	96	78.0	10	2	20.0
26	209	150	71.8	18	7	0.0
27	47	36	76.6	4	3	75.0
28	23	15	65.2	6	1	16.7
29	83	66	79.5	9	5	55.6
30	47	7	14.9	0	0	0.0
31	54	39	72.2	9	6	66.7
32	96	83	86.5	2	0	0.0
33	85	79	92.9	7	4	57.1
34	30	26	86.7	2	1	50.0
35	35	30	85.7	1	0	0.0
36	30	25	83.3	2	0	0.0
37	40	12	30.0	9	1	11.1
38	19	13	68.4	0	0	0.0

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	25	20	80.0	1	0	0.0
40	34	21	61.8	6	2	33.3
41	124	109	87.9	13	2	15.4
42	80	68	85.0	5	2	40.0
43	2	2	100.0	0	0	0.0
44	17	13	76.5	4	1	25.0
45	5	3	60.0	0	0	0.0
46	69	61	88.4	6	2	33.3
47	0	0	0.0	0	0	0.0
48	2	1	50.0	1	0	0.0

RESPIRATORY SUPPORT AND SURFACTANT THERAPY

- Overall, a total of 19072 babies required respiratory support in the neonatal units. Out of these, 11459 babies required conventional ventilation (CMV), 1505 babies required high frequency oscillatory ventilation (HFOV), 14127 babies required nasal CPAP, and 3415 babies were given heated, humidified high flow nasal cannula (HHHFNC) therapy.
  *These numbers are not mutually exclusive, and a baby might receive multiple modes of respiratory support.
- 92.3% (3251 out of 3524) of babies born below 32 weeks gestation; and 90.6% (3413 out of 3768) of babies with birth weight ≤1500 grams, required respiratory support.



- Overall, regardless of gestational age, surfactant was given to a total of 4387 babies. 61.8% (2328 out of 3768) of babies with birth weight ≤1,500 grams were given surfactant, and 42.4% of these were given within 1 hour of life. 68.1% (2400 out of 3524) of babies born below 32 weeks gestational age received surfactant, and 42.4% of these were given within 1 hour of life. For babies born at 32-36 weeks gestation, 24.1% (1629 out of 6761) had surfactant therapy. 358 term babies born at ≥ 37 weeks received surfactant.
- Inhaled nitric oxide was administered to 328 babies.

RESPIRATORY DISEASES AND CHRONIC LUNG DISEASE

Meconium Aspiration Syndrome

- A total of 1737 babies were diagnosed with meconium aspiration syndrome (MAS). Of these, 1560 were inborn babies and 177 were outborn babies. The incidence of inborn babies ≥ 35 weeks with MAS requiring ventilation (conventional ventilation, HFOV and/or CPAP) was 5.0 per 1000 livebirths, with 3.5 per 1000 livebirths needing invasive ventilation.
- Overall, 1223 babies ≥ 35 weeks received invasive ventilation for MAS; another 489 babies were given CPAP only. Inhaled nitric oxide was given to 118 babies with MAS.
- The incidence rate for pneumothorax in babies ≥ 35 weeks with MAS was 9.4% (164/1737)
- The mortality rate for inborn and outborn babies ventilated for MAS was 5.3% and 10.7% respectively, with an overall mortality rate of 5.9%.

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 73.5% and 75.9% respectively for babies between 22-24 weeks gestational age; 64.7% and 50.4% for babies between 25-27 weeks gestational age; and 17.4% and 12.8% for babies between 28-31 weeks gestational age.(Figure 7 and Table 7)
- For babies with oxygen dependency at 36 weeks post-conceptional age, survival to discharge were 87.5%, 92.6% and 93.7% 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 71.2% for babies with birth weight <750 g, 59.1% for babies with birth weight 750-999 g, 25.3% for babies with birth weight 1000-1249 g, and 7.9% 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 69.8% for babies with birth weight <750 g, 47.9% for babies with birth weight 750-999 g, 20.6% for babies with birth weight 1000-1249 g, and 8.2% 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 22.2% for babies with birth weight 750-999 g, 5.8% for babies with birth weight 1000-1249 g, and 1.9% for babies with birth weight 1250-1499 g. (Figure 8 and Table 8)

Figure 7

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

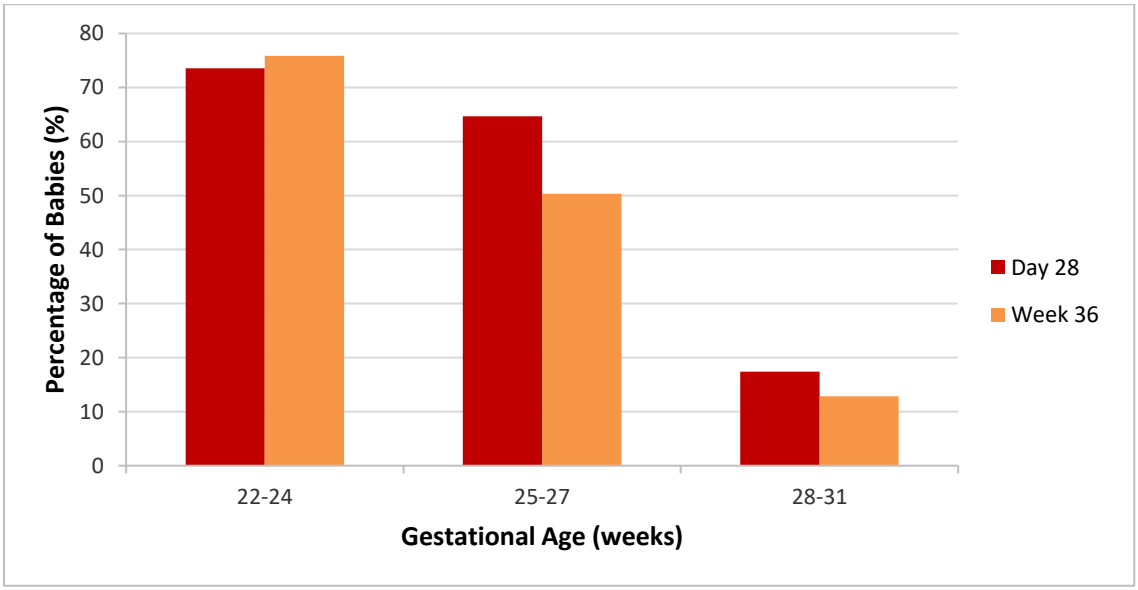


Table 7:
Incidence of oxygen dependency among admitted inborn babies with gestational age < 32 weeks

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*	150	34	25	29	22
	%	4.7	22.7	73.5	19.3	75.9
25-27	*n*	620	436	282	413	208
	%	19.6	70.3	64.7	66.6	50.4
28-31	*n*	2388	2209	384	2200	282
	%	75.6	92.5	17.4	92.1	12.8
Total included	*n*	3158	2679	691	2642	512
	%	100	84.8	25.8	83.7	19.4
Total babies		3158				

Figure 8

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

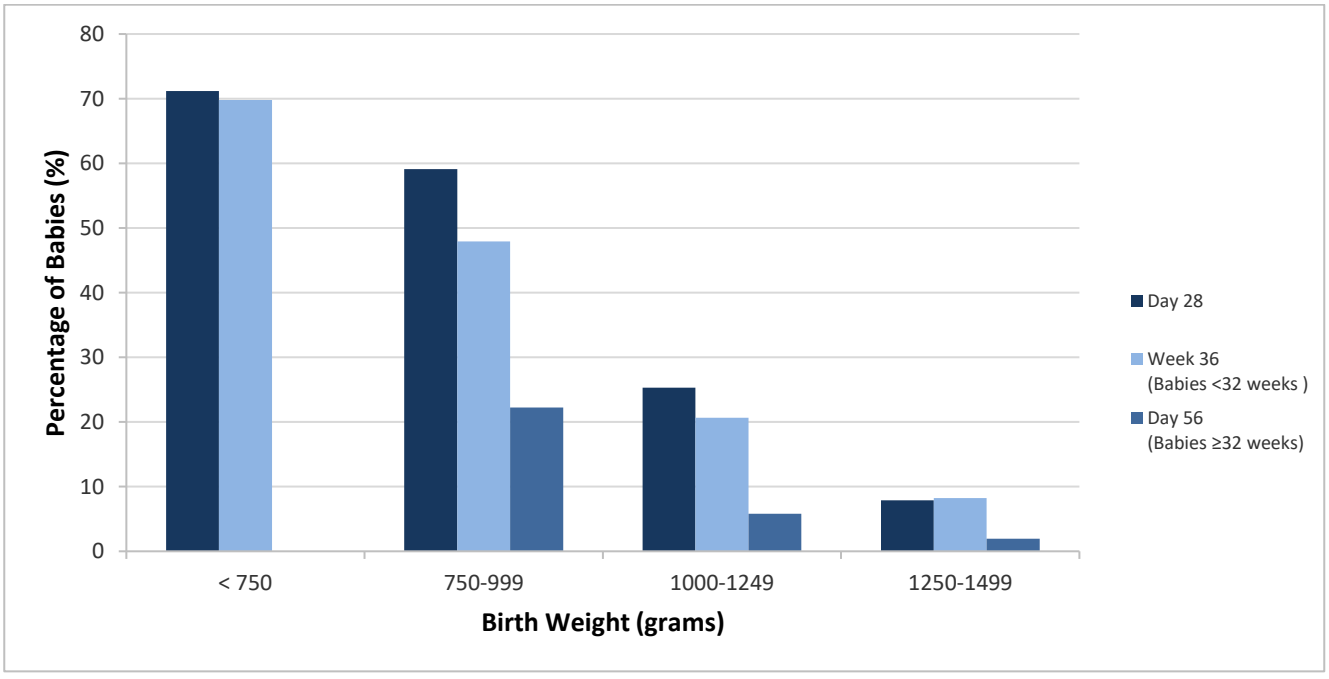


Table 8:
Incidence of oxygen dependency among admitted inborn babies with birth weight < 1500 grams

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*	318	118	84	106	74	1	0
	%	9.8	37.1	71.2	33.7	69.8	33.3	0.0
750-999	*n*	643	504	298	459	220	27	6
	%	19.7	78.4	59.1	75.4	47.9	79.4	22.2
1000 – 1249	*n*	985	886	224	688	142	190	11
	%	30.2	89.9	25.3	88.9	20.6	90.0	5.8
1250 - 1499	*n*	1313	1230	97	655	54	571	11
	%	40.3	93.7	7.9	93.0	8.2	93.8	1.9
Total Included	*n*	3259	2738	703	1908	490	789	28
	%	100	84.0	25.7	79.4	25.7	92.1	3.5
Total babies		3259						

CARDIOVASCULAR COMPLICATIONS

Patent Ductus Arteriosus

- Patent ductus arteriosus (PDA) was diagnosed in 1172 (37.1%) inborn babies with gestational age <32 weeks admitted to the NICUs. Overall, 97.5% of these babies has echocardiogram to confirm the diagnosis. Indomethacin/ibuprofen and paracetamol were administered to 16.6% and 43.9% of these babies respectively, 1.8% of them underwent PDA ligation. (Table 9)
- PDA was diagnosed in 1174 (36.0%) inborn babies with birth weight <1500g admitted to the NICUs. Indomethacin/ibuprofen and paracetamol were administered to 14.6% and 32.3% of these babies respectively, 1.7% of them underwent PDA ligation. (Table 10)

Persistent Pulmonary Hypertension of the Newborn (PPHN)

- A total of 953 babies were diagnosed with PPHN, 786 of these babies were ≥35 weeks gestation.
- Inhaled nitric oxide was given to 295 (31.0%) of babies with PPHN.

- The overall mortality rate of babies with PPHN was 31.5%.

Table 9:
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	%
22-24	150	38	25.3	37	97.4	30	78.9	18	47.4	0	0.0
25 - 27	620	364	58.7	360	98.9	71	19.5	196	53.8	7	1.9
28 -31	2388	770	32.2	746	96.9	94	12.2	300	39.0	14	1.8
Total	3158	1172	37.1	1143	97.5	195	16.6	514	43.9	21	1.8

Table 10:
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	%
< 750	318	130	40.9	130	100.0	22	16.9	56	43.1	4	3.1
750 - 999	643	356	55.4	345	96.9	63	17.7	187	52.5	10	2.8
1000- 1249	985	376	38.2	367	97.6	57	15.2	156	41.5	3	0.8
1250 - 1499	1313	312	23.8	307	98.4	29	9.3	113	36.2	3	1.0
Total	3259	1174	36.0	1149	97.9	171	14.6	379	32.3	20	1.7

RETINOPATHY OF PREMATURITY

- For inborn babies born at gestational age <32 weeks and survived to 6 weeks of age, 2167 (81.6%) babies were screened for retinopathy of prematurity (ROP) before discharge. Among these babies, 1812 (83.6%) did not have ROP, 297 (13.7%) had ROP stage 1 or 2, 49 (2.3%) had ROP stage 3, 4 (0.2%) had ROP stage 4 or 5, and 5(0.2%) had aggressive posterior ROP (APROP). The incidence rates of severe ROP (stage 3, 4, 5 and APROP) were 24.1%, 7.7%, 1.2% in babies with gestational age of 22-24 weeks, 25-27 weeks and 28-31 weeks respectively. A total of 47 babies had laser therapy and 6 babies were treated with anti-vascular endothelial growth factor (anti-VEGF) injection. (Figure 11 and Table 11)
- For inborn babies born with birth weight <1500 g and survived to 6 weeks of age, 2249 (82.8%) were screened for ROP before discharge. Among these babies, 1893 (84.2%) did not have ROP, 301(13.4%) had stage ROP 1 or 2, 46 (2.0%) had ROP stage 3, 4 (0.2%) had ROP stage 4 or 5, and 5(0.2%) had APROP. The incidence of severe ROP (stage 3, 4, 5 and APROP) were 20.0%, 3.7%, 1.5%, and 0.6%, in babies with birth weight <750 g, 750-999 g, 1000-1249 g and 1250-1499 g, respectively. A total of 46 babies underwent laser therapy and 6 babies had anti-VEGF injection. (Figure 12 and Table 12)
- In addition to the above, there were 10 outborn babies who were treated with laser therapy. All were below 32 weeks and <1500g in birth weight.

Figure 11

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

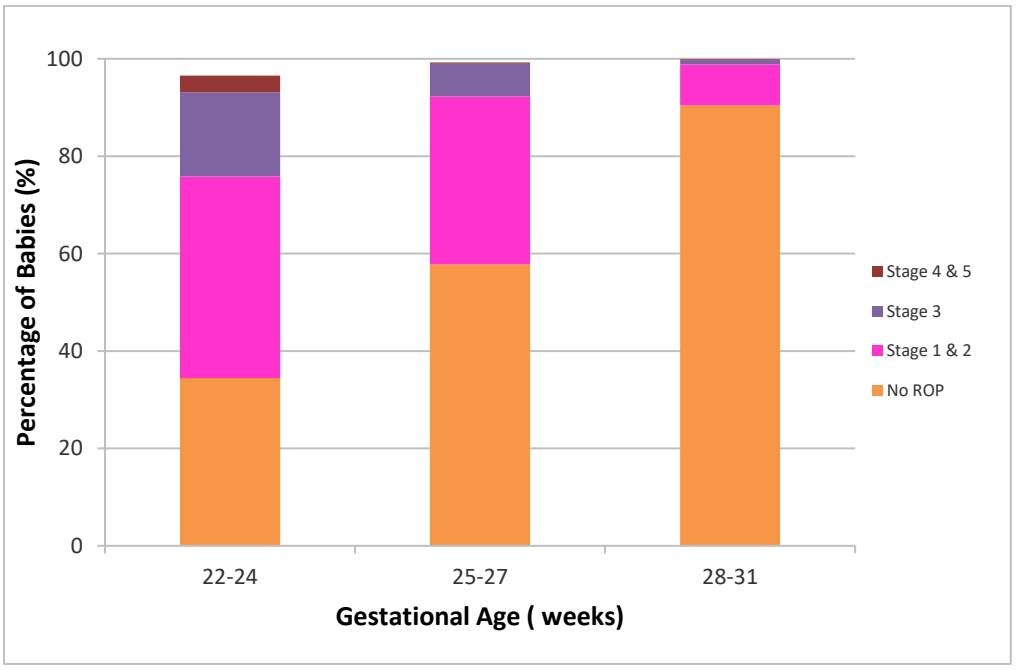


Table 11:
Incidence of retinopathy of prematurity (ROP) in admitted inborn babies in the MNNR by gestational age categories

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								Therapy	
					No ROP		ROP Stage 1 or 2		ROP Stage 3		ROP Stage 4 or 5		Laser	Anti-VEGF
	n	*n*	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%		
22-24	150	31	29	93.5	10	34.5	12	41.4	5	17.2	1	3.4	8	2
25-27	620	422	403	95.5	233	57.8	139	34.5	27	6.7	1	0.2	26	2
28-31	2388	2202	1735	78.8	1569	90.4	146	8.4	17	1.0	2	0.1	13	2
Total Included	3158	2655	2167	81.6	1812	83.6	297	13.7	49	2.3	4	0.2	47	6

Comment: Screening refers to those screened during the ward admission

Figure 12

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

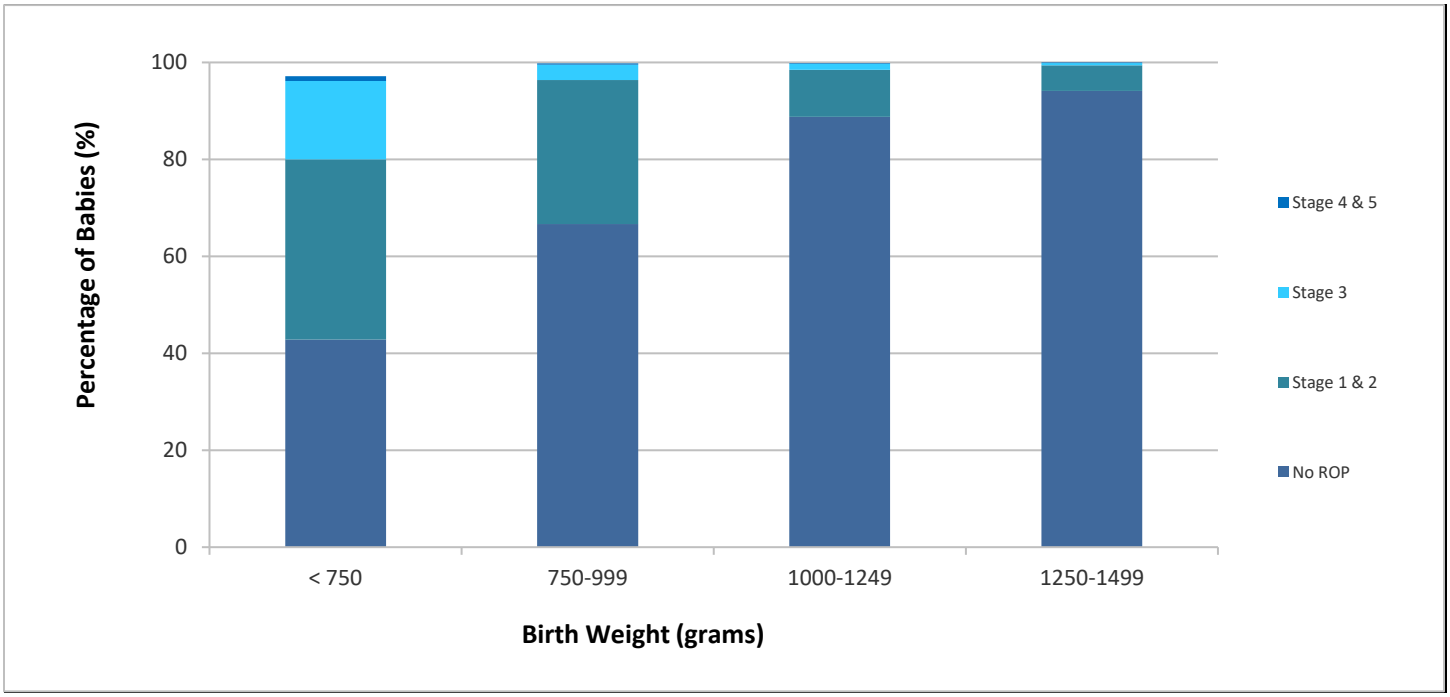


Table 12 :
Incidence of retinopathy of prematurity (ROP) in admitted inborn babies in the MNNR by birth weight categories

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								Therapy	
					No ROP		ROP Stage 1 or 2		ROP Stage 3		ROP Stage 4 or 5		Laser	Anti-VEGF
	n	*n*	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%		
< 750	318	109	105	96.3	45	42.9	39	37.1	17	16.2	1	1.0	18	3
750-999	643	496	465	93.8	310	66.7	138	29.7	15	3.2	1	0.2	15	1
1000-1249	985	884	793	89.7	704	88.8	77	9.7	10	1.3	1	0.1	9	2
1250-1499	1313	1226	886	72.3	834	94.1	47	5.3	4	0.5	1	0.1	4	0
Total included	3259	2715	2249	82.8	1893	84.2	301	13.4	46	2.0	4	0.2	46	6

Comment: Screening refers to those screened during the ward admission

INTRAVENTRICULAR HAEMORRHAGE

- A total of 3024 (95.8%) inborn babies with gestational age <32 weeks underwent cranial ultrasound examination for intraventricular haemorrhage (IVH). Among these babies, 1779 (58.8%) did not have IVH, 947 (31.3%) had grade 1 or 2 IVH, 171 (5.7%) had grade 3 IVH, and 127 (4.2%) had grade 4 IVH. The incidence rates of severe IVH (grade 3 or 4) were 28.2%, 24.7%, and 5.3% in babies with gestational age of 22-24 weeks, 25-27 weeks, and 28-31 weeks, respectively. 7 babies had ventriculo-peritoneal (VP) shunt inserted. (Figure 13 and Table 13)
- There were 3106 (95.3%) inborn babies with birth weight <1500 g who underwent cranial ultrasound examination. Among these babies, 1859 (59.9%) did not have IVH, 954 (30.7%) had grade 1 or 2, 169 (5.4%) had grade 3, and 124 (4.0%) had grade 4 IVH. The incidence rates of severe IVH (grade 3 or 4) were 24.8%, 18.7%, 8.1%, and 2.8% in babies with birth weights <750 g, 750-999 g, 1000-1249 g, and 1250-1499 g, respectively. Four babies had VP shunt inserted. (Figure 14 and Table 14)

Figure 13

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

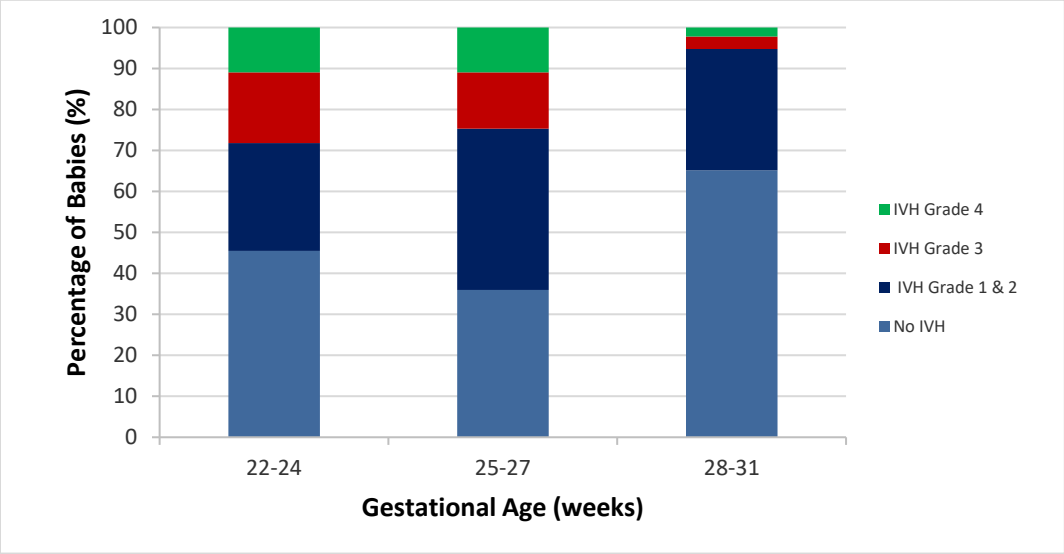


Table 13 :
Incidence of intraventricular haemorrhage (IVH) in admitted inborn babies < 32 weeks gestational age

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**	150	110	50	29	19	12
	%	4.7	73.3	45.5	26.4	17.3	10.9
25-27	**n**	620	584	210	230	80	64
	%	19.6	94.2	36.0	39.4	13.7	11.0
28-31	**N**	2388	2330	1519	688	72	51
	%	75.6	97.6	65.2	29.5	3.1	2.2
Total included	**N**	3158	3024	1779	947	171	127
	%	100	95.8	58.8	31.3	5.7	4.2
Total babies	3158						

Figure 14

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

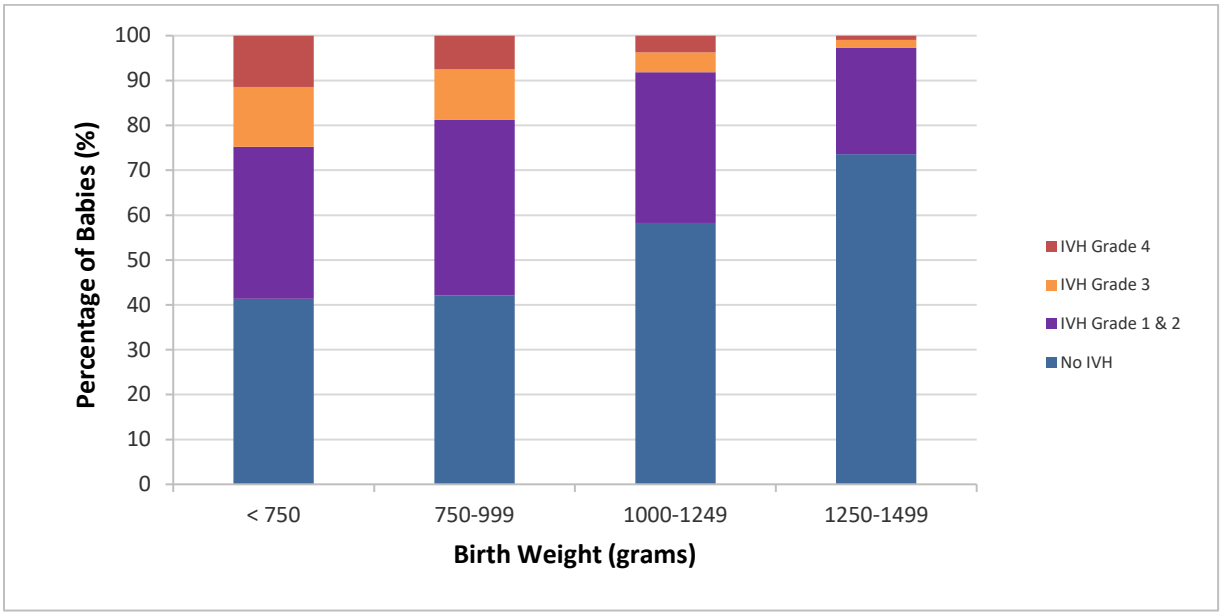


Table 14 :
Incidence of intraventricular haemorrhage (IVH) in admitted inborn babies <1500 grams birth weight

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**	318	254	105	86	34	29
	%	9.8	79.9	41.3	33.9	13.4	11.4
750-999	**n**	643	624	263	244	70	47
	%	19.7	97.0	42.1	39.1	11.2	7.5
1000-1249	**n**	985	971	566	326	43	36
	%	30.2	98.6	58.3	33.6	4.4	3.7
1250-1499	**n**	1313	1257	925	298	22	12
	%	40.3	95.7	73.6	23.7	1.8	1.0
Total included	**n**	3259	3106	1859	954	169	124
	%	100	95.3	59.9	30.7	5.4	4.0
Total babies	3259						

NECROTIZING ENTEROCOLITIS

- A total of 173 (5.5%) of the inborn babies with gestational age <32 weeks, developed necrotizing enterocolitis (NEC)(Stage 2 and above modified Bell's criteria) and 65 (37.6%) 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 3.3%, 8.9%, and 4.7%, respectively. (Figure 15 and Table 15)
- For inborn babies with birth weight <1500g, 182(5.6%) developed NEC (Stage 2 and above modified Bell's criteria) and 70 (38.5%) 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 7.5%, 10.9%, 4.4%, and 3.4%, respectively. (Figure 16 and Table 16)

Figure 15
Incidence of necrotizing enterocolitis (NEC) in admitted inborn babies according to gestational age categories

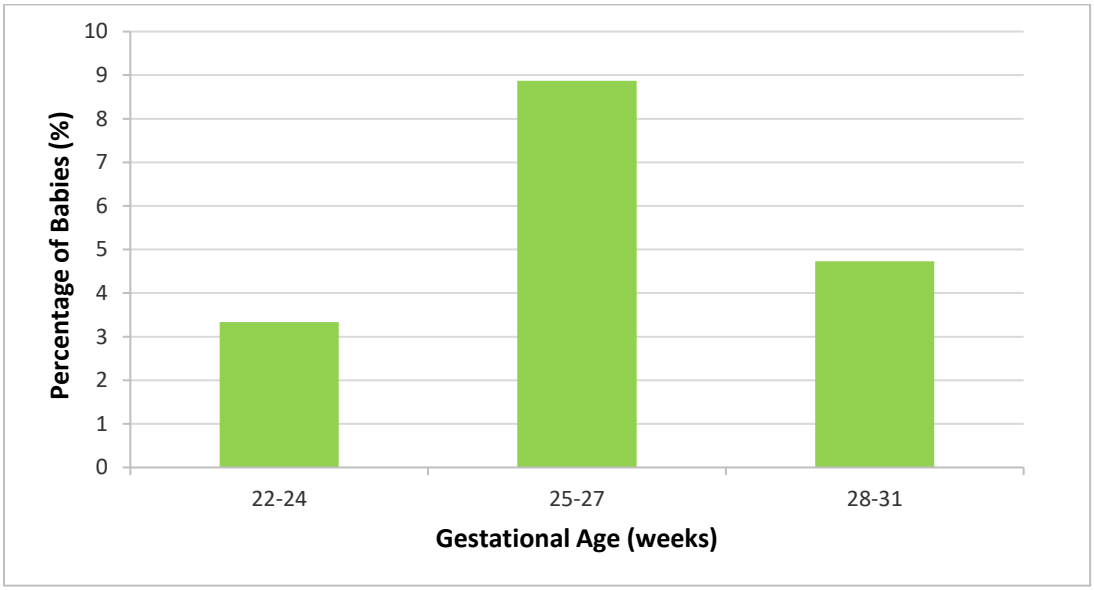


Table 15 :
Incidence and treatment of necrotizing enterocolitis (NEC) in admitted inborn babies according to gestational age categories

Gestational age (weeks)	Total number of admitted inborn babies	Babies with NEC		With Surgical treatment	
	n	*n*	*%*	*n*	*%*
22-24	150	5	3.3	4	80.0
25-27	620	55	8.9	27	49.1
28-31	2388	113	4.7	34	30.1
Total Included	3158	173	5.5	65	37.6
Total no. of missing (GA)	0				
Overall Total babies	3158				

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

Figure 16

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

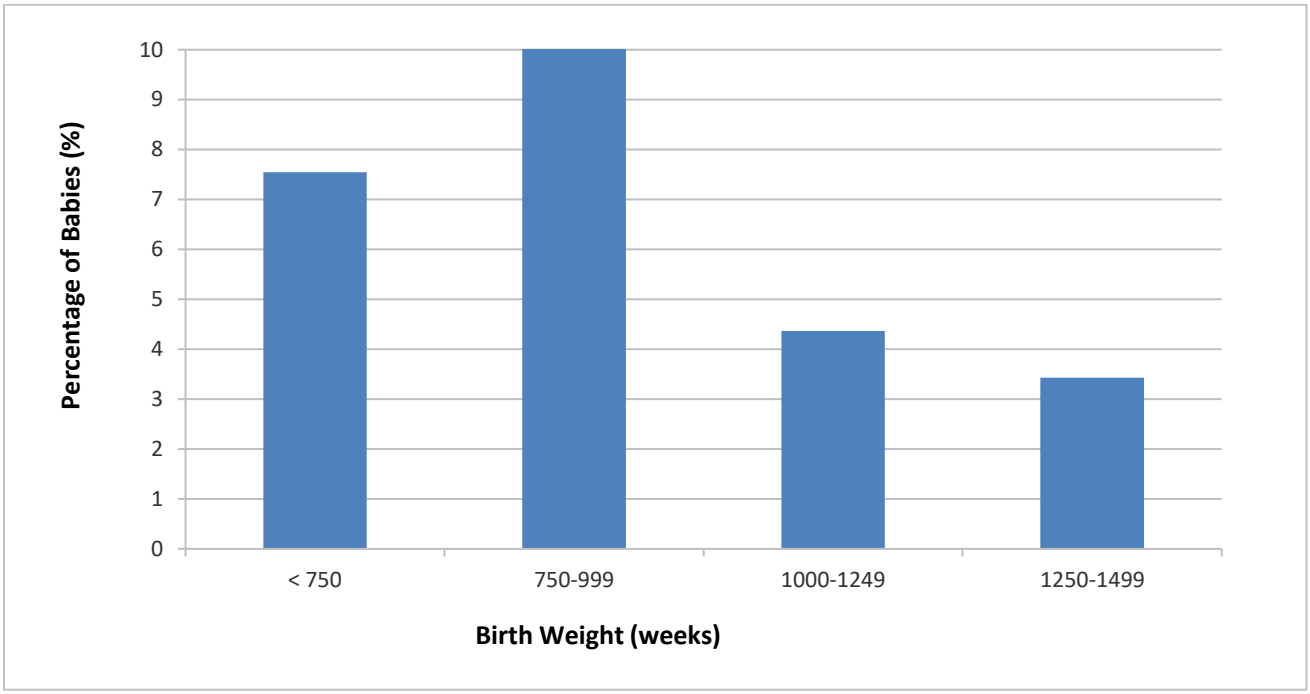


Table 16 :
Incidence and treatment of necrotizing enterocolitis (NEC) in admitted inborn babies according to birth weight categories

Birth weight (grams)	Total number admitted of inborn babies	Babies with NEC		With Surgical treatment	
	n	*n*	*%*	*n*	*%*
< 750	318	24	7.5	10	41.7
750-999	643	70	10.9	29	41.4
1000-1249	985	43	4.4	14	32.6
1250 – 1499	1313	45	3.4	17	37.8
Total included	3259	182	5.6	70	38.5
Total no. of missing (BW)	0				
Overall total babies	3259				

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 inborn babies with gestational age <32 weeks, was 1.5%. The incidence rates were 2.7%, 2.7%, and 1.1% in babies with gestational age 22-24 weeks, 25-27 weeks, and 28-31 weeks, respectively (Figure 17 and Table 17)
- 208 (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 26.0%, 15.7%, and 5.1% for babies with gestational age of 22-24 weeks, 25-27 weeks, and 28-31 weeks, respectively. (Figure 18 and Table 18)
- 224(7.7%) 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 24.1%, 12.5%, 7.5% and 3.6% for birth weight groups <750 g, 750-999 g, 1000-1249 g, and 1250-1499 g, respectively. (Figure 19 and Table 19)

Figure 17

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

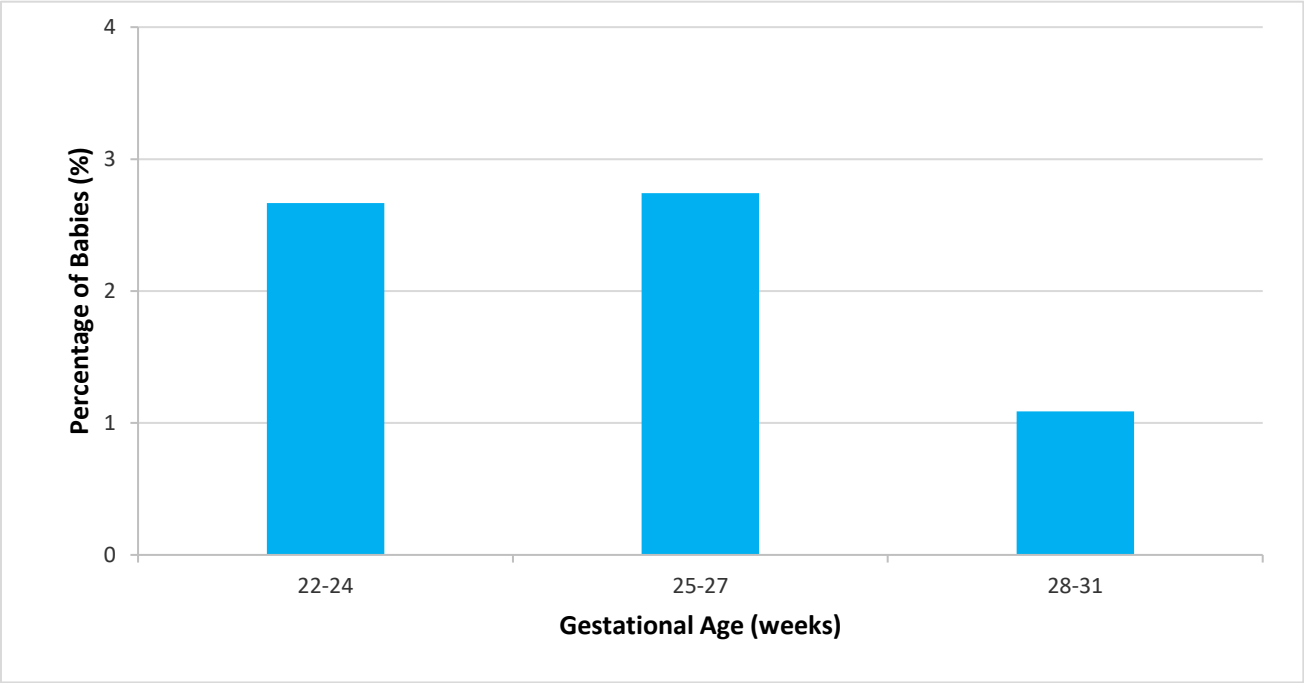


Table 17 :
Incidence of blood culture positive early onset sepsis in admitted inborn babies by gestational age categories

Gestational age at birth (completed weeks)	Total number of admitted inborn babies	No. of babies with early infection	
	n	*n*	%
22-24	150	4	2.7
25-27	620	17	2.7
28-31	2388	26	1.1
Total included	3158	47	1.5
Total no. of missing (GA)	0		
Total babies	3158		

Figure 18

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

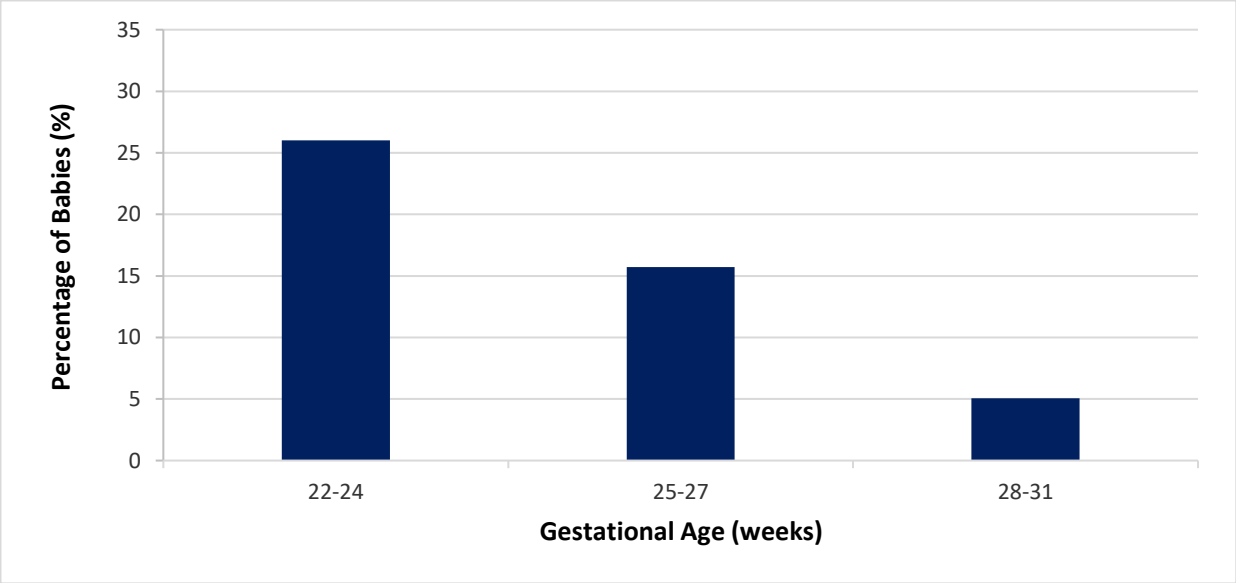


Table 18:
Incidence of blood culture positive late onset sepsis in admitted inborn babies by gestational age categories

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	150	50	13	26.0
25-27	620	509	80	15.7
28-31	2,388	2,270	115	5.1
Total included	3158	2,829	208	7.4
Total no. of missing (GA)	0			
Total babies	3158			

Figure 19

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

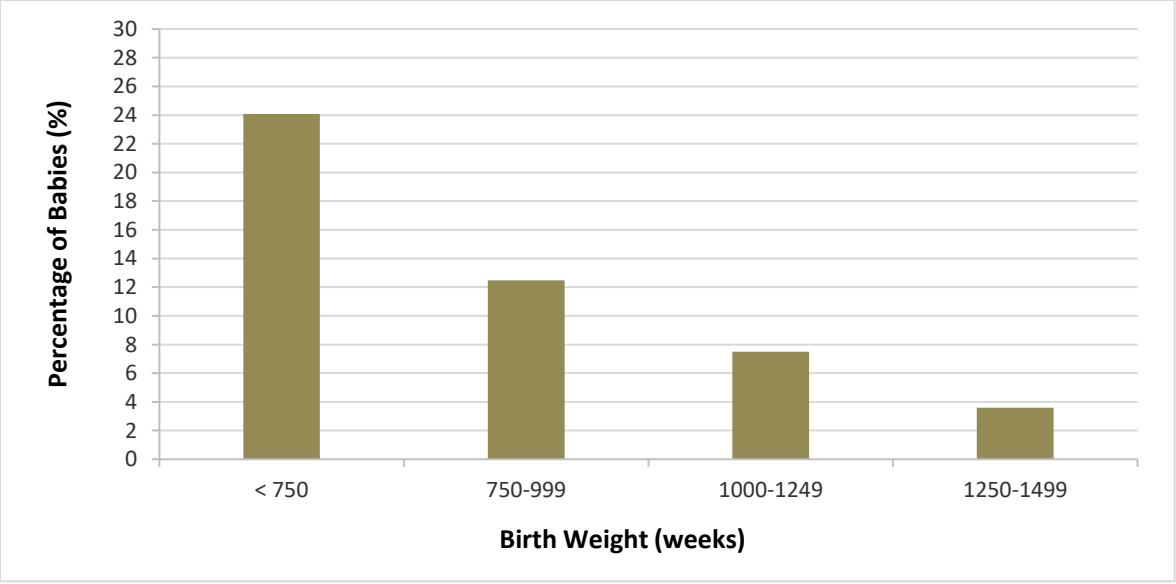


Table 19 :
Incidence of blood culture positive late onset sepsis in admitted inborn babies by birth weight categories

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	318	162	39	24.1
750-999	643	561	70	12.5
1000-1249	985	934	70	7.5
1250 - 1499	1,313	1253	45	3.6
Total included	3,259	2,910	224	7.7
Total no. of missing (BW)	0			
Overall total babies	3259			

THERAPEUTIC HYPOTHERMIA

- 948 babies born at ≥35 weeks gestational age, were diagnosed with hypoxic-ischaemic encephalopathy (HIE); 853 were inborn babies and 95 were outborn babies. Mild HIE was diagnosed in 429 babies, 350 had moderate HIE and 169 had severe HIE. 641 babies with HIE were given hypothermia therapy. Mortality rates for babies with moderate and severe HIE were 3.4% and 46.2% respectively.

SURVIVAL AND MORBIDITIES

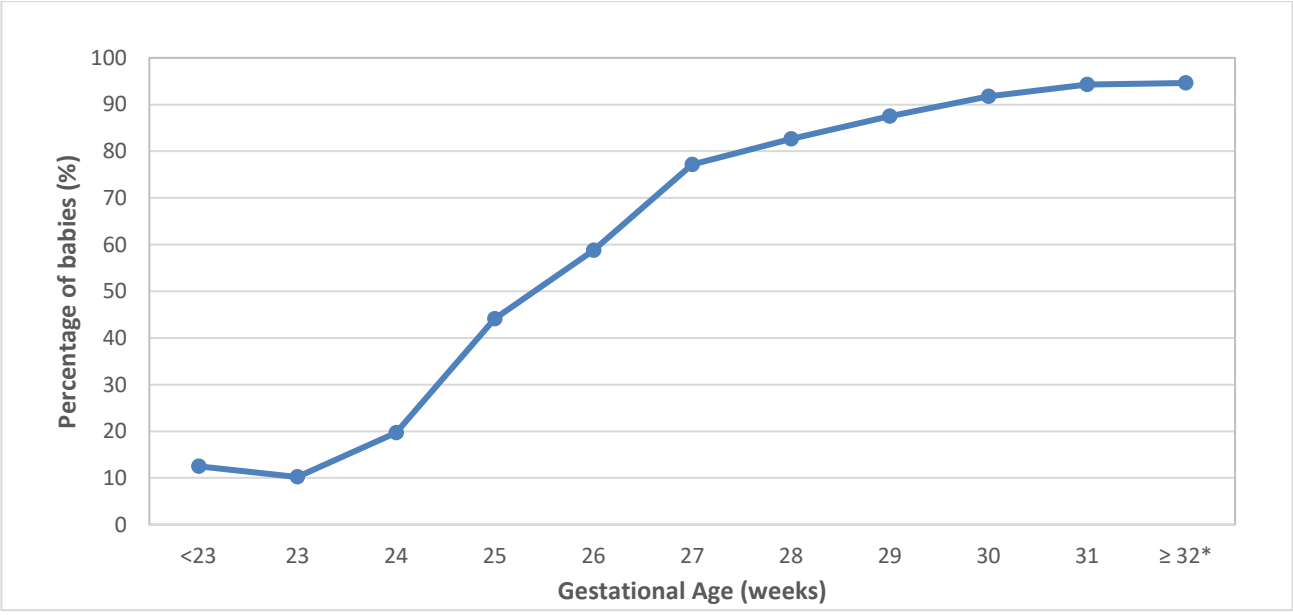
- The survival rates of very preterm babies, both inborn and outborn, included in the MNNR according to gestational age were 10.2% for 23 weeks, 19.7% for 24 weeks, 44.1% for 25 weeks, 58.8% for 26 weeks, 77.1% for 27 weeks, 82.7% for 28 weeks, 87.5% for 29 weeks, 91.7% for 30 weeks, and 94.3% for 31 weeks. (Figure 19 and Table 19)
- The survival rates of babies, according to birth weight categories, included in the MNNR were 5.3% for < 500 grams, 29.2% for 500-750 grams, 73.0% for 751-1000 grams, 88.9% for 1001-1250 grams, 93.0%% for 1251-1500 grams, 94.5% for 1501-1750 grams, 93.6% for 1751-2000 grams, 94.2% for 2001-2250 grams and 93.0% for 2251-2500 grams. (Figure 20 and Table 20). For the birth weight categories > 1500 grams, calculated survival rate does not include all live births in that category (see inclusion criteria).

- 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, 39.3% had 1 morbidity, 21.4% had 2 morbidities, 21.4% had 3 morbidities, and none had more than 3 morbidities. 17.9% did not have any of these morbidities.
- Among survivors with gestational age of 25-27 weeks, 38.3% had 1 morbidity, 14.8% had 2 morbidities, 7.2% had 3 morbidities, 1.5% had 4 morbidities, 0.5% had 5 morbidities, and none had 6 morbidities. 37.8% did not have any of these morbidities.
- Among survivors with gestational age of 28-31 weeks, 17.2% had 1 morbidity, 3.5% had 2 morbidities, 0.6% had 3 morbidities, and none had more than 3 morbidities. 78.7% did not have any of these morbidities. (Table 21a)
- Among survivors with birth weight <750 g, 34.7% had 1 morbidity, 24.5% had 2 morbidities, 16.3% had 3 morbidities, 1.0% had 4 morbidities, 1.0% had 5 morbidities, and none had 6 morbidities. 22.4% did not have any of these morbidities.
- Among survivors with birth weight 750-999 g, 39.9% had 1 morbidity, 13.0% had 2 morbidities, 4.6% had 3 morbidities, 1.1% had 4 morbidities, and none had more than 4 morbidities. 41.4% did not have any of these morbidities.
- Among survivors with birth weight 1000-1249 g, 23.1% had 1 morbidity, 4.1% had 2 morbidities, 1.0% had 3 morbidities, none had 4 morbidities, 0.1% had 5 morbidities, and none had 6 morbidities. 71.6% did not have any of these morbidities.
- Among survivors with birth weight 1250-1499 g, 11.2% had 1 morbidity, 1.6% had 2 morbidities, 0.1% had 3 morbidities, and none had more than 3 morbidities. 87.2% did not have any of these morbidities. (Table 21b)

Figure 20
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).*

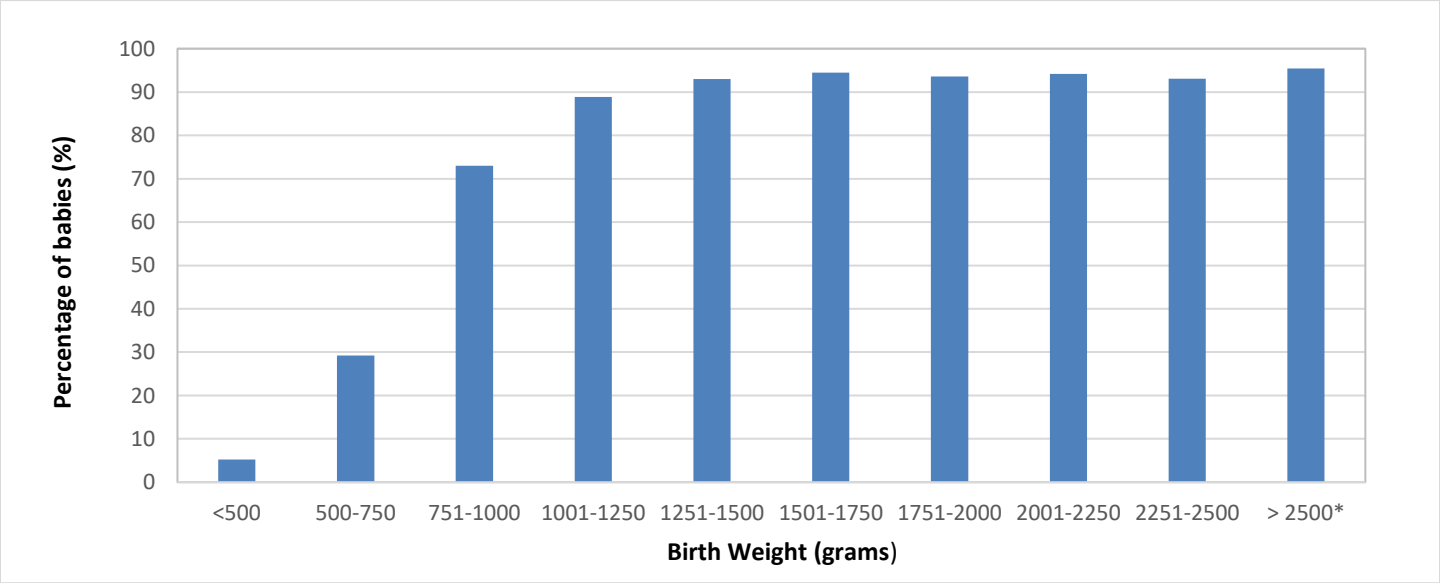
Table 20 :
Survival to discharge of all live births admitted to MNNR hospitals according to gestational age

Gestational age (completed weeks)	Total number of inborn & outborn babies	Number of survivors	% survival
<23	24	3	12.5
23	49	5	10.2
24	137	27	19.7
25	161	71	44.1
26	245	144	58.8
27	293	226	77.1
28	450	372	82.7
29	545	477	87.5
30	762	699	91.7
31	858	809	94.3
≥32*	16509	15621	94.6
Total included	20033	18454	92.1
Total no. of missing (GA)	0		
Total babies	20033		

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

Figure 21

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 21 :
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	19	1	5.3
500-750	397	116	29.2
751-1000	771	563	73.0
1001-1250	1,061	943	88.9
1251-1500	1,520	1414	93.0
1501-1750	1,550	1464	94.5
1751-2000	1,621	1517	93.6
2001-2250	1,513	1425	94.2
2251-2500	1,668	1552	93.0
> 2500*	9,913	9459	95.4
Total included	20033	18454	92.1
Total no. of missing (BW)	0		
Overall Total babies	20033		

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

Table 22a:
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** **%**	150 4.7	28 18.7	11 39.3	6 21.4	6 21.4	0 0.0	0 0.0	0 0.0	5 17.9
25-27	**n** **%**	620 19.6	405 65.3	155 38.3	60 14.8	29 7.2	6 1.5	2 0.5	0 0.0	153 37.8
28-31	**n** **%**	2388 75.6	2176 91.1	374 17.2	76 3.5	13 0.6	0 0.0	0 0.0	0 0.0	1713 78.7
Total babies <32 weeks included	**N** **%**	3158 100.0	2609 82.6	540 20.7	142 5.4	48 1.8	6 0.2	2 0.1	0 0.0	1871 71.7

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 22b:
Birth weight specific survival with significant morbidity(ies) in admitted inborn babies

Birth weight		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
(grams)		N %	n %	n %	n %	n %	n %	n %	n %	n %
< 750	**n** **%**	318 9.8	98 30.8	34 34.7	24 24.5	16 16.3	1 1.0	1 1.0	0 0.0	22 22.4
750-999	**n** **%**	643 19.7	476 74.0	190 39.9	62 13.0	22 4.6	5 1.1	0 0.0	0 0.0	197 41.4
1000-1249	**n** **%**	985 30.2	870 88.3	201 23.1	36 4.1	9 1.0	0 0.0	1 0.1	0 0.0	623 71.6
1250-1499	**n** **%**	1313 40.3	1224 93.2	137 11.2	19 1.6	1 0.1	0 0.0	0 0.0	0 0.0	1067 87.2
Total babies < 1500 grams included	**N** **%**	3259 100.0	2668 81.9	562 21.1	141 5.3	48 1.8	6 0.2	2 0.1	0 0.0	1909 71.6

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

APPENDICES

Appendix 1 Level of Neonatal Care

(Adapted from Committee on Foetus and Newborn, Levels of Neonatal Care, Paediatrics, Vol. 114 no. 5, November 2004, p.1345)

Level I Neonatal Care (Basic), well- newborn nursery: has the capability to:

- Provide neonatal resuscitation at every delivery
- Evaluate and provide postnatal care to healthy newborn infants
- Stabilise and provide care for infants born at 35 to 37 weeks gestation who remain physiologically stable
- Stabilise newborn infants who are ill and those born at <35 weeks gestation, until transfer to a hospital that can provide the appropriate level of neonatal care

Level II Neonatal Care (Specialty), Special care nursery: Level II units are subdivided into two categories on the basis of their ability to provide assisted ventilation including continuous positive airway pressure

1. ***Level II A*** *has the capability to:*

- Resuscitate and stabilise preterm and/or ill infants before transfer to a facility at which newborn intensive care is provided
- Provide care for infants born at >32 weeks gestation and weighing ≥1500 g (1) who have physiologic(al) immaturity such as apnoea of prematurity, inability to maintain body temperature, or inability to take oral feeding or (2) who are moderately ill with problems that are anticipated to resolve rapidly and are not anticipated to need subspecialty service on an urgent basis
- Provide Care for infants who are convalescing after intensive care

2. ***Level II B*** *has the capabilities* of a Level IIA nursery and the additional capability to provide mechanical ventilation for brief durations (<24 hours) or continuous positive airway pressure

Level III (Subspecialty) Neonatal Intensive Care Unit (NICU): Level III units subdivided into three categories:

1. ***Level III A NICU*** has the capability to

- Provide comprehensive care for infants born at >28 weeks gestation and weighing >1000 g
- Provide sustained life support limited to conventional mechanical ventilation
- Perform minor surgical procedures such as placement of central venous catheters or inguinal hernia repair

2. ***Level III B NICU*** has the capability to provide

- Comprehensive care for extremely low birth weight infants (≤1000 g and ≤28 weeks gestation)
- Advanced respiratory support such as high-frequency ventilation and inhaled nitric oxide
- Prompt and on-site access to a full range of paediatric medical subspecialties
- Advanced imaging, with interpretation on an urgent basis, including computed tomography, magnetic resonance imaging, and echocardiography Paediatric surgical specialists and paediatric anaesthesiologists on- site or at a closely related institution to perform major surgeries such as ligation of patent ductus arteriosus and repair of abdominal wall defects, necrotising enterocolitis with bowel perforation, trachea-oesophageal fistula and/or oesophageal atresia and myelomeningocele

3. ***Level III C NICU*** has the capabilities of a Level III B NICU and which is located within an institution that has the capability to provide extracorporeal membrane oxygenation (ECMO) and surgical repair of complex congenital cardiac malformation that requires cardiopulmonary bypass.

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 < 1000 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. For babies ≥ 32 weeks - state if O_2 / any form of CPAP or ventilatory support required at Day 56.	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.
Cardiovascular a. Persistent Pulmonary Hypertension (PPHN)	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

b. Heart failure	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) 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	If ultrasound of brain done, enter the worst grade: **Grade 1:** Subependymal germinal matrix (GM) haemorrhage only **Grade 2:** IVH without ventricular dilation **Grade 3:** IVH with ventricular dilation **Grade 4:** IVH with parenchymal involvement

Tick "Ultrasound not done" if it was not done.	
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 • Klebsiella • Pseudomonas • Acinetobacter • Fungal (see definition) • Others, specify • ESBL organisms	***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 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	*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)

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	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)

Malaysian National Neonatal Registry

Unit 2.4 (Suite 3), Enterprise 3B,
Technology Park Malaysia,
Lebuhraya Puchong -Sg. Besi
57000 Bukit Jalil,
Kuala Lumpur

Tel/Fax: 03-89964505

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
Malay				
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 2020)

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

Admitted to neonatal ward: ◯ Yes → (Proceed to complete ALL sections in this CRF) ◯ No → (Proceed to complete Section 1, 2 [without No.31c], 4[No.48 only] and 5)

☐ Abandoned baby → (if this box is ticked, item No. 1, No. 4a, No. 6 to No.21 are not mandatory)

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

SECTION 1 : PATIENT PARTICULARS & MATERNAL HISTORY

* **1. Name of mother:**	
2. Name of baby (Optional):	
* **3. RN of baby:**	
* **4a. 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:.....
4b. Baby's MyKid number:	☐☐☐☐☐☐ – ☐☐ – ☐☐☐☐
* **5a. Date of birth of baby:** (dd/mm/yy)	☐☐ / ☐☐ / ☐☐☐☐ **5b. Time of birth**: (24 hour format. Enter the best estimated time of birth if the exact time unknown) ☐☐☐☐
* **6. Ethnic group of Mother:**	◯ Malay ◯ Indian ◯ Bumiputra Sabah, specify:..... ◯ Other, Malaysian ◯ Chinese ◯ Orang Asli ◯ Bumiputra Sarawak, specify:..... ◯ Non-citizen, specify country.....
* **7. Maternal age:**	☐☐

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

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

SECTION 2 : BIRTH HISTORY

* **19. Antenatal steroid:**	◯ Yes → ◯ 1 dose ◯ 2 doses ◯ No ◯ Unknown
* **20. Antenatal magnesium sulphate:**	◯ Yes ◯ No ◯ Unknown
* **21. Intrapartum antibiotic:**	◯ Yes ◯ No ◯ Unknown
* **22. Birth weight:**	☐☐☐☐ (gram)
* **23. Gestation:**	☐☐ (weeks)
* **24. Growth status:**	◯ SGA ◯ AGA ◯ LGA
* **25. Gender:**	◯ Male ◯ Female ◯ Ambiguous / Indeterminate
* **26. 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
* **27. Multiplicity:**	◯ Singleton ◯ Twin ◯ Triplet ◯ Other, specify:..... Specify birth order if not a singleton: ☐☐
* **28. Final Mode of delivery:**	◯ Vaginal delivery → ◯ SVD ◯ Breech ◯ Instrumental → ☐ Vacuum ☐ Forceps ◯ Caesarean section → ◯ Elective ◯ Emergency ◯ Others, specify:..... ◯ Unknown

SECTION 2 : BIRTH HISTORY (continue)

* 29. 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
* 30. 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
* 31. 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)		☐☐ . ☐ (ºC)			

SECTION 3: NEONATAL EVENT

* 32. 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		
* 33. Surfactant:	○ Yes →	○ < 1 hr ○ 1-2 hrs ○ > 2 hrs	
	○ No		
* 34. Parenteral nutrition:	○ Yes ○ No		

SECTION 4: PROBLEMS/ DIAGNOSES

* 35. Respiratory:	☐ Meconium aspiration syndrome ☐ Pulmonary haemorrhage ☐ Congenital pneumonia ☐ Community acquired pneumonia ☐ Transient tachypnoea of newborn ☐ Pulmonary interstitial emphysema ☐ Nosocomial pneumonia	
* 36. RDS:	○ Yes ○ No	
* 37. Pneumothorax:	○ Yes → ○ No	Pneumothorax developed during: ○ Spontaneous ○ CPAP ○ CMV ○ HFV
* 38. 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
* 39. CVS :	*39a. PPHN : ○ Yes ○ No	*39b. Heart Failure : ○ Yes ○ No
* 40. PDA: (Only for < 37 weeks GA)	○ Yes → ○ No	a) ECHO done: ○ Yes ○ No
		b) Pharmacological closure: ○ Yes ○ No → If Yes then to choose ☐ Indomethacin ☐ Ibuprofen ☐ Paracetamol
		c) Ligation: ○ Yes ○ No
* 41. NEC (stage 2 and above):	○ Yes → ○ No	a) surgical treatment: ○ Yes ○ No
		b) NEC present before admission to your centre: (for outborn baby only) ○ Yes ○ No
* 42. 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)

*** 43a. 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

*** 43b. Cystic Periventricular Leukomalacia**

○ Yes ○ No

*** 44a. 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 (autocalculate) : _____days

*** 44b. CLABSI**

○ Yes ○ No

*** 45. 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:……

*** 46. 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:……	

*** 47. 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

*** 48. Congenital anomalies:**

*** 48a. Major congenital anomalies :**

○ Yes ○ No

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

***48b. 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)

*** 48c.** ☐ 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

***49a. Date of discharge / transfer / death:** (dd/mm/yy)	☐☐/☐☐/☐☐	**49b. Time of Death:** (24 hour format) (mandatory for death cases) ☐☐☐☐ (enter the best estimated time of death if the exact time is unknown)
*** 50. Weight and growth status on discharge:** — **a) Weight:**	☐☐☐☐ (grams)	
b) Growth status:	○ SGA ○ AGA ○ LGA	
*** 51. Total duration of hospital stay (neonatal/ paeds care):**	☐☐☐ (in completed days) (auto calculate)	
*** 52. Home oxygen therapy:**	○ Yes ○ No	
*** 53. 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 ○ Other, specify: …… ○ Lack of NICU bed ○ 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: /
2. Name:		**3. RN:**		Centre:
4. Mother's I/C Number:	**New IC:**		**Passport:**	

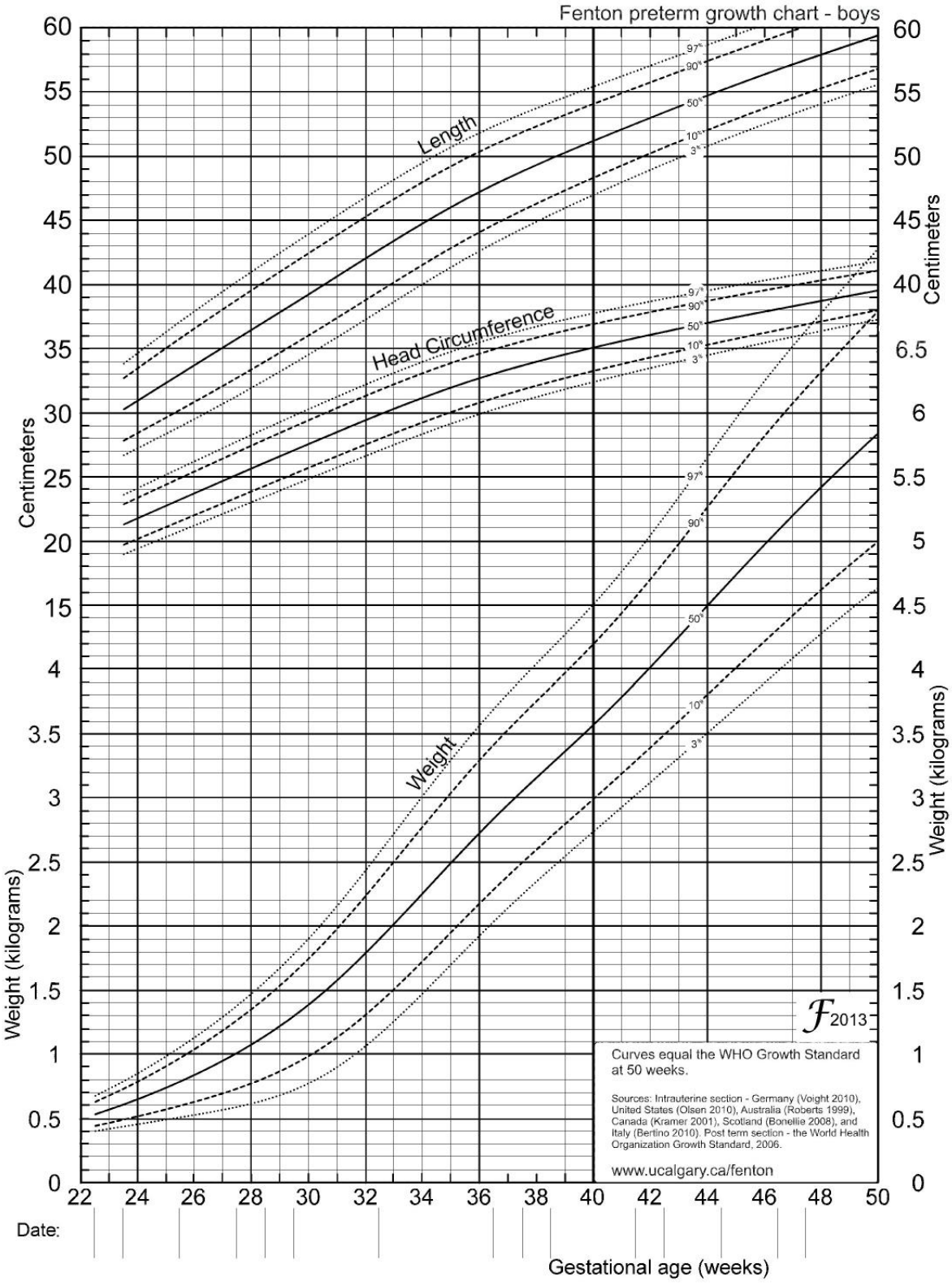
Immediate cause of death (Modified Wigglesworth): Tick relevant button to reach correct classification

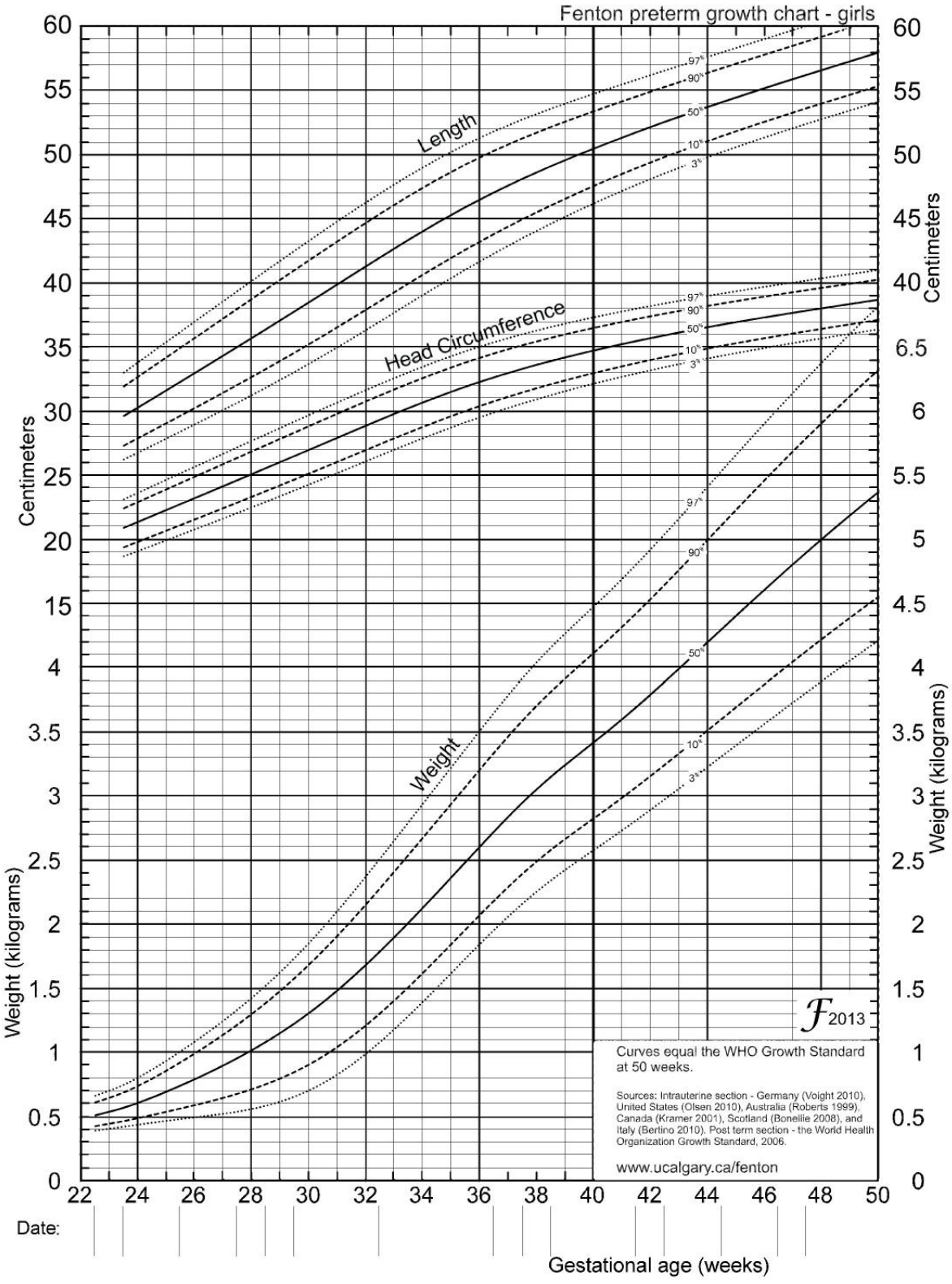
NEONATAL DEATH
(Is there any LCM?)

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
      - ○ Hydrancephaly
      - ○ 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
97th
90th
50th
10th
3rd
Centimeters
Weight (kilograms)
Date:
Gestational age (weeks)
Curves equal the WHO Growth Standard at 50 weeks.
Sources: Intrauterine section - Germany (Voight 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
F2013


Fenton preterm growth chart - girls
Length
Head Circumference
Weight
97%
90%
50%
10%
3%
Centimeters
Weight (kilograms)
Date:
Gestational age (weeks)
Curves equal the WHO Growth Standard at 50 weeks.
Sources: Intrauterine section - Germany (Voight 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
F2013

Appendix 5 Presentations

POSTER, ABSTRACT AND PAPER PRESENTIONS

1. Neoh SH. *Survival of VLBW neonates.* Presented at the MNNR Online Seminar, January 2022
2. Boo NY. *HIE 2020.* Presented at the MNNR Online Seminar, January 2022
3. Chee SC. *NEC in VLBW neonates.* Presented at the MNNR Online Seminar, January 2022
4. Farah Inaz. *MAS.* Presented at the MNNR Online Seminar, January 2022
5. Wong AC. *Admission hypothermia in VLBW neonates.* Presented at the MNNR Online Seminar, January 2022
6. Pauline Choo. *Retinopathy of Prematurity*. Presented at the MNNR Online Seminar, January 2022
7. Ang EL. *Intraventricular haemorrhage*. Presented at the MNNR Online Seminar, January 2022
8. Azanna AH. *BPD 2020*. Presented at the MNNR Online Seminar, January 2022
9. Eric Ang BK. *Central line associated blood stream infection.* Presented at the MNNR Online Seminar, January 2022