Te māuiui roro i ngā pēpi whānau hou | Neonatal encephalopathy

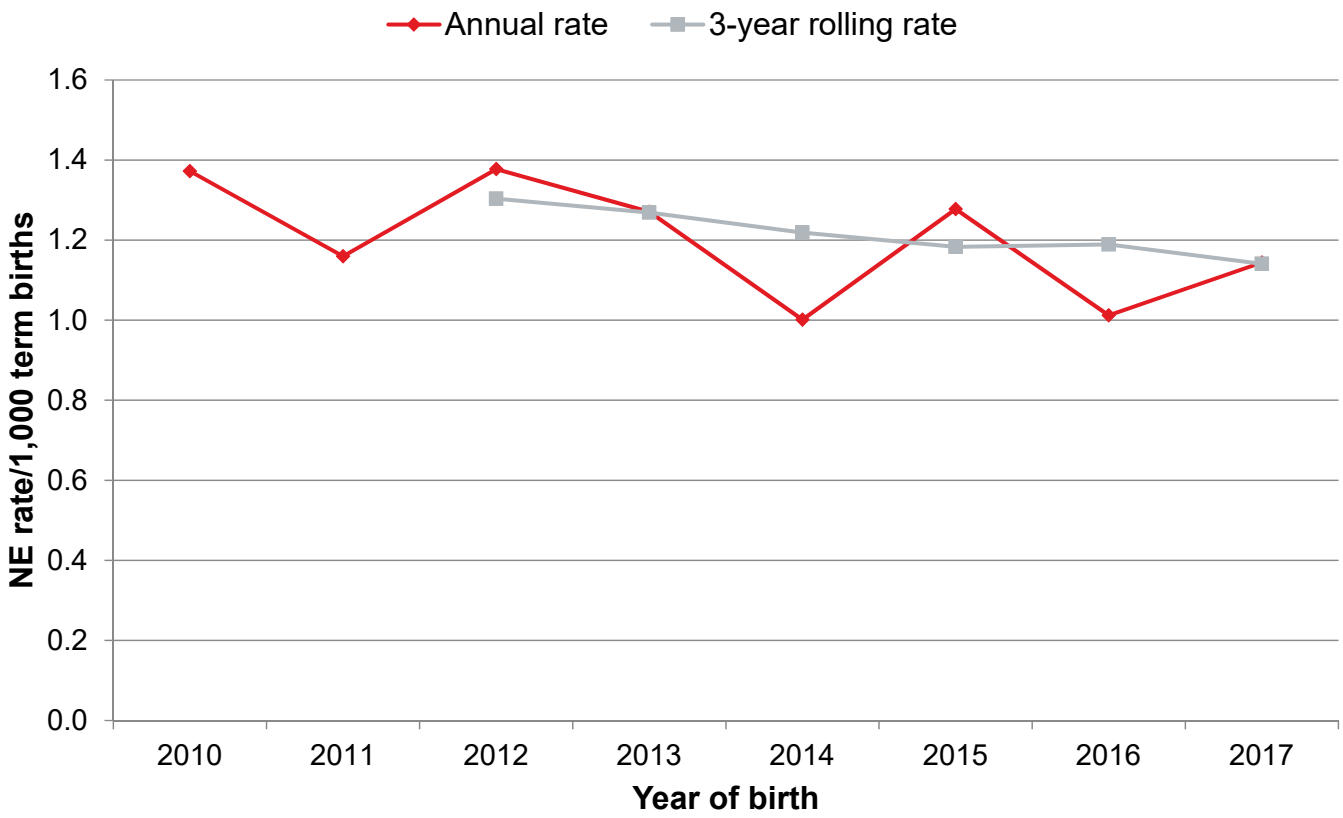
Introduction

Neonatal encephalopathy (NE) is a clinically defined syndrome of disturbed neurological function within the first week after birth in an infant born from 35 weeks' gestation, manifested by difficulty in initiating and maintaining respiration, depression of tone and reflexes, subnormal level of consciousness and often seizures. The severity of the encephalopathy is measured by the Sarnat stages 1, 2, or 3 or as mild, moderate or severe.[1]

The PMMRC collects data on babies who present with moderate or severe NE in the first seven days after birth. Data have been collected on NE babies from 37 weeks onwards since 2010. In 2016, the PMMRC started collecting data on babies from 35 weeks' gestation. Due to the small number of cases in 35–36 weeks' gestation babies collected to date, only data relating to babies born at 37 weeks or later are presented in this chapter. There are about 65 babies each year with moderate to severe NE in Aotearoa/New Zealand who are reported to the PMMRC.

There are a number of risk factors for NE as identified in the peer reviewed literature. These include antenatal risk factors, such as maternal diabetes, obesity, thyroid dysfunction, pre-eclampsia and previous caesarean section, evidence of fetal growth restriction, abnormal amniotic fluid volume and abnormal fetal heart tracing before labour. Intrapartum risk factors include clinical chorioamnionitis and ominous fetal heart tracing,[2] cord prolapse, placental abruption and uterine rupture.[3]

Figure 4.1: NE annual and three-year rolling rates (per 1,000 term births) 2010–2017



Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

[1] Nelson KB, Leviton A. 1991. How much of neonatal encephalopathy is due to birth asphyxia? *American Journal of Diseases of Children* 145(11): 1325–31.

[2] Locatelli A, Incerti M, Paterlini G, et al. 2010. Antepartum and intrapartum risk factors for neonatal encephalopathy at term. *American Journal of Perinatology* 27(8): 649–54.

[3] Martinez-Biarge M, Madero R, González A, et al. 2012. Perinatal morbidity and risk of hypoxic-ischemic encephalopathy associated with intrapartum sentinel events. *American Journal of Obstetrics & Gynecology* 206: 148.e1–7.

Extracted from the full report at: www.hqsc.govt.nz/our-programmes/mrc/pmmrc/publications-and-resources/publication/3832

International comparisons

It is frequently difficult to compare NE rates with other countries, due to differences in definitions of terms, inclusion and exclusion criteria, and data quality issues. A previous meta-analysis estimated the NE incidence in high-income regions to be 1.6 per 1,000 live births.[4] The New Zealand rate of 1.2 per 1,000 live births over the period 2010–2017 is therefore similar to other comparable countries.

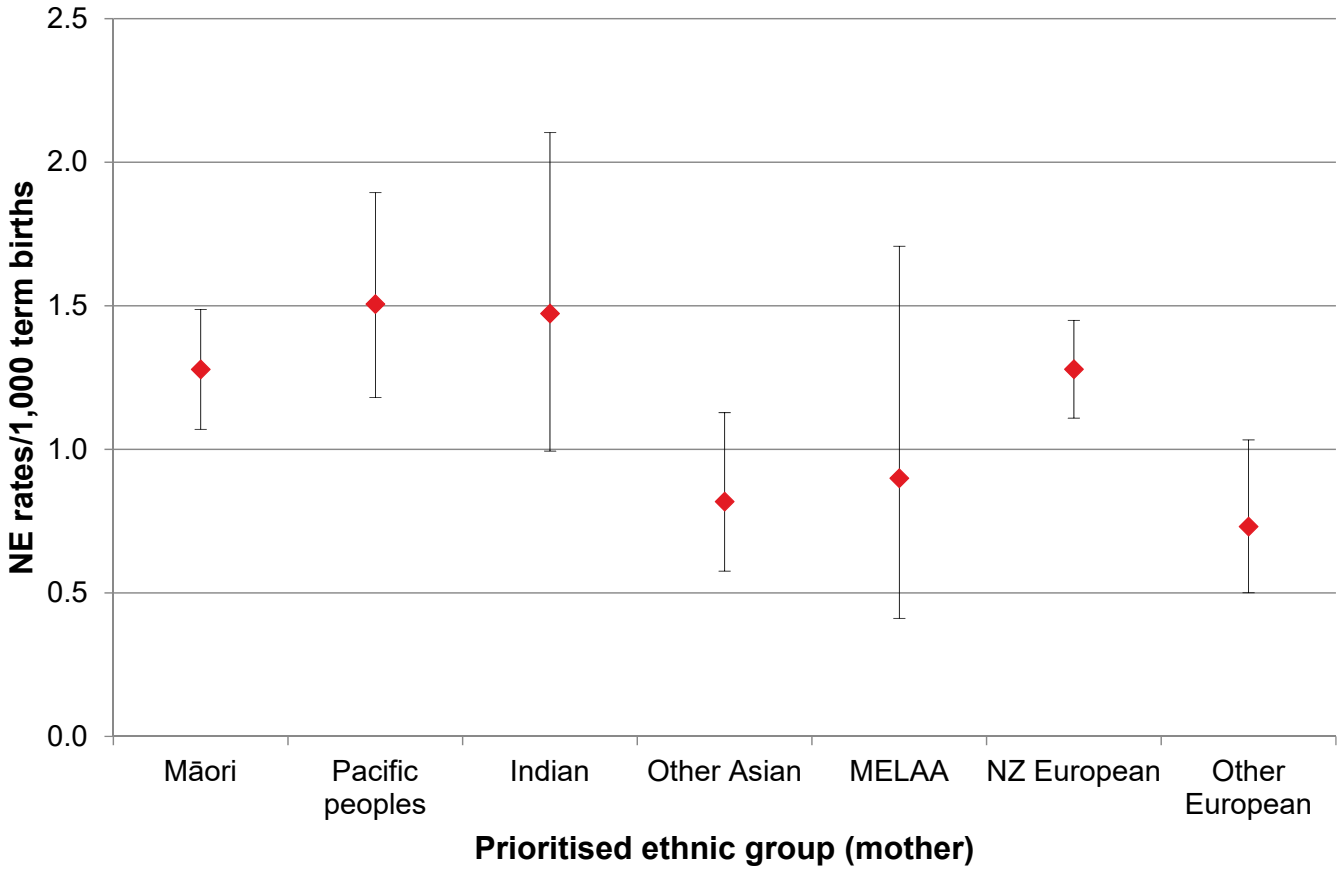
The rate of NE cases per 1,000 term births fluctuated from year to year, with a high of 1.38 per 1,000 live births in 2012 and a low of 1.00 in 2014. However, between the years 2010 and 2017, the rate has not shown a statistically significant trend up or down (chi-squared test for trend=2.41, p=0.12) (Figure 4.1). Over the past eight years there has been an average of 65–70 cases per year (Table 4.1).

There was some variation in rates of NE by maternal prioritised ethnic group, with 'Other European' and 'Other Asian' mothers having the lowest rates (Figure 4.2 and Table 4.11).

Findings

NE rates varied substantially by NZDep2013 quintile. Babies whose mothers lived in quintiles 2 to 5 were statistically significantly more likely to develop NE than those living in quintile 1 (Figure 4.3 and Table 4.11).[5]

Figure 4.2: NE rates (per 1,000 term births) by maternal prioritised ethnic group (with 95% CIs) 2010–2017



MELAA = Middle Eastern, Latin American, or African.

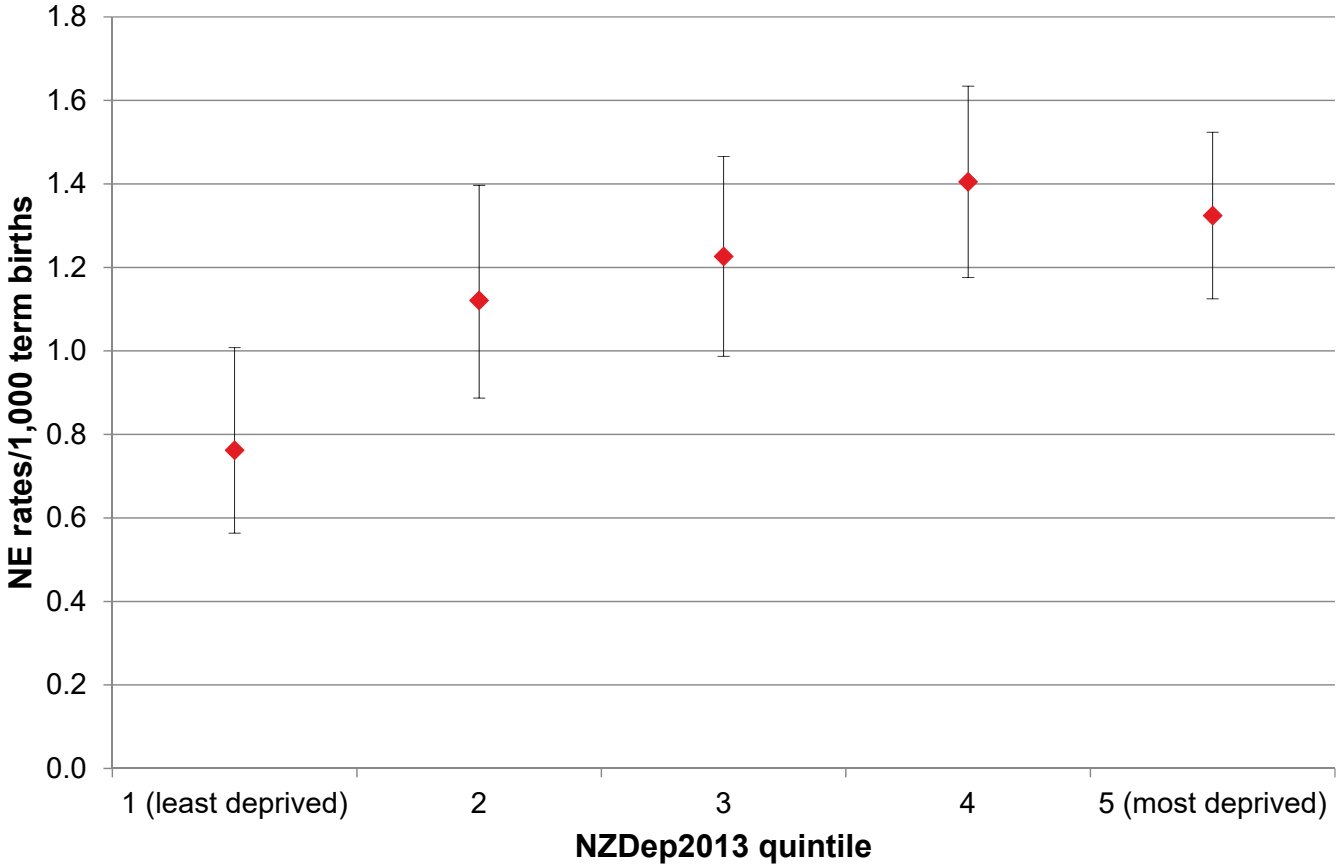
Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

[4] Lee ACC, Kozuki N, Blencowe H, et al, 2013. Intrapartum-related neonatal encephalopathy incidence and impairment at regional and global levels for 2010 with trends from 1990. *Pediatric Research* 74(a1): 50–72.

[5] The rate ratio comparing quintile 2 with quintile 1 was 1.47, 95% CI 1.03–2.10. For quintile 3 compared with quintile 1 the rate ratio was 1.61, 95% CI 1.14–2.26.

Extracted from the full report at: www.hqsc.govt.nz/our-programmes/mrc/pmmrc/publications-and-resources/publication/3832

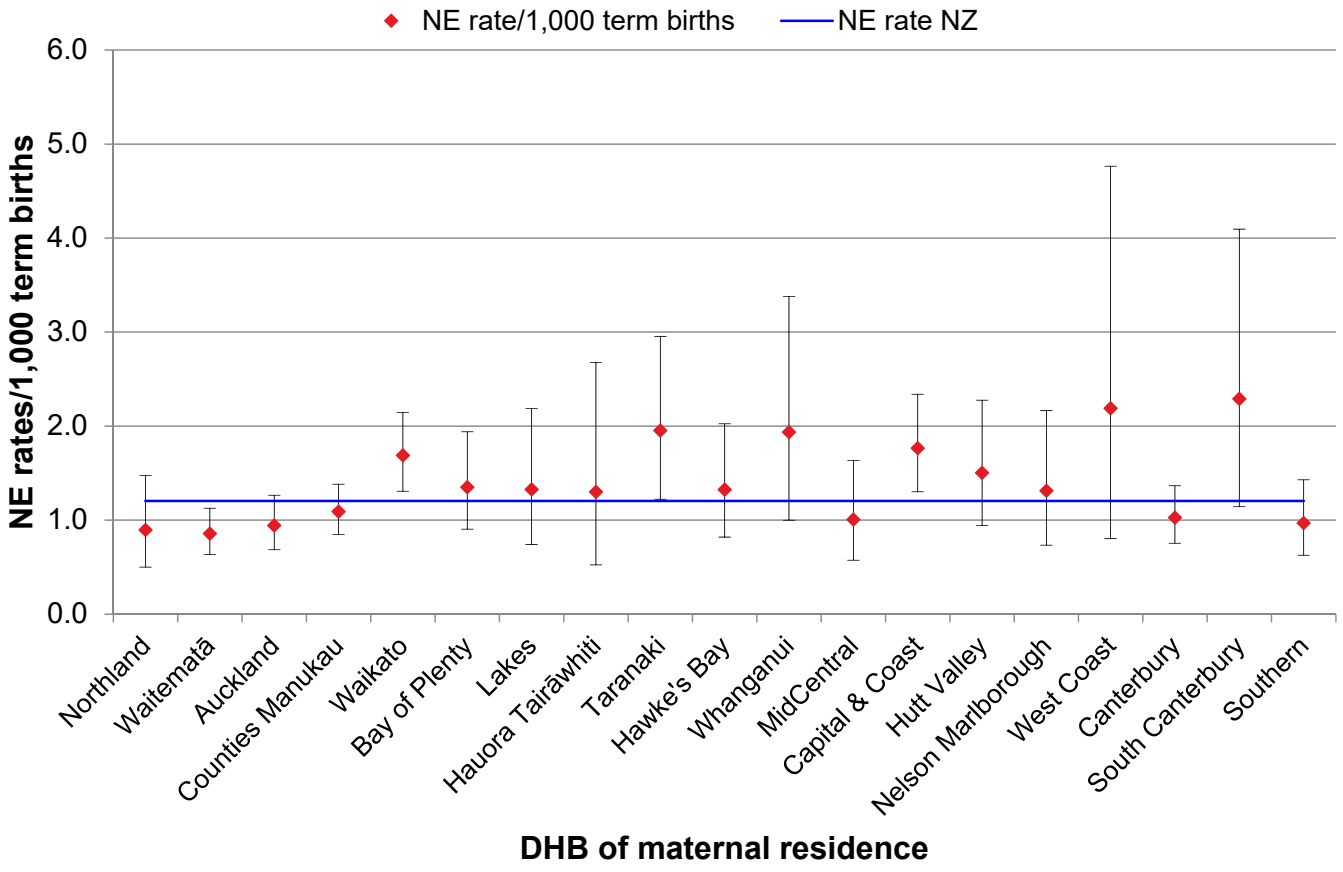
Figure 4.3: NE rates (per 1,000 term births) by NZDep2013 quintile (with 95% CIs) 2010–2017



Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

There was also considerable variation in NE rates by DHB of residence. The rates in most DHBs were not statistically significantly different to the national rate of 1.20 per 1,000 term births. However, over the eight-year reporting period 2010–2017, Waitematā DHB had a rate lower than the national average. Capital & Coast, Waikato and Taranaki DHBs all had rates that were higher than the national average (Figure 4.4 and Table 4.12). Due to the statistically low frequency of cases, it was not possible to determine if there are any trends of an increase or decrease in rates for individual DHBs.

Figure 4.4: NE rates (per 1,000 term births) by DHB of maternal residence* (compared with New Zealand NE rate) (with 95% CIs) 2010–2017



* Excludes Wairarapa DHB, which had fewer than three cases.

Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

Rates of NE varied by gestational age, with higher rates in those at 37 weeks' gestation, and at ≥41 weeks. This is probably due to a number of different factors, and further case review will be required to analyse this in detail. There were no statistically significant differences by infant sex. Babies with lower birthweight had higher rates of NE, with those under 2,500g having the highest rate. While small in number, babies who were multiples were at higher risk than singletons (Table 4.1). Most of the twins who developed NE born from 37 weeks onwards were dichorionic diamniotic, with 75% being delivered by caesarean section. About half of the babies were the second twin to be delivered. Of the second twins who developed NE, most were delivered by caesarean section after a normal vaginal delivery with the first twin (data not shown).

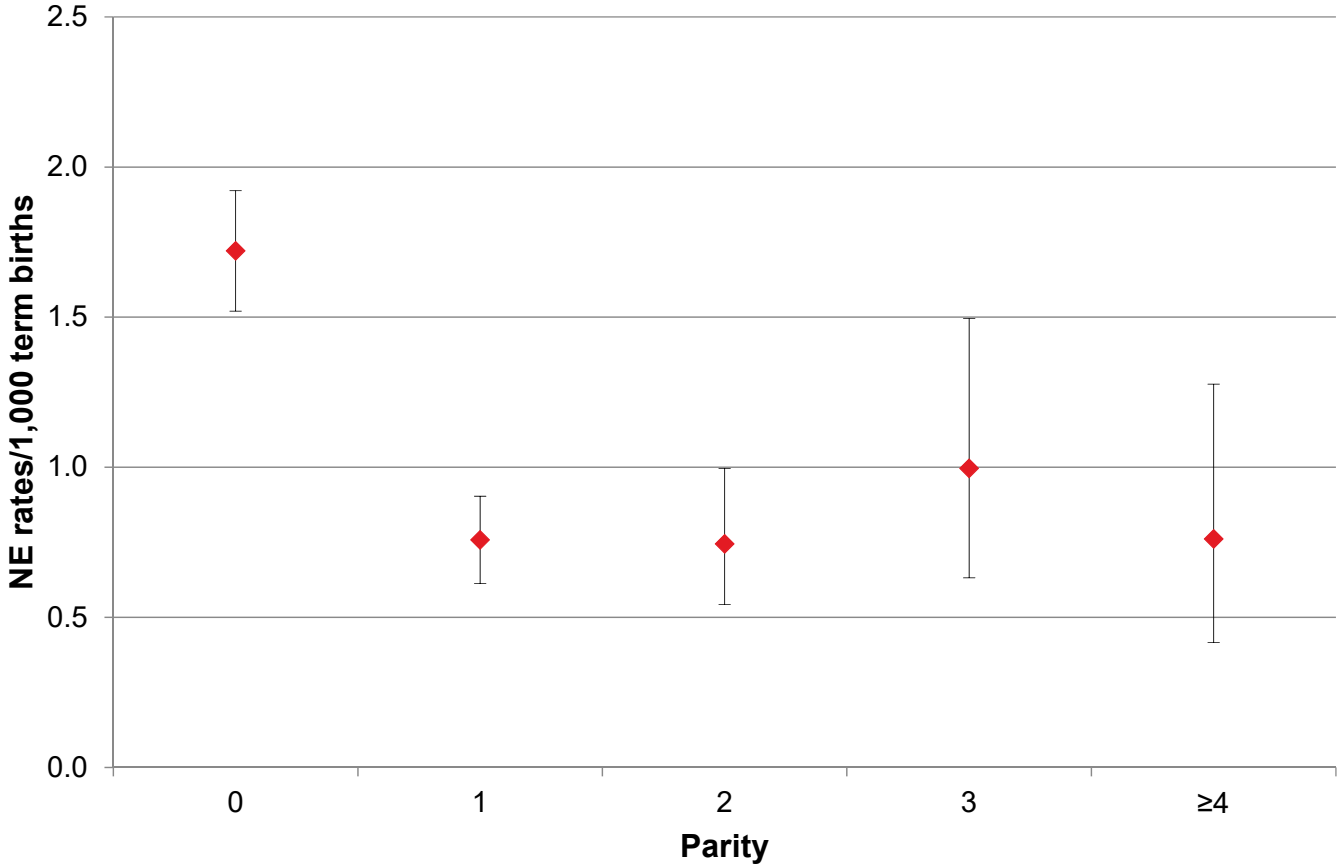
Table 4.1: NE rates (per 1,000 term births) by gestation, sex, birthweight, and plurality 2010–2017

	MAT births ≥37 weeks		NE babies		Rate (/1,000 term births)	
	N=450,097		n=542			
	n	%	n	%	/1,000	95% CI
Gestation at birth (weeks)						
37	31,286	7.0	61	11.3	1.95	1.49–2.50
38	78,754	17.5	83	15.3	1.05	0.84–1.31
39	129,059	28.7	123	22.7	0.95	0.78–1.12
40	133,521	29.7	138	25.5	1.03	0.86–1.21
41	67,704	15.0	122	22.5	1.80	1.48–2.12
≥42	9,773	2.2	15	2.8	1.53	0.86–2.53
Sex						
Male	230,113	51.1	292	53.9	1.27	1.12–1.41
Female	219,964	48.9	250	46.1	1.14	1.00–1.28
Undetermined/unknown	20	0.0	-	-	-	-
Birthweight (g)						
<2,500	8,267	1.8	23	4.2	2.78	1.76–4.17
2,500–3,999	354,814	78.8	451	83.2	1.27	1.15–1.39
4,000–4,499	55,660	12.4	50	9.2	0.90	0.67–1.18
≥4,500	11,272	2.5	18	3.3	1.60	0.95–2.52
Unknown	20,084	4.5	-	-	-	-
Plurality						
Singleton	442,890	98.4	530	97.8	1.20	1.09–1.30
Multiple	5,411	1.2	12	2.2	2.22	1.15–3.87
Unknown	1,796	0.4	-	-	-	-

Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

Babies of primiparous women had the highest rates of NE, being statistically significantly higher than women with one, two, three or four or more babies (Figure 4.5). The rate ratio for NE in babies of primiparous compared with multiparous women was 2.21, 95% CI 1.84–2.66.

Figure 4.5: NE rates (per 1,000 term births) by parity prior to index birth* 2010–2017

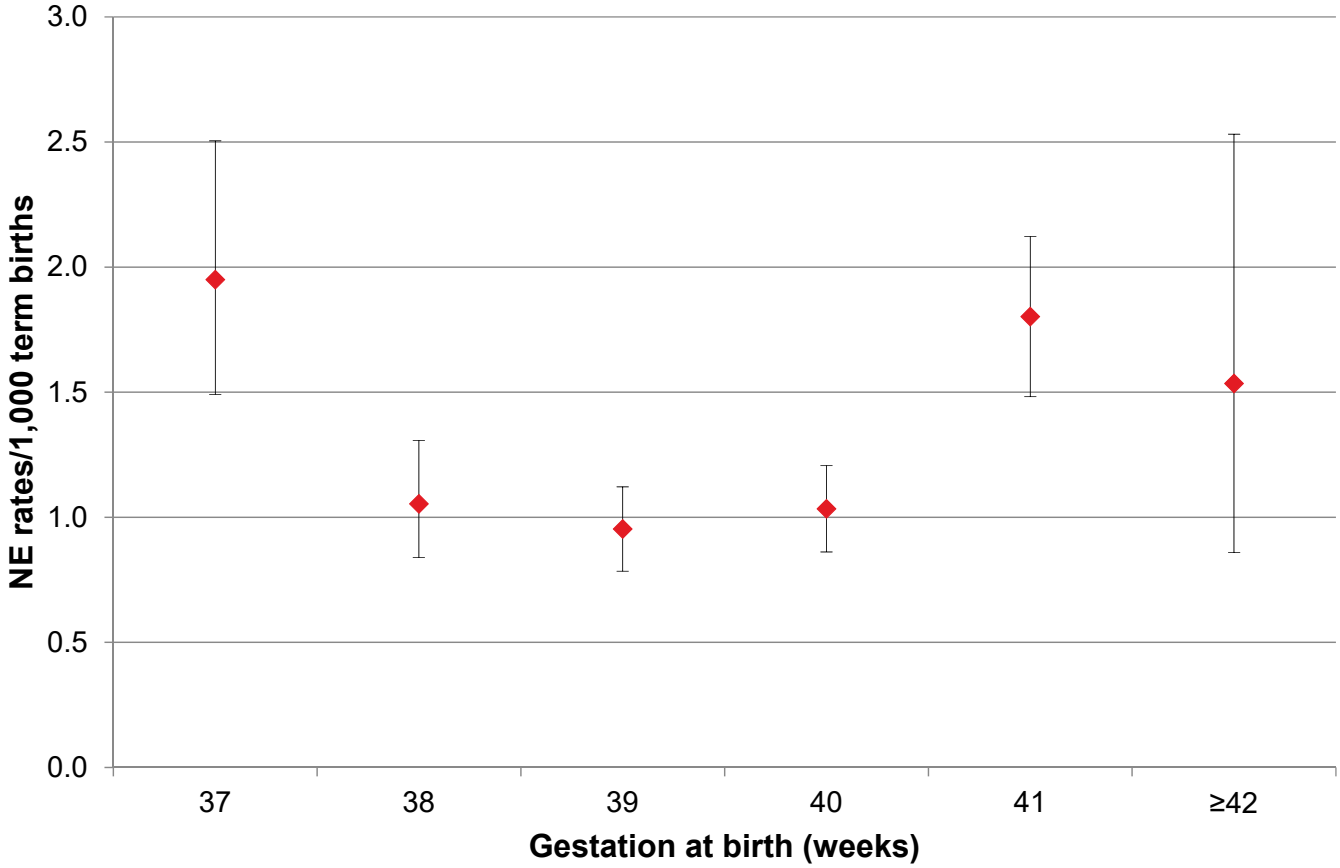


* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

Sources: Numerator: PMMRC's NE data extract where matched to MAT data, ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

There was variation in the rates of NE by gestational age at birth, with those at the extreme ends of term pregnancies having higher rates. The number of births in those ≥42 weeks was relatively small (Figure 4.6).

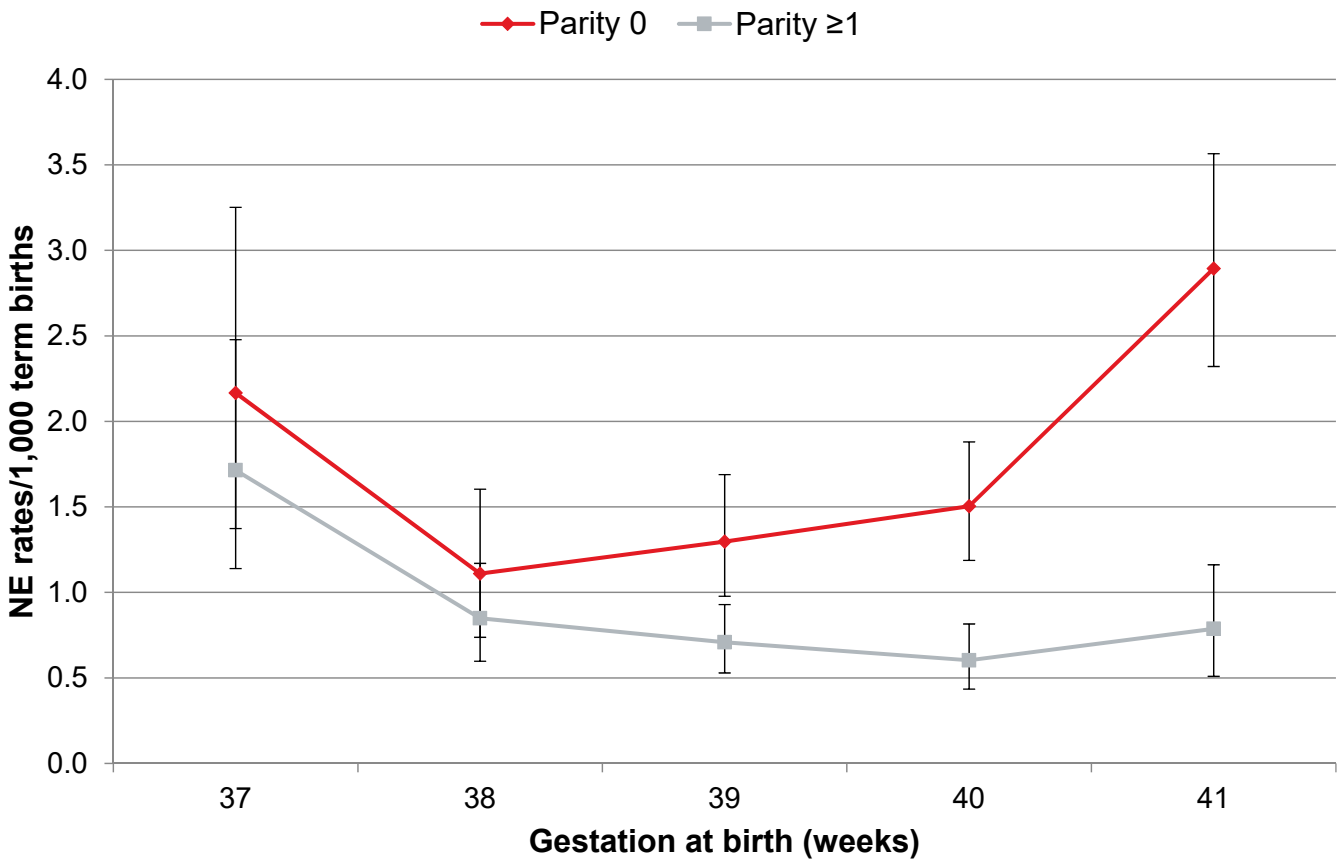
Figure 4.6: NE rates (per 1,000 term births) by gestation at birth (≥37 weeks) 2010–2017



Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

When examined by both parity and gestational age, the same patterns remained. Rates of NE were higher in babies born at 37 and 41 weeks' gestation. Rates were elevated in primiparous women, regardless of gestational age, but statistically significantly higher from 39 weeks onwards (Figure 4.7).

Figure 4.7: NE rates (per 1,000 term births) by parity and gestation* 2010–2017



* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice. Excludes gestation at birth greater than 41 weeks with fewer than three cases among parity ≥1. Excludes 16 unknown parity among MAT births.

Sources: Numerator: PMMRC's NE data extract where matched to MAT data, ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

During the study period, there were no differences in NE rates amongst babies of smoking mothers compared with non-smoking mothers. However, smoking is a risk factor for late stillbirth[6] and small for gestational age[7]. NE rates were statistically significantly higher in babies of women who had a BMI of 35 or greater, compared with women with a BMI less than 25. This supports the Ministry of Health's *Guidelines for Consultation with Obstetric and Related Medical Services (Referral Guidelines)*, which state all women with a BMI of 35 or greater should be recommended by their LMC to have an obstetric consultation.[8]

There was no significant variation in NE rates by baby gestation at first antenatal visit. However, it should be noted that 37% of mothers whose babies developed NE did not have antenatal care in the first trimester. This was similar to the percentage of all mothers who did not book in the first trimester (33%). The PMMRC has previously recommended that the Ministry of Health, DHBs and professional colleges explore barriers to early booking with a view to increasing the number of women who book with an LMC before 10 weeks' gestation. This requires ongoing consideration and action. Consistent with the international literature, babies who were small for gestational age were twice as likely to have moderate to severe NE compared

[6] Cronin RS, Li M, Thompson JMD, et al. 2019. An individual participant data meta-analysis of maternal going-to-sleep position, interactions with fetal vulnerability, and the risk of late stillbirth. *The Lancet* 10: 49–57. URL: https://doi.org/10.1016/j.eclinm.2019.03.014 (accessed 15 August 2019).

[7] McCowan L, Horgan RP. 2009. Risk factors for small for gestational age infants. *Best Practice & Research: Clinical Obstetrics & Gynaecology* 23(6): 779–93.

[8] Ministry of Health. 2012. *Guidelines for Consultation with Obstetric and Related Medical Services (Referral Guidelines).* Wellington: Ministry of Health.

Extracted from the full report at: www.hqsc.govt.nz/our-programmes/mrc/pmmrc/publications-and-resources/publication/3832

with babies who were appropriate size for gestational age.[9] As part of its NE prevention programme, ACC has funded the implementation of the Growth Assessment Protocol (GAP) in DHBs, which has occurred in some, but not all DHBs presently. We commend ACC on its action on this important issue, and anticipate the evaluation of this programme and its effectiveness once it has been established throughout Aotearoa/New Zealand.

Babies of primiparous women make up 61% of babies with NE, and have an NE rate that is significantly higher than babies of multiparous women, regardless of whether they were para one, two, three, four, or more. While primiparous women make up 41% of the birthing population, 60% of babies with NE are born to primips (Table 4.2 and Figure 4.5).

Table 4.2: Maternal smoking, BMI, gestation at first antenatal visit, customised birthweight centiles, and parity among NE babies* 2010–2017

	MAT births ≥37 weeks		NE cases		Rate (/1,000 term births)	
	N=403,616		n=469			
	n	%	n	%	/1,000	95% CI
Currently smoking						
Yes	57,615	14.3	69	14.7	1.20	0.93–1.52
No	345,988	85.7	400	85.3	1.16	1.04–1.27
Unknown	13	0.0	-	-	-	-
Maternal BMI (kg/m^2)						
<18.50	11,347	2.8	6	1.3	0.53	0.19–1.15
18.50–24.99	197,351	48.9	189	40.3	0.96	0.82–1.09
25.00–29.99	104,354	25.9	141	30.1	1.35	1.13–1.57
30.00–34.99	52,781	13.1	65	13.9	1.23	0.95–1.57
35.00–39.99	23,742	5.9	43	9.2	1.81	1.31–2.44
≥40	13,430	3.3	25	5.3	1.86	1.20–2.75
Missing data for height and or weight	611	0.2	-	-	-	-
Gestation first antenatal visit (weeks)						
≤14	270,094	66.9	297	63.3	1.10	0.97–1.22
15–27	114,963	28.5	148	31.6	1.29	1.08–1.49
≥28	16,895	4.2	22	4.7	1.30	0.82–1.97
Postnatal registration	1,655	0.4	<3	x	s	s
Unknown	9	0.0	-	-	-	-
Customised birthweight centiles						
Small for gestational age	36,970	9.2	86	18.3	2.33	1.86–2.87
Appropriate for gestational age	298,967	74.1	343	73.1	1.15	1.03–1.27
Large for gestational age	47,571	11.8	40	8.5	0.84	0.60–1.14
Unknown	20,108	5.0	-	-	-	-
Parity						
0	164,466	40.7	283	60.3	1.72	1.52–1.92
1	137,219	34.0	104	22.2	0.76	0.61–0.90
2	60,437	15.0	45	9.6	0.74	0.54–1.00
3	23,086	5.7	23	4.9	1.00	0.63–1.49
≥4	18,392	4.6	14	3.0	0.76	0.42–1.28
Unknown	16	0.0	-	-	-	-

* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

'x' indicates percentage suppressed due to small numbers.

's' indicates rate suppressed due to small numbers.

BMI = body mass index.

Sources: Numerator: PMMRC's NE data extract where matched to MAT data, ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

[9] The rate ratio for small for gestational age infants compared with appropriate for gestational age infants was 2.03, 95% CI 1.60–2.57.

There were a range of antenatal complications recorded for women whose babies developed NE, including antepartum haemorrhage and hypertension, including gestational hypertension and pre-eclampsia. Both primiparous and multiparous mothers of babies with NE experienced antenatal complications. The percentages of those affected generally followed patterns that would be expected from the birthing population – that is, there were lower numbers of multiparous women with pre-eclampsia compared with primiparous women. There were a number of women who were induced through a variety of means and who had epidural anaesthesia. Without denominator data – that is, without knowing the rates and use of these procedures during delivery of babies that did not have NE – we cannot comment on whether these factors indicated increased risk to babies. While most women whose babies developed NE had a good outcome, there were a number with an adverse outcome. Of those with an adverse outcome, 4 women died and 15 survived but with serious morbidity (Table 4.3).

Table 4.3: Antenatal complications, obstetric interventions, and maternal outcome among NE cases by parity and Sarnat stage 2010–2017

	NE cases		Primiparous#		Multiparous+		Sarnat stage			
							Moderate		Severe	
	n=542		n=318		n=224		n=375		n=167	
	n	%	n	%	n	%	n	%	n	%
Antenatal complications										
Antepartum haemorrhage (≥20 weeks vaginal bleeding)	56	10.3	29	9.1	27	12.1	37	9.9	19	11.4
Hypertension	68	12.5	48	15.1	20	8.9	52	13.9	16	9.6
Maternal trauma (antenatal)*	12	2.2	5	1.6	7	3.1	6	1.6	6	3.6
Induction/augmentation of labour										
Induction of labour	132	24.4	85	26.7	47	21.0	101	26.9	31	18.6
Induced or augmented labour (any method)	254	46.9	173	54.4	81	36.2	194	51.7	60	35.9
Oxytocin for induction or augmentation	125	23.1	91	28.6	34	15.2	99	26.4	26	15.6
Epidural anaesthesia	142	26.2	104	32.7	38	17.0	113	30.1	29	17.4
Maternal outcome										
Deceased or alive with serious morbidity	19	3.5	6	1.1	13	2.4	11	2.0	8	1.5
Alive and well	523	96.5	312	57.6	211	38.9	364	67.2	159	29.3

* Vehicular, violent personal injury, other.

Primiparous: parity = 0 defined prior to current birth.

+ Multiparous: parity ≥1 defined prior to current birth.

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

Nearly one-quarter of babies with NE had an acute peripartum event, including abruption (7.6%) and shoulder dystocia (6.6%). Table 4.4 points to many antenatal and intrapartum factors that may indicate risk for NE for the babies. This table is not definitive in itself but provides an indication of possible areas to focus on in the future.

Table 4.4: Peripartum complications and mode of birth among NE cases 2010–2017

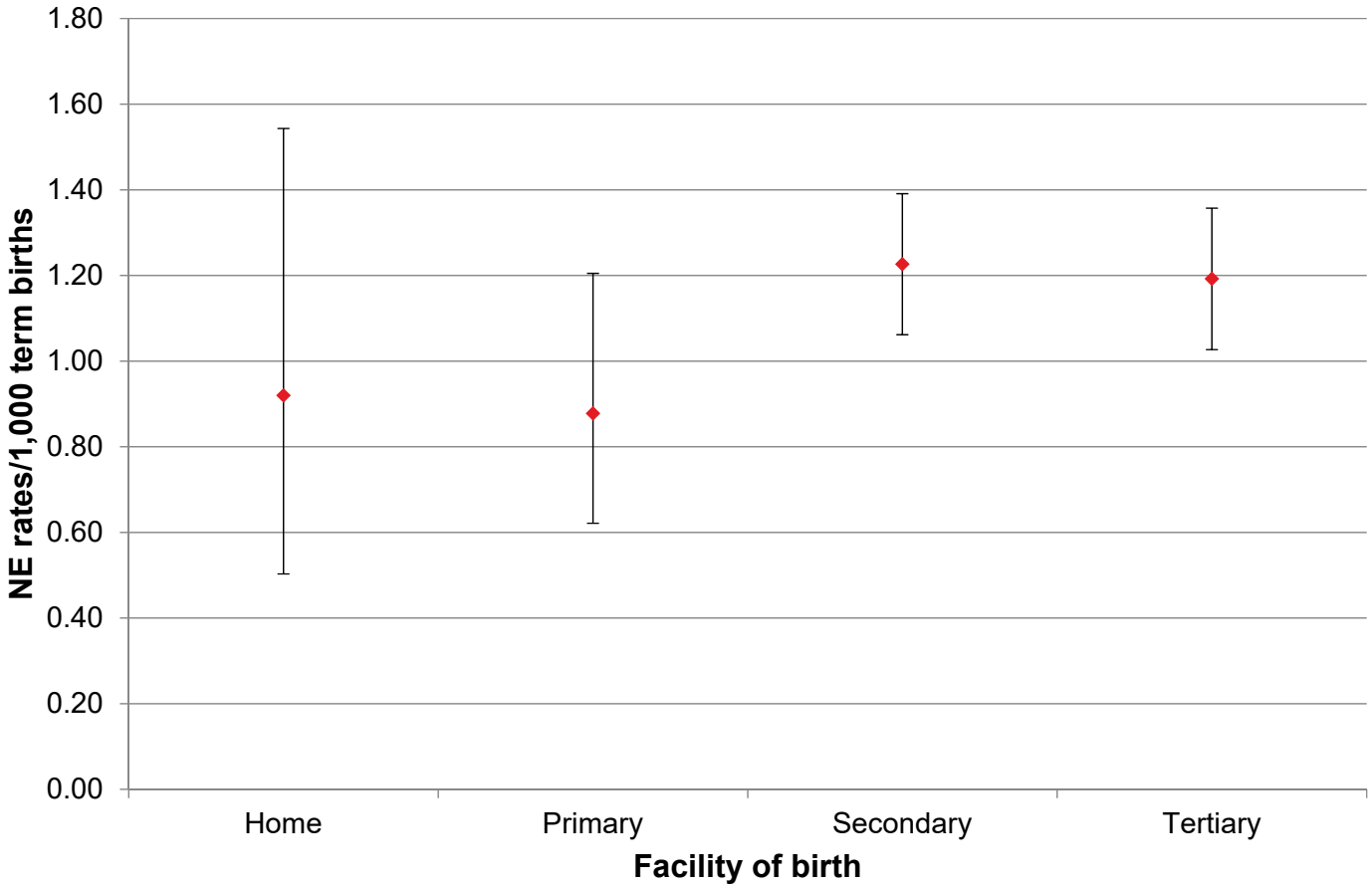
	Total NE cases	
	n=542	
	n	%
Acute peripartum events	131	24.2
Cord prolapse	18	3.3
Abruption	41	7.6
Uterine rupture	12	2.2
Shoulder dystocia	36	6.6
Breech complication	12	2.2
Other complication	18	3.3
Liquor		
Blood stained	46	8.5
Thick meconium	120	22.1
Thin meconium	71	13.1
Mode of birth		
Normal vaginal birth	216	39.9
Operative vaginal birth	80	14.8
Forceps	32	5.9
Ventouse	46	8.5
Unknown	2	0.4
Vaginal breech birth	10	1.8
Caesarean section birth	236	43.5
Elective	11	2.0
Prelabour emergency	57	10.5
Antepartum haemorrhage/Abruption	8	1.5
Suspected fetal distress	41	7.6
Other	8	1.5
Unknown	-	-
In labour emergency	168	31.0
Antepartum haemorrhage/Abruption	14	2.6
Suspected fetal distress	117	21.6
Failure to progress/Cephalopelvic disproportion	17	3.1
Other	20	3.7
Attempt at operative vaginal birth before caesarean	16	3.0

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

There was some variation in rates of NE by the facility of birth (Figure 4.8 and Table 4.5). When examining rates of NE by the facility of birth, it is important to consider other information also. This includes where the intended place of birth was and, if transferred, when in the pregnancy or birthing process this occurred. Also important is whether the chosen facility of birth would be recommended for each particular woman and baby. This is the subject of a proposed research project by the Neonatal Encephalopathy Working Group.

Figure 4.8: NE rates (per 1,000 term births) by place of birth* (with 95% CIs) 2010–2017



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Sources: Numerator: PMMRC's NE data extract where matched to MAT data, ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

Table 4.5: NE rates (per 1,000 term births) by place of birth* 2010–2017

Facility of birth	MAT births ≥37 weeks N=403,616		NE cases n=469		Rate (/1,000 term births)	
	n	%	n	%	/1,000	95% CI
Home	15,221	3.8	14	3.0	0.92	0.50–1.54
Primary	43,288	10.7	38	8.1	0.88	0.62–1.20
Secondary	173,696	43.0	213	45.4	1.23	1.06–1.39
Tertiary	167,776	41.6	200	42.6	1.19	1.03–1.36
Unknown	3,635	0.9	4	0.9	-	-

* All data limited to mothers who were registered for care with an LMC (either a midwife, obstetrician or GP) claiming from the Section 88 Primary Maternity Services Notice.

Sources: Numerator: PMMRC's NE data extract where matched to MAT data, ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

Neonatal wellbeing just after birth, measured by Apgar scores, was consistently poor at 1 minute. In those babies with moderate to severe NE, 76.6% had an Apgar score less than 7 at five minutes. The percentage of babies who had cord blood gases recorded has fluctuated over the years. However, of note in 2017, 22% of babies who went on to develop NE did not have cord blood gases recorded. Of all babies who developed NE, 66% had abnormal gases (Table 4.6).

Table 4.6: Immediate newborn wellbeing among NE babies 2010–2017

	2010		2011		2012		2013		2014		2015		2016		2017		Total	
	n=82		n=67		n=79		n=70		n=55		n=70		n=56		n=63		n=542	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Apgar scores																		
Apgar score <3 at 1 minute	48	58.5	41	61.2	47	59.5	40	57.1	37	67.3	39	55.7	37	66.1	36	57.1	325	60.0
Apgar score <5 at 1 minute	65	79.3	54	80.6	62	78.5	58	82.9	49	89.1	51	72.9	48	85.7	50	79.4	437	80.6
Apgar score <7 at 1 minute	73	89.0	61	91.0	70	88.6	65	92.9	53	96.4	59	84.3	51	91.1	56	88.9	488	90.0
Apgar score <7 at 5 minutes	61	74.4	54	80.6	62	78.5	57	81.4	43	78.2	50	71.4	46	82.1	42	66.7	415	76.6
Apgar score <7 at 10 minutes	39	47.6	38	56.7	49	62.0	32	45.7	29	52.7	35	50.0	33	58.9	29	46.0	284	52.4
Apgar score <9 at 10 minutes	52	63.4	52	77.6	62	78.5	52	74.3	45	81.8	48	68.6	44	78.6	41	65.1	396	73.1
Cord blood gases: summary data																		
Normal (none of pH ≤7, BE ≤−12, lactate ≥6)	12	14.6	14	20.9	11	13.9	13	18.6	7	12.7	8	11.4	6	10.7	10	15.9	81	14.9
Abnormal (any of pH ≤7, BE ≤−12, lactate ≥6)	47	57.3	41	61.2	55	69.6	48	68.6	40	72.7	47	67.1	42	75.0	39	61.9	359	66.2
No gases reported	23	28.0	12	17.9	13	16.5	9	12.9	8	14.5	15	21.4	8	14.3	14	22.2	102	18.8
No gases and Apgar <7 at 1 minute	14	17.1	8	11.9	8	10.1	6	8.6	8	14.5	6	8.6	6	10.7	10	15.9	66	12.2
No gases and Apgar ≥7 at 1 minute	8	9.8	4	6.0	5	6.3	3	4.3	-	-	9	12.9	<3	x	3	4.8	34	6.3
No gases and unknown Apgar	<3	x	-	-	-	-	-	-	-	-	-	-	-	-	<3	x	<3	x

BE = base excess.

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

Table 4.7: Induced cooling therapy among NE babies 2010–2017

Cooling	2010		2011		2012		2013		2014		2015		2016		2017		Total	
	n=82		n=67		n=79		n=70		n=55		n=70		n=56		n=63		n=542	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Yes	56	68.3	51	76.1	62	78.5	58	82.9	45	81.8	56	80.0	44	78.6	43	68.3	415	76.6
No	26	31.7	16	23.9	17	21.5	12	17.1	10	18.2	14	20.0	12	21.4	20	31.7	127	23.4
Age at cooling	n=56		n=51		n=62		n=58		n=45		n=56		n=44		n=43		n=415	
≤6 hours	46	82.1	39	76.5	53	85.5	47	81.0	39	86.7	44	78.6	34	77.3	36	83.7	338	81.4
>6 hours	10	17.9	8	15.7	9	14.5	11	19.0	6	13.3	11	19.6	10	22.7	7	16.3	72	17.3
Unknown time	-	-	4	7.8	-	-	-	-	-	-	<3	x	-	-	-	-	5	1.2

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

Extracted from the full report at: www.hqsc.govt.nz/our-programmes/mrc/pmmrc/publications-and-resources/publication/3832

Table 4.7 reports on cooling therapy in babies with NE by year of birth. There was a slight reduction in the number and percentage of babies who were cooled in 2017 compared with previous years, with 20 babies who were not cooled. Of these, 8 had severe and 12 had moderate NE. Of those with severe NE, most babies died on the day of birth. The babies who had moderate NE who were not cooled usually either presented late or were not recognised within the 6-hour period. Of the seven babies in 2017 who were cooled starting at more than 6 hours after birth, all were born in a secondary unit and transferred to a tertiary unit. Some were cooled passively before this time (data not shown).

The majority of babies with NE were resuscitated at birth (92%). Resuscitation ranged from giving oxygen only, through to cardiac massage, and adrenaline. A small percentage of babies had a positive blood culture. Over 70% of babies were given anticonvulsants (Table 4.8).

Table 4.8: Neonatal resuscitation and early neonatal management by Sarnat stage among NE babies 2010–2017

	NE babies		Sarnat stage			
			Moderate		Severe	
	n=542		n=375		n=167	
	n	%	n	%	n	%
Resuscitation at birth						
Yes	498	91.9	343	91.5	155	92.8
No	44	8.1	32	8.5	12	7.2
Type of resuscitation at birth*						
Oxygen only	8	1.5	7	1.9	<3	x
IPPV with mask	357	65.9	256	68.3	101	60.5
IPPV with ETT	285	52.6	166	44.3	119	71.3
Cardiac massage	215	39.7	110	29.3	105	62.9
Adrenaline	87	16.1	28	7.5	59	35.3
Respiratory and ventilation management						
Mechanical ventilation	422	77.9	274	73.1	148	88.6
Nitric oxide	125	23.1	77	20.5	48	28.7
Infection						
Positive blood culture	21	3.9	16	4.3	5	3.0
Antibiotics	488	90.0	349	93.1	139	83.2
Anticonvulsant therapy	384	70.8	261	69.6	123	73.7
Phenobarbitone	342	63.1	225	60.0	117	70.1
Phenytoin	114	21.0	59	15.7	55	32.9
Benzodiazepines	136	25.1	85	22.7	51	30.5
Other	71	13.1	52	13.9	19	11.4

* Categories not mutually exclusive.

IPPV = intermittent positive pressure ventilation.

ETT = endotracheal tube.

'x' indicates percentage supressed due to small numbers.

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

Overall, 77% of babies were cooled, with a slightly higher proportion of babies with moderate NE being cooled. The rates of cooling were the same for babies of Māori mothers as for New Zealand European mothers. Mortality was much higher in babies with severe NE, with 61% of babies dying, compared with 2% of babies with moderate NE (Table 4.9).

Table 4.9: Use of cooling and outcomes of encephalopathy by Sarnat stage among NE babies 2010–2017

	NE babies		Sarnat stage			
			Moderate		Severe	
	n=542		n=375		n=167	
	n	%	n	%	n	%
Induced cooling						
Yes	415	76.6	298	79.5	117	70.1
No	127	23.4	77	20.5	50	29.9
Deceased						
Yes	108	19.9	7	1.9	101	60.5
No	434	80.1	368	98.1	66	39.5

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

Of those babies with NE who survived, nearly half of those with moderate NE had a normal physical examination on discharge or transfer, compared with 15% of those with severe NE. Nearly all babies (97%) with severe NE had an MRI prior to discharge (Table 4.10). The PMMRC has previously recommended that all babies with moderate and severe NE should receive an MRI scan.[10]

Table 4.10: Investigations and neonatal outcome by Sarnat stage of NE survivors 2010–2017

Investigations	Total NE survivors		Sarnat stage			
			Moderate		Severe	
	n=434		n=368		n=66	
	n	%	n	%	N	%
Examination on discharge/transfer						
Normal	193	44.5	183	49.7	10	15.2
Mild or moderate abnormality	150	34.6	126	34.2	24	36.4
Severe abnormality	30	6.9	6	1.6	24	36.4
Not examined	22	5.1	19	5.2	3	4.5
Examined but finding unknown	17	3.9	13	3.5	4	6.1
Missing data	22	5.1	21	5.7	<3	x
MRI (investigation done)	334	77.0	270	73.4	64	97.0
No MRI or Unknown	100	23.0	98	26.6	<3	x
Results of MRI						
Moderately/Severely abnormal	123	28.3	81	22.0	42	63.6
Normal or only mildly abnormal	205	47.2	184	50.0	21	31.8
Unknown result	6	1.4	5	1.4	<3	x

MRI = magnetic resonance imaging (of the brain).

'x' indicates percentage suppressed due to small numbers.

Source: PMMRC's NE data extract ≥37 weeks 2010–2017.

[10] PMMRC. 2013. *Seventh Annual Report of the Perinatal and Maternal Mortality Review Committee: Reporting mortality 2011*. URL: https://www.hqsc.govt.nz/assets/PMMRC/Publications/Seventh-PMMRC-Report-FINAL-June-2013.pdf (accessed 2 September 2019).

Extracted from the full report at: www.hqsc.govt.nz/our-programmes/mrc/pmmrc/publications-and-resources/publication/3832

Neonatal encephalopathy appended tables

Table 4.11: NE rates (per 1,000 term births) by prioritised ethnic group, maternal age and NZDep2013 quintile 2010–2017

	MAT births ≥37 weeks		NE cases		Rate (/1,000 term births)	
	N=450,097*		n=542			
	n	%	n	%	/1,000	95% CI
Prioritised ethnic group (mother)						
Māori	112,614	25.0	144	26.6	1.28	1.07–1.49
Pacific peoples	48,467	10.8	73	13.5	1.51	1.18–1.89
Asian	65,599	14.6	67	12.4	1.02	0.79–1.30
Indian	20,367	4.5	30	5.5	1.47	0.99–2.10
Other Asian	45,232	10.0	37	6.8	0.82	0.58–1.13
MELAA	10,006	2.2	9	1.7	0.90	0.41–1.71
European	213,391	47.4	249	45.9	1.17	1.02–1.31
NZ European	169,638	37.7	217	40.0	1.28	1.11–1.45
Other European	43,753	9.7	32	5.9	0.73	0.50–1.03
Other	-	-	-	-	-	-
Maternal age (years)						
<20	24,099	5.4	34	6.3	1.41	0.98–1.97
20–34	331,714	73.7	405	74.7	1.22	1.10–1.34
35–39	75,935	16.9	84	15.5	1.11	0.88–1.37
≥40	18,326	4.1	19	3.5	1.04	0.62–1.62
Unknown	23	0.0	-	-	-	-
NZDep2013 quintile						
1 (least deprived)	64,296	14.3	49	9.0	0.76	0.56–1.01
2	70,481	15.7	79	14.6	1.12	0.89–1.40
3	82,352	18.3	101	18.6	1.23	0.99–1.47
4	102,499	22.8	144	26.6	1.40	1.18–1.63
5 (most deprived)	127,616	28.4	169	31.2	1.32	1.12–1.52
Unknown	2,853	0.6	-	-	-	-

* Includes 20 unknown maternal ethnicity among MAT births.

MELAA = Middle Eastern, Latin American, or African.

Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

Table 4.12: NE rates (per 1,000 term births) by DHB of maternal residence 2010–2017

DHB of residence	MAT births ≥37 weeks[#]	Total NE cases[#]	Rate (/1,000 term births)	
	N=446,356	n=540		
	n	n	/1,000	95% CI
Northland	16,761	15	0.89	0.50–1.48
Waitematā	58,451	50	0.86	0.63–1.13
Auckland	46,677	44	0.94	0.68–1.27
Counties Manukau	62,332	68	1.09	0.85–1.38
Waikato	39,694	67	1.69	1.31–2.14
Bay of Plenty	21,480	29	1.35	0.90–1.94
Lakes	11,317	15	1.33	0.74–2.19
Hauora Tairāwhiti	5,384	7	1.30	0.52–2.68
Taranaki	11,272	22	1.95	1.22–2.95
Hawke's Bay	15,851	21	1.32	0.82–2.03
Whanganui	6,203	12	1.93	1.00–3.38
MidCentral	15,910	16	1.01	0.57–1.63
Capital & Coast	27,198	48	1.76	1.30–2.34
Hutt Valley	14,631	22	1.50	0.94–2.28
Nelson Marlborough	11,427	15	1.31	0.73–2.17
West Coast	2,741	6	2.19	0.80–4.76
Canterbury	45,775	47	1.03	0.75–1.37
South Canterbury	4,806	11	2.29	1.14–4.10
Southern	25,824	25	0.97	0.63–1.43
Other*	2,622	-	-	-

* Other includes Overseas, Unknown and Other.

[#] Wairarapa DHB excluded from this table (numerator and denominator) as there were <3 cases for the time period.

Sources: Numerator: PMMRC's NE data extract ≥37 weeks 2010–2017; Denominator: MAT births ≥37 weeks 2010–2017.

10. The PMMRC recommends that DHBs with rates of NE significantly higher than the national rate review, or continue to review, the higher rate of NE in their area and identify areas for improvement.	**Taranaki DHB** acknowledges that their DHB rate of NE (2.71/1,000 term births) for the 2012–2016 period is significantly higher than the national rate (1.19/1,000 term births). Taranaki DHB note that the year-by-year numbers are small, so it is difficult to generalise. There was an increased rate of NE cases in 2012, which is likely responsible for Taranaki DHB's overall findings. All cases of NE are captured by the Taranaki DHB maternity obstetric outcomes protocol in which a key indicator for review is unexpected admission to the Neonatal Unit. Any actions or quality improvements identified are entered onto a work plan to ensure these are completed. Taranaki DHB has also adopted the Health Quality & Safety Commission's guidance for SAC rating and reporting of maternity cases, which includes NE. **Capital & Coast DHB** continues to review each case of NE, looking for recurring themes that can be addressed. Communication workshops for senior medical officers and senior midwives to address culture/supervision issues have taken place. Education is supporting best practice. Weekly multidisciplinary CTG (cardiotocograph) education sessions are in place. All employed midwives and obstetricians are required to attend our mandatory Fetal Surveillance Education Programme. There is no cost for LMCs to attend the Fetal Surveillance Education Programme at Capital & Coast DHB. Staffing is a challenge, and monitoring and systems around safe staffing are in place and reviewed regularly.