2023

REPORT OF THE

AUSTRALIAN AND NEW ZEALAND NEONATAL NETWORK

UNSW SYDNEY

ANZNN

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Please note that there is the potential for minor revisions of data in this report. Please check the online version at **< www.anznn.net >** for any amendments.

Contents

Acknowledgements

This is the twenty-eighth report of the Australian and New Zealand Neonatal Network (ANZNN), the sixteenth report in the current format and the twelfth to include a report on 2 to 3-year follow-up. The ANZNN has endeavoured to retain the information provided in previous reports to allow comparative reporting over time. Details of the current format can be found under 'Structure of this report'.

We would like to acknowledge all the units involved in the provision of data for this report. The ANZNN greatly appreciates the contribution of all participating units and we thank them for their ongoing support together with our data managers for their hard work and attention to detail.

The ANZNN greatly values the time, effort and expertise of the members of the ANZNN Advisory Council and their conceptual, intellectual and financial contributions, all of which have helped make this network a respected and world-recognised organisation.

We thank the following members of the ANZNN Executive Committee for their commitment and guidance for all the activities of the ANZNN: Kei Lui (Chairperson), David Barker, Malcolm Battin, Margaret Broom, Merophy Brown, Georgina Chambers, Manbir Chauhan, Anjali Dhawan, Rod Hunt, Amy Keir, Carl Kuschel, Anita Lala, Simon Lam, Melissa Luig, Natalie Merida, Tori Oliver, Laura Prado, Sara Sedgley, Naomi Spotswood, Tobias Strunk and Kenneth Tan.

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We acknowledge our colleagues from the National Perinatal Epidemiology and Statistics Unit (NPESU) and the Centre for Big Data Research in Health for their continued support and encouragement.

Structure of this report

Chapter 1: This chapter presents the structure and organisation of the ANZNN together with some historical information related to its establishment. Also included is information on funding, selection criteria as well as a brief synopsis of level III registrants in Australia and New Zealand for 2023.

Chapter 2: 'Babies registered to level III units' provides information and characteristics on the ANZNN registrants in 2023 who are either born in a hospital with a level III unit or who are born elsewhere and then transferred to a level III unit within the first 28 days of life.

Chapter 3: 'Mothers of level III registrants' provides information on the mothers of level III registrants registered to the ANZNN in 2023.

Chapter 4: 'Characteristics of level III registrants' provides information about the babies admitted to a level III neonatal unit during 2023.

Chapter 5: 'Babies registered to level II units' provides information about babies registered to the level II special care baby units during 2023.

Chapter 6: 'Extremely preterm follow-up, 2017–2020 births' provides 2 to 3 year follow-up information about extremely preterm and/or extremely low birthweight babies registered to the level III neonatal units during 2017 to 2020.

Appendices: Appendix 1 presents 10-year trends.

Appendix 2 presents data tables by birthweight for 2023.

Appendix 3 describes the methods employed for this report.

Appendix 4 contains confidentiality guidelines, and conditions for data collection, use and security.

Appendix 5 presents the Minimum Data Sets for the ANZNN.

Abbreviations

ANZNN	Australian and New Zealand Neonatal Network
APH	antepartum haemorrhage
Bayley-III	Bayley Scales of Infant and Toddler Development Third Edition
Bayley 4 (A&NZ)	Bayley Scales of Infant and Toddler Development (Australian and New Zealand Standardised 4th edition)
CI	confidence interval
CLD	chronic lung disease
CPAP	continuous positive airway pressure
CRIB	Clinical Risk Index for Babies
ECMO	extracorporeal membrane oxygenation
g	gram
GIFT	gamete intra-fallopian transfer
GMFCS	gross motor function classification system
HFOV	high frequency oscillatory ventilation
HMD	hyaline membrane disease
ICD-10-AM	The International Statistics Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification
IPPV	intermittent positive pressure ventilation
IQR	interquartile range
IUGR	intrauterine growth restriction
IVF	in vitro fertilisation
IVH	intraventricular haemorrhage
$MgSO_4$	magnesium sulphate
NEC	necrotising enterocolitis
NHF	nasal high flow
NICU	neonatal intensive care unit
NPESU	National Perinatal Epidemiology and Statistics Unit
O_2	oxygen
PCR	polymerase chain reaction
PMA	post menstrual age
PPROM	preterm pre-labour rupture of membranes
PVL	periventricular leukomalacia
ROP	retinopathy of prematurity
SD	standard deviation
UNSW	University of New South Wales
WHO	World Health Organization
WPPSI	Wechsler Preschool and Primary Scale of Intelligence

Participating units and current supporting staff

Level III nurseries:

Australia

New South Wales

Children's Hospital at Westmead

(NICU & special care beds: 23)
Nadia Badawi (Co-director), Himanshu Popat (Co-director), Darcy O'Connor, Rob Halliday, Andrew Bedding, Karina Rogers

John Hunter Hospital

(NICU & special care beds: 43)
Larissa Korostenski (Director), Alissa Argomand, Stacey Leonard, Diane Sutherland

Liverpool Health Service

(NICU & special care beds: 31)
Nele Legge (Director), Ian Callander, Amanda Beasley, Melanie Edmands

Nepean Hospital

(NICU & special care beds: 37)
Lyn Downe (Director), Vijay Shingde, Basiliki Lampropoulos, Jacqueline Furey, Mee Fong Chin

Royal Hospital for Women

(NICU & special care beds: 46)
Srini Bolisetty (Director), Kei Lui, Diane Cameron, Brianna Draskovic, Joanne Blaeck

Royal North Shore Hospital

(NICU & special care beds: 27)
Eveline Staub (Director), Jennifer Bowen, Amy Sparks, Lyn Barnes

RPA Women and Babies

(NICU & special care beds: 34)
Meredith Ward (Director)

Sydney Children's Hospital

(NICU & special care beds: 4)
Hari Ravindranathan (Director), Janelle Young

Westmead Hospital

(NICU & special care beds: 44)
Melissa Luig (Director), Melissa Ross, Tracey Anne Goyen, Jane Baird, Gemma Lowe

Neonatal Intensive Care Units' (NICUS) Data Registry

(New South Wales and Australian Capital Territory)
Sara Sedgley, Sarah West, Mark Leckie

Australian Capital Territory

The Canberra Hospital

(NICU & special care beds: 29)
Hazel Carlisle (Director), Allana Carter, Judith Smith, Laura Maher, Amanda Dyson, Laura Briguglio, Melanie Rosin

Victoria

Joan Kirner Women's & Children's at Sunshine Hospital

(Special care beds: 30)
Clare Collins (Director), Damien Gilby, Elizabeth Noble, Julie Chen, Sara Ojiambo

Mercy Hospital for Women

(NICU & special care beds: 58)
Arun Sasi (Director), Dan Casalaz, Jim Holberton, Emily Burke, Elisha Josev

Monash Medical Centre

(NICU & special care beds: 64)
Lindsay Zhou (Director), Kenneth Tan, Rod Hunt, Rose Li, Emily Johnston, Samantha Tyrer, Nicole Jayawickreme

Royal Children's Hospital

(NICU & special care beds: 34)
Leah Hickey (Director), Trisha Prentice, Jo Brooks

Royal Women's Hospital

(NICU & special care beds: 60)
Risha Bhatia (Director), Carl Kuschel, Jeanie Cheong, Alison Martin, Jennifer Walsh

Tasmania

Royal Hobart Hospital

(NICU & special care beds: 26)
Tony De Paoli (Director), Peter Dargaville, Naomi Spotswood, Ruth Wilson, Charlotte Jenkins

Queensland

Gold Coast Hospital

(NICU & special care beds: 33)
Peter Schmidt (Director), Timothy Hong, Manbir Chauhan, Kobi Best, Patricia Roberts, Teena George

Mater Mothers' Hospital

(NICU & special care beds: 79)
Pita Birch (Director), Elizabeth Hurrion, Tori Oliver, Roshni Anchankudi, Leith Poulsen, Richard Mausling

Royal Brisbane and Women's Hospital

(NICU & special care beds: 71)
Donna Bostock (Director), Katherine White, David Cartwright, Linda McLaughlin, Melissa Lai, Zuleiga Goder, Gonzalo Chinchilla

Townsville University Hospital

(NICU & special care beds: 44)
Gary Alcock (Director), Louise McIldowie, Wendy Kennedy, Samantha Lowien

South Australia

Flinders Medical Centre

(NICU & special care beds: 35)
Scott Morris (Director), Kathryn Martinello, Edith van Loon, Kelly Wessell, Vinita Abraham

Women's and Children's Hospital

(NICU & special care beds: 49)
Michael Stark (Director), Amy Keir, Andy McPhee, Sara Cadd, Meg Bater, Natalie Joyner, Lucy Wiszniak

Western Australia

King Edward Memorial and Perth Children's Hospitals

(NICU & special care beds: 137)
Mary Sharp (Director), Steven Resnick, Rebecca Thomas, Rolland Kohan, Shripada Rao, Andy Gill, Jane Pillow, Damber Shrestha, Gayatri Jape

Fiona Stanley Hospital

(NICU & special care beds: 22)
Mangesh Deshmukh (Director), Shailender Mehta, Julia Lembke

Northern Territory

Royal Darwin Hospital

(NICU & special care beds: 25)
Mantho Kgosiemang (Director), Dennis Bonney, Deborah Ribbon, Connie Yii, Laura Prado, Simone Martin

Newborn emergency transport services

Newborn & paediatric Emergency Transport Service (NETS, NSW)

Andrew Berry (Director)

Paediatric Infant Perinatal Emergency Retrieval (PIPER, Victoria)

Michael Stewart (Director)

Neonatal Retrieval Service (NeoRESQ, Queensland)

Lucy Cooke (Director)

Newborn Emergency Transport Service of Western Australia (NETS, WA)

Jonathan Davis (Director)

SAAS MedSTAR Kids (South Australia)

Bron Hennebry (Director)

New Zealand

Christchurch Women's Hospital

(NICU & special care beds: 41)
Bronwyn Dixon (Director), Nicola Austin, Adrienne Lynn, Brian Darlow (Professor of Paediatrics), Trish Graham

Dunedin Hospital

(NICU & special care beds: 16)
Jason Wister (Director), Frances McCaffrey, Saskia Vink

Middlemore Hospital

(NICU & special care beds: 38)
Michael Meyer (Director), Jacqueline Lee, Kelly Roczniak, Rebecca Griffith, Chris McKinlay

National Women's Health (at Auckland City Hospital)

(NICU & special care beds: 46)
Mariam Buksh (Director), Malcolm Battin, David Knight, Sabine Huth, Ross Anthony

Waikato Hospital

(NICU & special care beds: 41)
Miranda Bailey (Director), Jutta van den Boom, Christine Jones, Vinayak Kodur

Wellington Regional Hospital

(NICU & special care beds: 40)
Helen Miller (Director), Harshad Patel, Claire Jacobs

Hong Kong*

Prince of Wales Hospital*

(NICU & special care beds: 82)
Alan So (Director), Simon Lam, Peggy Chan, Xuelian Wang

Singapore*

Singapore General Hospital*

(NICU & special care beds: 30)
Woei Bing Poon (Director), Vijayendra Ranjan Baral, Priyantha Edison

*data not included in this report

Level II nurseries:

Australia

New South Wales

Blacktown Hospital

(Special care beds: 24)
Anjali Dhawan (Director), Therese Freeman, Jessica Lagos

Campbelltown Hospital

(Special care beds: 15)
Raymond Chin (Director), Lauren Rodgers, Catherine Allgood, Fiona Kite

Gosford District Hospital

(Special care beds: 25)
Ahmed Khan (Director), Adam Buckmaster, Jane Wardle

St George Hospital

(Special care beds: 8)
Bob Fonseca (Director), Beverley Lewis

The Maitland Hospital

(Special care beds: 8)
David Rogers (Director), Jessica Crombie, Linda Bailey, Benita Botha

Tamworth Hospital

(Special care beds: 6)
Genaro Domingo (Director), Therese Madden

Wagga Wagga Base Hospital

(Special care beds: 7)
John Preddy (Director), Dianne Webb

Wollongong Hospital

(Special care beds: 20)
Susie Piper (Director), Ian Wright, Sylvia Lees, Danielle Coggan

Victoria

The Northern Hospital

(Special care beds: 15)
Wei Qi Fan (Director), Pampha Khanal, Angelica Francis

Queensland

Bundaberg Hospital

(Special care beds: 8)
Matt Wakeley (Director), Christopher Edwards, Christina White

Cairns Hospital

(Special care beds: 22)
Neil Archer (Director), Sue McMahon, Marg Cuming

Logan Hospital

(Special care beds: 16)
Jan Cullen (Director), Angela Geraghty

Mackay Base Hospital

(Special care beds: 8)
Vasanthakumar Selvarajah (Director), Joanne Morganson

Redcliffe Hospital

(Special care beds: 10)
Simon Grew (Director), Meredith Shallcross, Jeanie Cooper

Redland Hospital

(Special care beds: 8)
Dougie Thomas (Director), Sharon Grobler

Sunshine Coast University Hospital

(Special care beds: 27)
Lizelle Weber (Director), Janet Rowley

South Australia

Lyell McEwin Hospital

(Special care beds: 16)
Michael Hewson (Director), Caitlin Bartlett

Northern Territory

Alice Springs Hospital

(Special care beds: 8)
James Dowler (Director), Minnu Jolly

New Zealand

Gisborne Hospital

(Special care beds: 6)
Shaun Grant (Co-Director), Stanley Ng (Co-Director), Lianne Hollis, Claire Johansen

Hawkes Bay Hospital

(Special care beds: 12)
Daniel Riviere (Director), Margarette Tapgos, Emily Gallagher, Ally Bambry

Lower Hutt Hospital

(Special care beds: 12)
Sarah Mills (Director), Debbie Bashaw

Nelson Hospital

(Special care beds: 8)
Helke Florkowski (Director), Nathalie Robinson

North Shore Hospital

(Special care beds: 12)
Christopher Peterson (Director), Kerryn Shaw, Mary Lou Macapondag, Karen Tubac

Palmerston North Hospital

(Special care beds: 17)
Jeff Brown (Director), Mollie Hill, Holly Cunningham

Rotorua Hospital

(Special care beds: 10)
Sarka Davidkova (Director), Leanne Turvey, Taylah Ma, Jacquie Koberstein

Southland Hospital

(Special care beds: 6)
Ian Shaw (Director), Liz Hanning-Baird

Taranaki Base Hospital

(Special care beds: 8)
Lisa Power (Director), Amanda Thompson

Tauranga Hospital

(Special care beds: 12)
Anita Lala (Director), Anna Hayns

Timaru Hospital

(Special care beds: 2)
Mick Goodwin (Director), Mark Liddy

Waitakere Hospital

(Special care beds: 15)
Christopher Peterson (Director), Stefanie Smith

Wairau Hospital

(Special care beds: 4)
Margaret Andre (Director)

Whakatane Hospital

(Special care beds: 4)
Michael Herd (Director), Kellie Butler, Rosie Anand

Whanganui Hospital

(Special care beds: 4)
David Montgomery (Director), Barbara Hammond

Whangarei Area Hospital

(Special care beds: 8)
David Barker (Director), Georgia Kidd, Sarah Blake

ANZNN Program and Secretariat

National Perinatal Epidemiology and Statistics Unit (NPESU)

Georgina Chambers (Director), Sharon Chow, Prudence Creighton, Evelyn Karantonis, Will Shenton, Aarathy Babu, Pratyusha Athota

1. Organisation of the ANZNN

History

A prospective audit of high-risk infants commenced in 1994 with all level III neonatal intensive care units (NICUs) in Australia and New Zealand contributing data on babies from 1 January 1995. One of the member level II units became a level III unit in 2014, followed by another two units in 2020 and 2022, respectively. An NICU in Hong Kong also joined in 2017 followed by an NICU in Singapore in 2023, bringing the total of NICU members to 33. For the purposes of this report, data submitted by NICU members outside of Australia and New Zealand have not been included.

In 1998, all the level II units in New Zealand joined the Network and began contributing data. The level II unit in Tasmania, Australia joined in 1999 and level II units within Australia continue to join with a total of 16 units contributing data in 2023.

Aims and objectives

The ANZNN clinical quality registry aims to improve the care of high-risk newborn infants and their families in Australia and New Zealand by enabling benchmarking and so collaborative audit, plus facilitating research.

This is achieved through the following objectives:

- provide a core data set that will:
    - provide information on neonatal outcomes, adjusted for case mix and disease severity, to participating neonatal units to assist with quality improvement
    - identify trends and variations in morbidity or mortality
    - assist with the identification of areas of priority for research
    - enhance the ability to carry out multicentre studies and randomised controlled trials through collaboration
- monitor the clinical indicators for perinatal care and improving clinical practice while maintaining national standards of evidence-based care
- monitor the use of new technologies, e.g. high flow/oxygen air usage by patient type and outcome
- achieve consistency in national data collections.

Each year, an annual report of the ANZNN clinical quality registry is published as part of the *Report of the Australian and New Zealand Neonatal Network* series.

Structure of the ANZNN

The ANZNN is located in the National Perinatal Epidemiology and Statistics Unit (NPESU) within the University of New South Wales (UNSW Sydney). The arrangement is managed under a memorandum of understanding (MOU) between the ANZNN and UNSW Sydney.

The governance structure of the ANZNN (Figure 1) consists of the Advisory Council, the Executive Committee, and the Data Collection and Operations Committee. The Advisory Council is the governing body of ANZNN and includes the director (or their nominee) of each participating unit, academic neonatologists and regional representatives of neonatal nurses. The Director of the NPESU, who is the data custodian for the ANZNN, is also a member of the Advisory Council. The purpose of the Advisory Council is to monitor the progress of the ANZNN, discuss current issues and agree on new variables for inclusion in the minimum data set and to approve the use of the data for research – all as recommended by the Executive Committee.

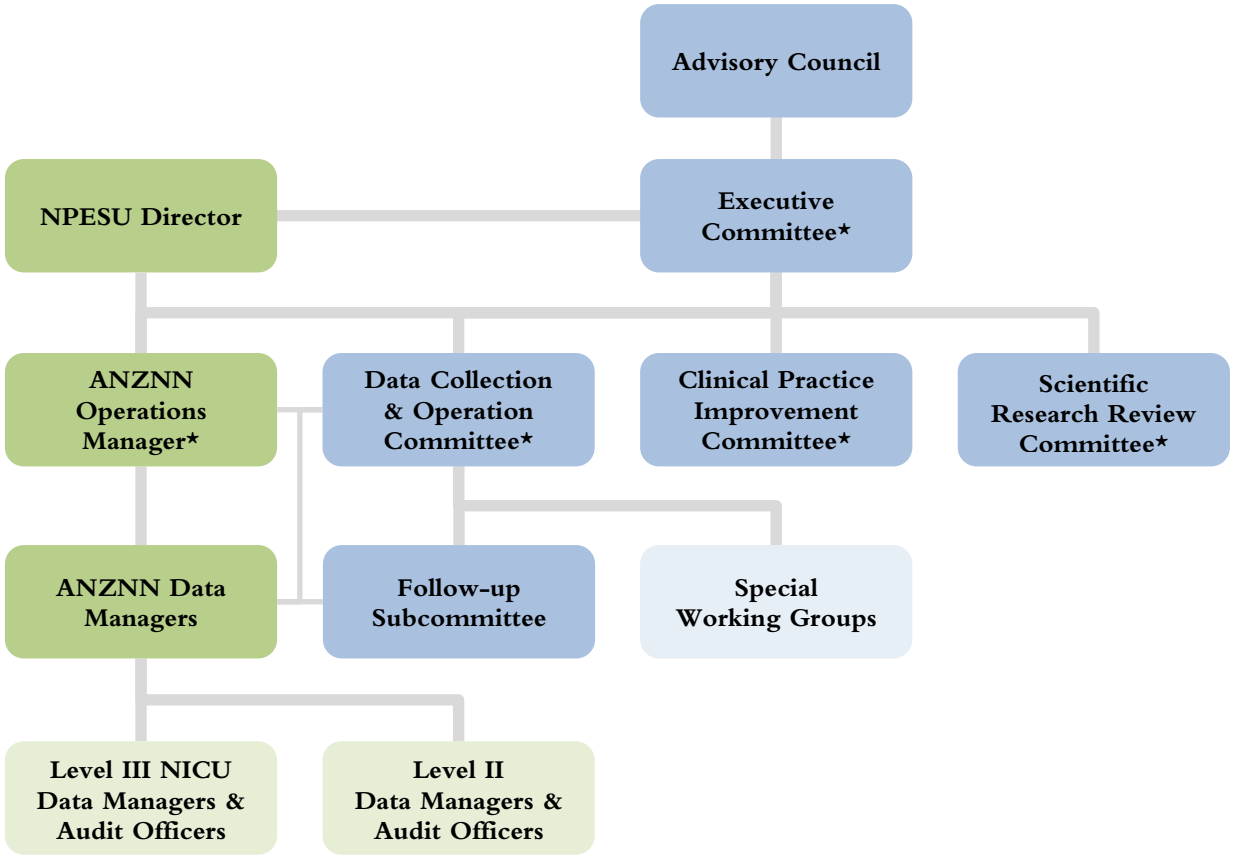
The Executive Committee is an elected committee with regional representation from unit directors, a data manager group representative and neonatal nurse representatives from across the network, and a consumer representative. It oversees the general functioning of the network, finance and decision-making, as reported by the Chairman and Operations Manager.

The Data Collection and Operation Committee coordinates the operations of the ANZNN data collection, monitors the workload and progress of the annual report and reports through the Executive Committee to the Advisory Council.

The Operations Manager deals with day-to-day business of the ANZNN and reports to the Executive Committee and Data Collection and Operation Committee.

The unit data managers and audit officers are responsible for the collection and submission of data to the ANZNN. The ANZNN Operations Manager is the point of contact for the ANZNN and liaises with the ANZNN committees, NPESU, data managers and audit officers.

FIGURE 1: Structure of the ANZNN



*****ANZNN Management Group – comprised of the Chairs of these committees and the ANZNN Operations Manager.*
Note: *NICU = neonatal intensive care unit.*

Registration criteria

Babies who were admitted to a participating unit during the first 28 days of life and meet one or more of the following criteria are eligible for registration with the ANZNN clinical quality registry:

- born at less than 32 weeks gestation, or
- weighed less than 1,500 grams at birth, or
- received assisted ventilation (mechanical ventilation) including intermittent positive pressure ventilation (IPPV) or continuous positive airway pressure (CPAP) or nasal high flow (NHF) for four or more consecutive hours, or died while receiving mechanical ventilation prior to four hours of age, or
- received major surgery (surgery that involved opening a body cavity), or
- received therapeutic hypothermia.

The hospital of registration was the first level III NICU in which the baby, aged less than 28 days, stayed for four or more hours. Babies who received their entire care in a level II hospital or who were not transferred to a level III NICU during the first 28 days were registered to the first level II centre that they remained in for

four or more hours. Data is collected until the baby's first discharge to home. Babies who were discharged home prior to admission to a participating unit were not eligible for registration in the ANZNN clinical quality registry.

Funding support

The ANZNN is primarily funded through the annual registration fees from level III units. The registration fee is determined annually by the Advisory Council. In return, individual units receive a feedback report that enables them to benchmark their unit against the combined ANZNN data set.

Chiesi Australia makes an annual contribution and the ANZNN thanks them for their generosity and support.

Data set variables

The variables used for the 2023 audit are listed in Appendix 5 and are also available on the website < **www.anznn.net** >.

2023

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Babies born in Australia

There were 10,262 babies registered to the ANZNN from the 25 level III NICUs in Australia, representing 3.6% of the 286,998 notified live births in 2023 (Australian Bureau of Statistics 2024). Of these registrants, 79.5% were born in a hospital with tertiary care facilities. There were 2,734 babies born before 32 weeks gestation representing 26.6% of Australian registrants.

Maternal ethnicity was provided for 92.1% of mothers: 66.8% of the mothers of these babies identified as Caucasian and 17.4% as Asian. Nearly one in ten mothers (9.5%) identified as Aboriginal or Torres Strait Islander, which was higher than the proportion reported in all births in Australia in 2023 (8.6%) (Australian Bureau of Statistics 2023).

Among Australian NICU admissions registered to the ANZNN, 1,646 were from multiple births representing 16.0% of ANZNN admissions in Australia in 2023.

Male babies were over-represented among NICU admissions – 59.3% of the Australian ANZNN registrants, compared with 51.4% among live births in Australia (Australian Bureau of Statistics 2024).

Assisted ventilation (intermittent positive pressure ventilation (IPPV), continuous positive airway pressure (CPAP) or nasal high flow (NHF)) was provided for 10,085 babies (3.5% of live births) and non-invasive ventilation (CPAP or NHF) was the only form of respiratory assistance for 7,027 babies.

Babies born in New Zealand

There were 2,587 babies who met ANZNN registration criteria from the six level III NICUs in New Zealand representing 4.5% of the 56,955 live births registered in New Zealand in 2023 (Statistics New Zealand 2024). Of these registrants, 87.9% were born in a hospital with tertiary care facilities. There were 666 babies born before 32 weeks gestation representing 25.7% of New Zealand registrants.

Maternal ethnicity was reported for 99.8% of the New Zealand registrants. The percentage of Caucasian mothers was 39.8%. A higher proportion of mothers identified themselves as Māori (21.7%) compared to 15.1% of mothers identified as Pacific peoples and 19.6% as Asian.

Among New Zealand NICU admissions registered to the ANZNN, 348 were from multiple births representing 13.5% of ANZNN admissions in New Zealand in 2023.

Male babies were also over-represented among NICU admissions in New Zealand – 57.6% of the New Zealand registrants compared to 51.7% of total live births in New Zealand (Statistics New Zealand 2024).

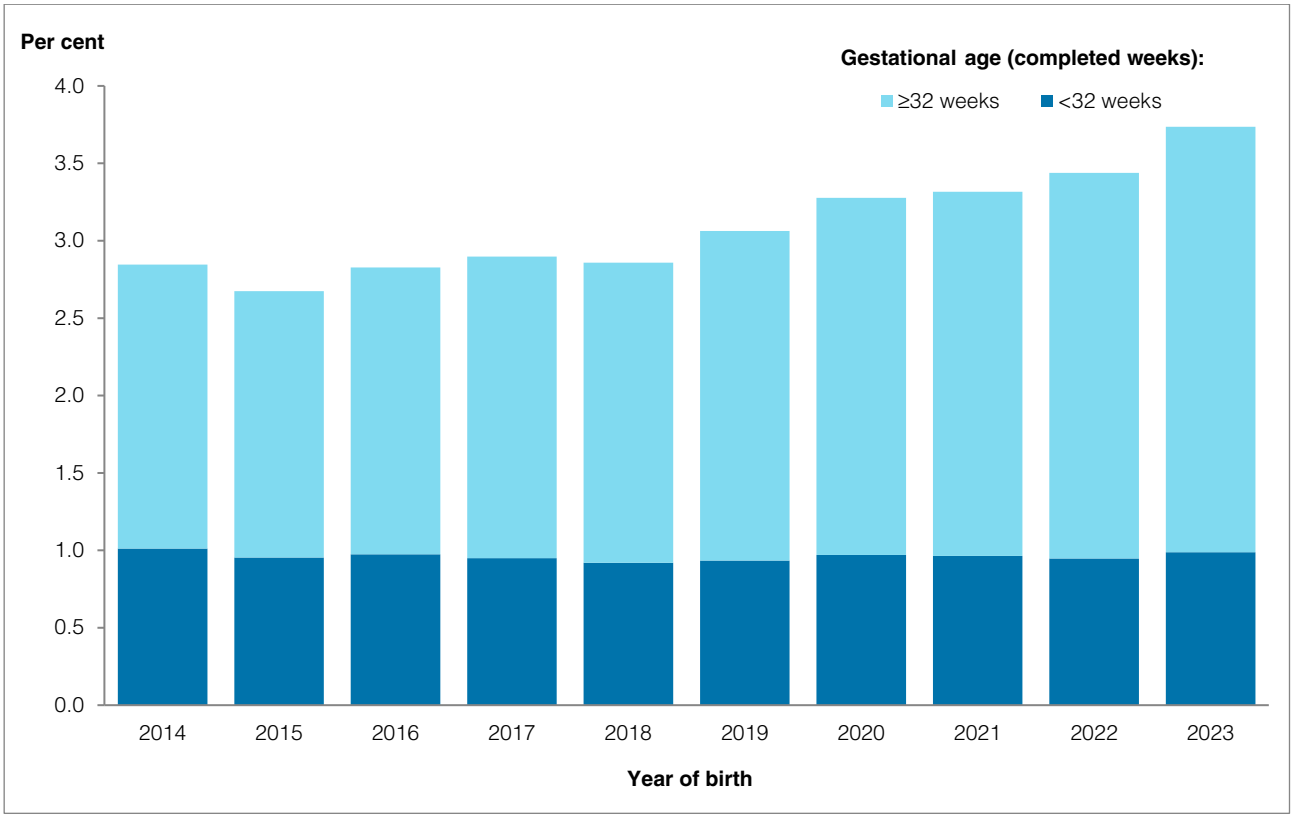
Assisted ventilation (IPPV, CPAP or NHF) was given to 2,565 babies representing 4.5% of all live births with 1,999 babies receiving non-invasive ventilation (CPAP or NHF) as the only form of respiratory assistance (3.5% of all live births).

2. Babies registered to level III units

This section includes data on the ANZNN registrants from all 31 level III NICUs in Australia and New Zealand. Registrants also include babies born in other hospitals and transferred to a level III NICU within the first 28 days of life.

Of the babies born in 2023 and admitted to an NICU in Australia and New Zealand, 12,849 fulfilled the registration criteria for inclusion in the ANZNN clinical quality registry. The population represents 3.7% of the 343,953 live births in the two countries in 2023 (Australian Bureau of Statistics 2024; Statistics New Zealand 2024) (Figure 2), compared with 3.4% in 2022. The number of registrants in 2023 was 472 more than in 2022.

FIGURE 2: Proportion of liveborn babies in Australia and New Zealand who were ANZNN level III registrants, by year of birth, ANZNN 2014–2023



Of the 12,849 ANZNN registrants born in 2023, there were 3,400 (26.5%) babies born before 32 weeks gestation and 9,449 babies born at 32 weeks or more (73.5%). Of the registrants born before 32 weeks gestation, 98.7% received assisted ventilation. The major indication for assisted ventilation in this age group was hyaline membrane disease.

The largest level III NICU in Australia and New Zealand registered nearly 1,200 babies in 2023, the smallest just under 30 (Figure 3). The median number of babies registered to an ANZNN unit was 390.

The gestational age at birth and birthweight for babies qualifying for inclusion in the ANZNN 2023 level III audit is set out in Tables 1 and 2 respectively. The number of babies qualifying under each registration criteria is set out in Figure 4, and the 10-year trend (2014–2023) in gestational age at birth is presented in Figure 11 in Appendix 1.

FIGURE 3: Number of level III registrants born at each neonatal intensive care unit, ANZNN 2023

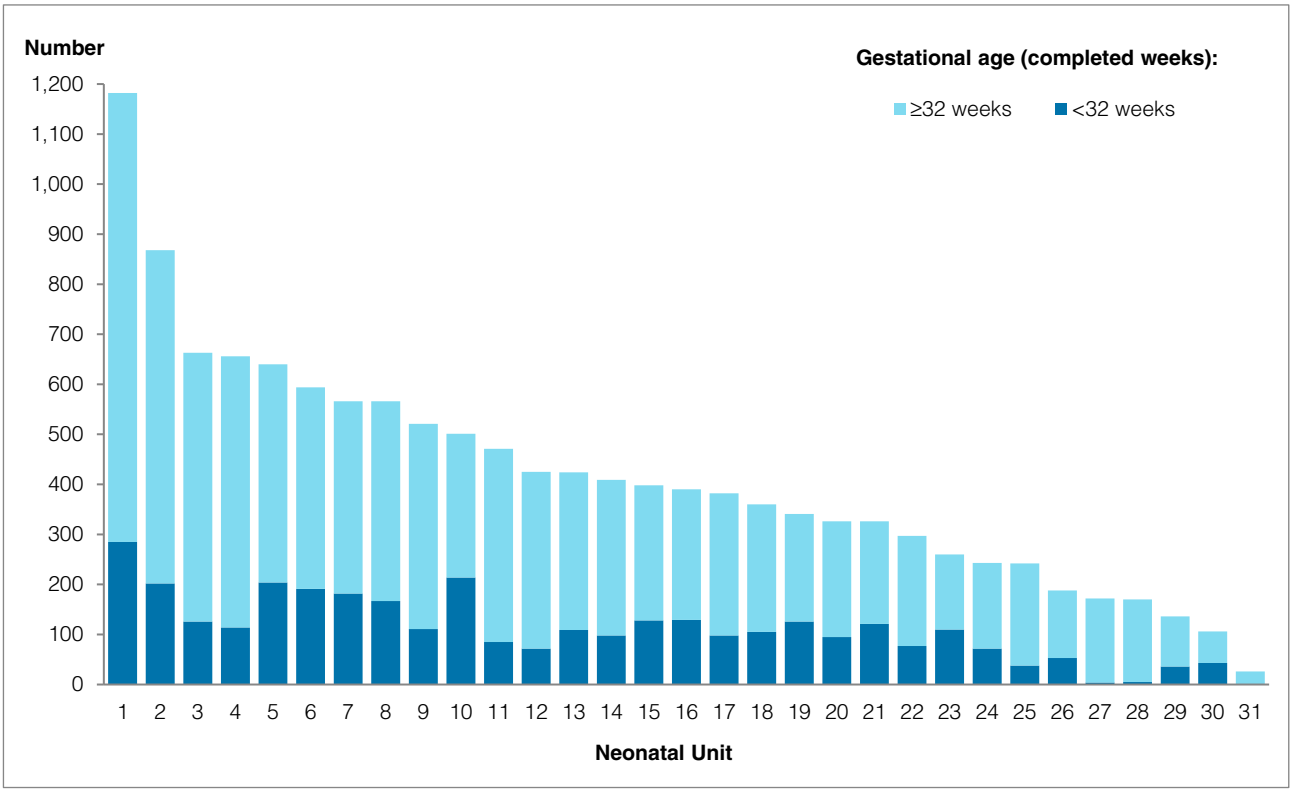


TABLE 1: Level III registrants born at each completed week of gestation, ANZNN 2023

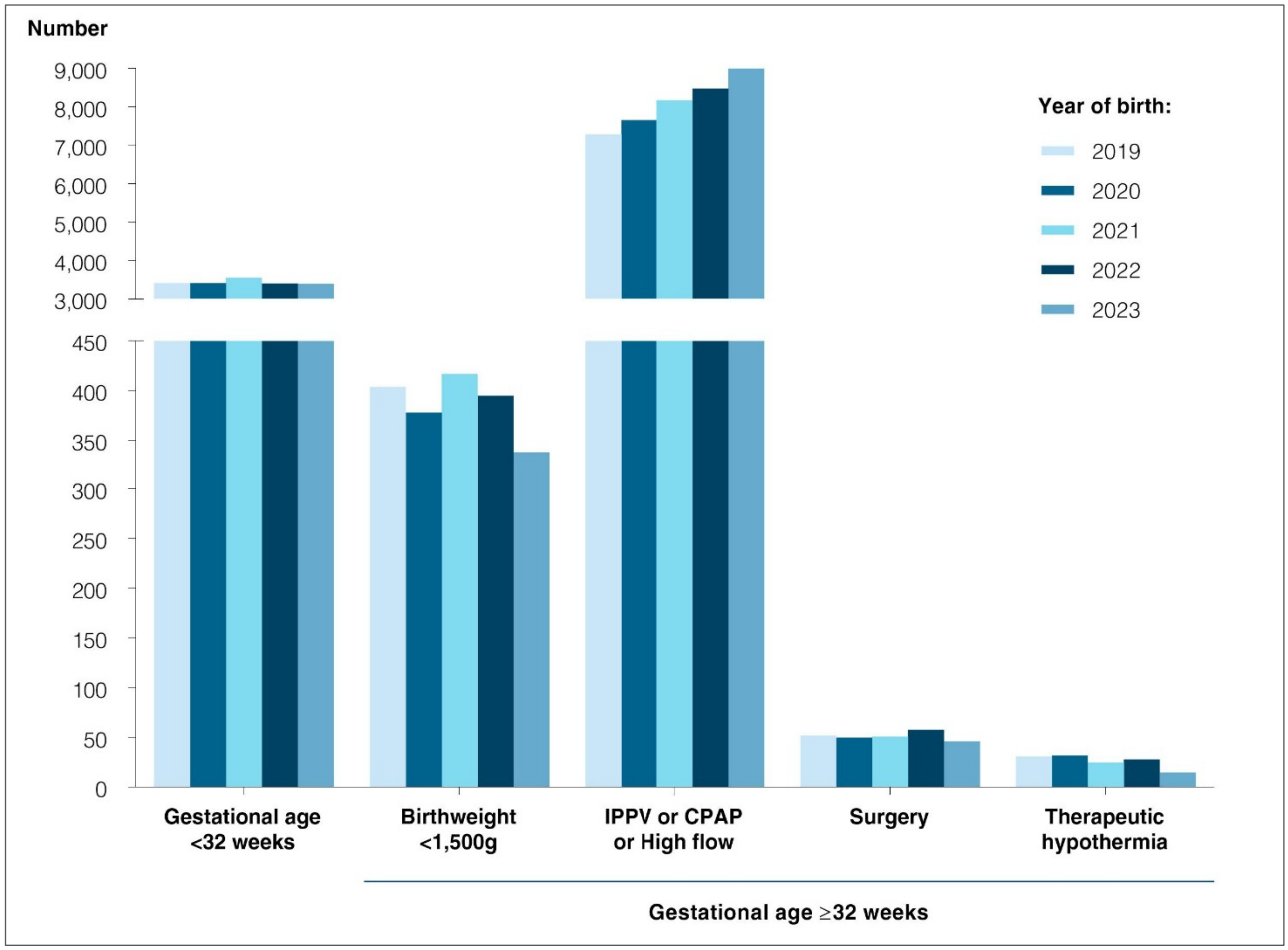
Gestational age (weeks)	Number of babies	Percent	Cumulative percent
<24	140	1.1	1.1
24	174	1.4	2.4
25	245	1.9	4.4
26	269	2.1	6.4
27	337	2.6	9.1
28	432	3.4	12.4
29	488	3.8	16.2
30	594	4.6	20.8
31	721	5.6	26.5
All babies <32 weeks	**3,400**	**26.5**	
32	797	6.2	32.7
33	761	5.9	38.6
34	823	6.4	45.0
35	754	5.9	50.9
36	911	7.1	58.0
37	1,162	9.0	67.0
38	1,235	9.6	76.6
39	1,421	11.1	87.7
40	971	7.6	95.2
41	545	4.2	99.5
≥42	69	0.5	100.0
Total	**12,849**	**100.0**	

Note: *Gestational ages ≥42 weeks have been combined to maintain confidentiality of small numbers.*

TABLE 2: Level III registrants in each birthweight group, ANZNN 2023

Birthweight (grams)	Number of babies	Percent	Cumulative percent
<500	57	0.4	0.4
500–599	137	1.1	1.5
600–699	231	1.8	3.3
700–799	241	1.9	5.2
800–899	246	1.9	7.1
900–999	278	2.2	9.3
1,000–1,099	286	2.2	11.5
1,100–1,199	337	2.6	14.1
1,200–1,299	320	2.5	16.6
1,300–1,399	383	3.0	19.6
1,400–1,499	404	3.1	22.7
All babies <1,500g birthweight	**2,920**	**22.7**	
1,500–1,999	1,772	13.8	36.5
2,000–2,499	1,662	12.9	49.5
2,500–2,999	1,759	13.7	63.1
3,000–3,499	2,104	16.4	79.5
3,500–3,999	1,691	13.2	92.7
≥4,000	941	7.3	100.0
Total	**12,849**	**100.0**	

FIGURE 4: Level III registrants by registration criteria, ANZNN 2019–2023



Note: *Babies are assigned to the first registration criteria that they meet in the following order: (i) gestational age <32 weeks, (ii) birthweight <1,500g, (iii) received 4 or more hours of IPPV, CPAP or high flow, (iv) received major surgery, (v) received therapeutic hypothermia.*

3. Mothers of level III registrants

Maternal age

While there are many determinants of perinatal outcome, an important one is maternal age. In 2023, the age of mothers of neonates registered as high-risk ranged from less than 16 years to over 50 years. The highest proportion of registrant mothers was aged 30–34 years (33.6%) followed by mothers aged 35–39 years (23.4%). Together they accounted for nearly three in five of the mothers (57.0%) of ANZNN registrants in 2023 (Table 3). In 2023, the proportion of babies born to teenage mothers increased slightly from 2022, and those born to mothers in the 35–39 age group increased slightly, from 22.7% in 2022 to 23.4%.

Nearly two in five of the babies born to teenage mothers (36.9%) were born at less than 32 weeks completed gestation, while 24.8% of babies born to mothers 30–34 years were less than 32 weeks gestation at birth (Table 3).

TABLE 3: Age group of mothers of level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)								
Maternal age (years)	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
					Number				
Less than 20	11	11	19	36	29	31	55	95	287
20–24	22	54	78	115	129	144	222	602	1,366
25–29	34	87	151	188	282	332	565	1,230	2,869
30–34	37	146	172	264	436	505	852	1,838	4,250
35–39	27	93	145	209	328	376	565	1,218	2,961
40 and over	9	26	37	94	96	146	198	317	923
Not stated	0	2	4	14	15	24	31	103	193
Total	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
Less than 20	7.9	2.6	3.2	4.0	2.2	2.0	2.2	1.8	2.3
20–24	15.7	12.9	13.0	12.7	9.9	9.4	9.0	11.4	10.8
25–29	24.3	20.9	25.1	20.8	21.7	21.6	23.0	23.2	22.7
30–34	26.4	35.0	28.6	29.1	33.5	32.9	34.7	34.7	33.6
35–39	19.3	22.3	24.1	23.1	25.2	24.5	23.0	23.0	23.4
40 and over	6.4	6.2	6.1	10.4	7.4	9.5	8.1	6.0	7.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: *Not stated data are excluded from per cent calculations.*
Maternal data for babies of a multiple birth are presented for each registrant.

Previous antenatal history

A previous preterm delivery was reported by 1,117 (8.7%) mothers of babies registered to ANZNN in 2023 while 329 mothers (2.6%) reported a previous perinatal loss.

Assisted conception

Assisted conception refers to any medically assisted infertility treatment used in the pregnancy. Types of infertility treatment include ovulation induction, in vitro fertilisation (IVF), intrauterine insemination and other infertility treatments not already mentioned.

There were 1,215 (9.5%) pregnancies resulting from assisted conception in the ANZNN 2023 cohort with most (87.8%) following IVF treatment. Of the pregnancies resulting from assisted conception, 60.2% of the mothers were more than 34 years of age at the time of giving birth, compared with 53.9% in 2022.

Presenting antenatal problem

Many mothers of ANZNN registrants were admitted to hospital with complications prior to the baby's birth. The presenting antenatal problem refers to the antenatal complication that led to the baby's birth and subsequent admission to an NICU. There may be other complications related to this pregnancy, but they are not reported here. Information about the presenting antenatal problem was available for 99.5% of 2023 ANZNN registrants. The mothers of one in six registrants (17.0%) presented with preterm labour while fetal distress (13.9%) was the second highest presenting antenatal problem (Table 4).

The maternal antenatal complications for registrants born at 37–44 weeks, 32–36 weeks and less than 32 weeks gestational age are set out in Figure 5. For women who gave birth before 32 weeks gestation and women who gave birth at 34–36 weeks gestation, the most common presenting antenatal problem was preterm labour (32.2% and 26.8% respectively) followed by preterm pre-labour rupture of membranes (21.4% and 15.1% respectively).

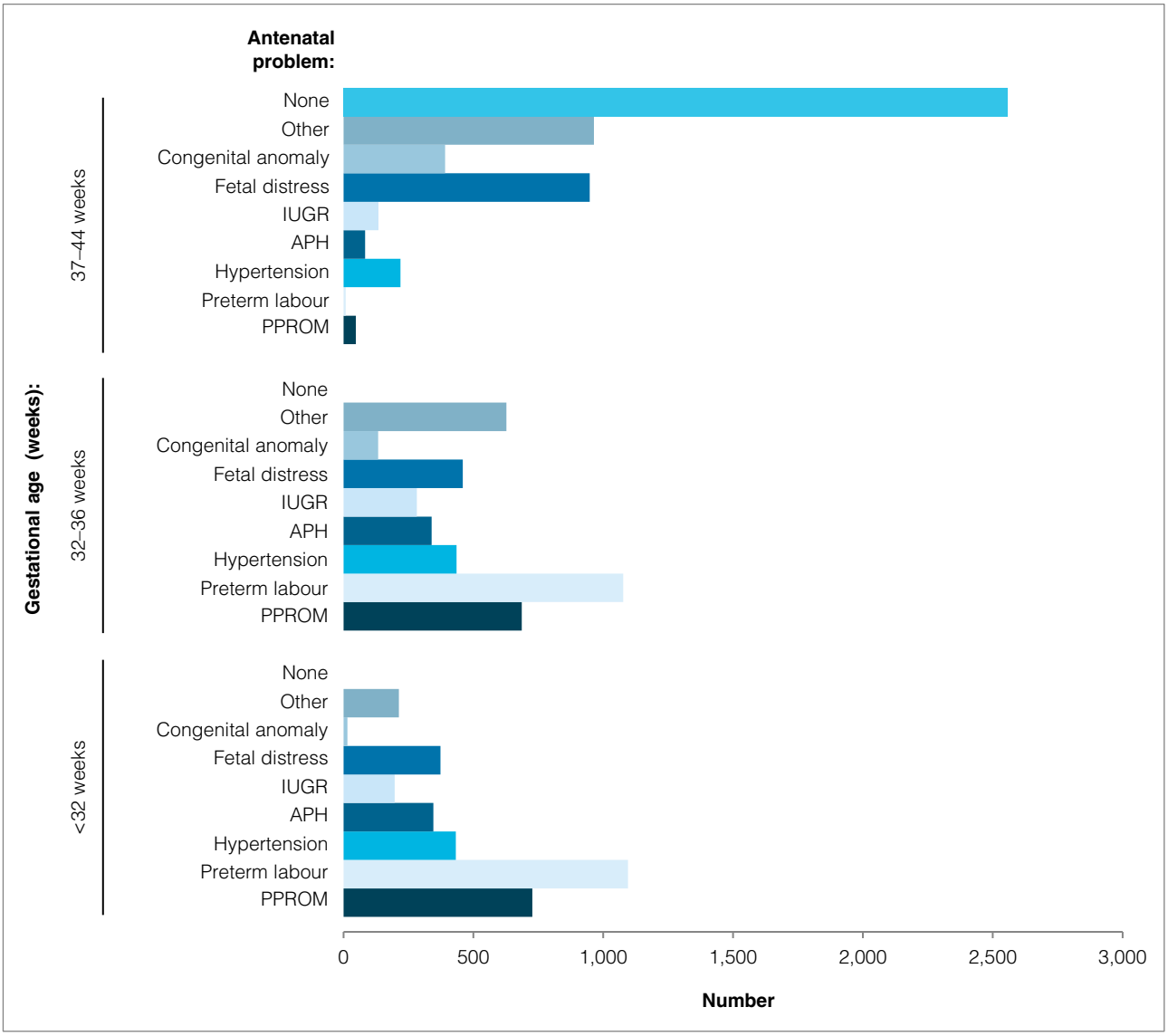
Overall 79.6% of mothers of registrants had a pregnancy complication recorded. Among women who gave birth at term, nearly half (47.3%) were recorded as having no maternal presenting antenatal problem.

TABLE 4: Mother's presenting antenatal problem for level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)								
Presenting antenatal problem	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
					Number				
No antenatal problems	0	0	0	0	0	0	0	2,557	2,557
Preterm pre-labour rupture of membranes	34	124	122	186	261	311	375	47	1,460
Preterm labour	80	155	201	283	376	412	665	8[(a)]	2,180
Hypertension in pregnancy	<5	23	74	129	202	n.p.	235	219	1,086
Antepartum haemorrhage	13	56	80	82	115	162	177	83	768
Intrauterine growth restriction	0	15	30	59	93	110	172	134	613
Fetal distress	<5	n.p.	n.p.	121	165	171	288	948	1,780
Other problem	7	25	32	54	95	165	462	964	1,804
Congenital anomalies	0	<5	<5	5	8	n.p.	108	391	539
Not stated	0	1	0	1	0	2	6	52	62
Total	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
No antenatal problems	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.8	20.0
Preterm pre-labour rupture of membranes	24.3	29.7	20.1	20.2	19.8	20.0	15.1	0.9	11.4
Preterm labour	57.1	37.1	33.2	30.8	28.6	26.5	26.8	0.1	17.0
Hypertension in pregnancy	n.p.	5.5	12.2	14.0	15.4	n.p.	9.5	4.1	8.5
Antepartum haemorrhage	9.3	13.4	13.2	8.9	8.7	10.4	7.1	1.6	6.0
Intrauterine growth restriction	0.0	3.6	5.0	6.4	7.1	7.1	6.9	2.5	4.8
Fetal distress	n.p.	n.p.	n.p.	13.2	12.5	11.0	11.6	17.7	13.9
Other problem	5.0	6.0	5.3	5.9	7.2	10.6	18.6	18.0	14.1
Congenital anomalies	0.0	n.p.	n.p.	0.5	0.6	n.p.	4.4	7.3	4.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
(a) These mothers presented with preterm labour, then went on to deliver at term.
Note: *Not stated data are excluded from per cent calculations.*
Maternal data for babies of a multiple birth are presented for each registrant.

FIGURE 5: Presenting antenatal problem for mothers of level III registrants by gestational age, ANZNN 2023



Note: *Maternal data for babies of a multiple birth are presented for each registrant.*
PPROM = preterm pre-labour rupture of membranes. APH = antepartum haemorrhage. IUGR = intrauterine growth restriction.

Antenatal corticosteroid use

Corticosteroids given to the mother during the antenatal period, via any route at a time likely to enhance fetal maturation, are recorded for ANZNN registrants.

Since 1997, consideration has been given to administering maternal antenatal corticosteroids before the 34th completed week of gestation with the aim of improving neonatal outcomes by enhancing newborns' maturation. The preferred regimen is more than one dose of antenatal corticosteroids, with the first dose given more than 24 hours and less than eight days before the baby's birth.

Table 5 presents antenatal corticosteroids use for mothers of ANZNN registrants in each gestational age group. In 2023, 88.7% of mothers of ANZNN registrants born before 34 weeks of gestation received one or more doses of antenatal corticosteroids, leaving 11.3% of mothers of registrants in this group who did not report receiving any antenatal corticosteroids. Of the mothers who received antenatal corticosteroids, 15.4% received them more than seven days prior to giving birth.

For mothers of ANZNN registrants born before 32 weeks of gestation, 90.9% received one or more doses of antenatal corticosteroids and 9.1% mothers of registrants in this group were not reported as receiving any antenatal corticosteroids. Of the mothers who received antenatal corticosteroids, 15.1% received them more than seven days prior to giving birth (Table 5). The 10-year trend (2014–2023) for maternal corticosteroids is represented by Figure 12 in Appendix 1.

TABLE 5: Antenatal corticosteroid use for mothers of level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)								
Antenatal corticosteroids	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
					Number				
None	7	30	49	81	127	234	1,531	4,612	6,671
Incomplete course	n.p.	110	170	243	357	457	212	n.p.	1,616
Complete course within 7 days of birth	75	235	294	467	620	640	396	29	2,756
Given >7 days prior to birth	<5	41	93	126	204	210	235	n.p.	958
Not stated	1	3	0	3	7	17	114	703	848
Total	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
None	5.0	7.2	8.1	8.8	9.7	15.2	64.5	98.1	55.6
Incomplete course	n.p.	26.4	28.1	26.5	27.3	29.7	8.9	n.p.	13.5
Complete course within 7 days of birth	54.0	56.5	48.5	50.9	47.4	41.5	16.7	0.6	23.0
Given >7 days prior to birth	n.p.	9.9	15.3	13.7	15.6	13.6	9.9	n.p.	8.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not stated data are excluded from per cent calculations.*
Maternal data for babies of a multiple birth are presented for each registrant.

Magnesium sulphate

Babies born at less than 32 weeks gestation are at high risk of neurologic injury during labour and immediately after birth. Antenatal administration of magnesium sulphate ($MgSO_4$) to very preterm babies has been demonstrated to provide neuroprotection (Crowther et al 2003, Rouse 2009, Conde-Agudelo and Romero 2009).

For mothers of ANZNN registrants born at less than 32 weeks of gestation, 61.7% were given antenatal $MgSO_4$ (Table 6).

TABLE 6: Magnesium sulphate use for mothers of level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)									
Magnesium sulphate	**<24**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**Total**
						Number				
None	22	35	35	46	60	78	134	352	519	1,281
Given but stopped before 24 hours	7	9	12	10	15	12	14	15	9	103
Given within 24 hours	91	99	157	168	199	274	260	196	158	1,602
Given but details unknown	19	25	39	43	59	66	73	18	20	362
Not stated	1	6	2	2	4	2	7	13	15	52
Total	**140**	**174**	**245**	**269**	**337**	**432**	**488**	**594**	**721**	**3,400**
						Per cent				
None	15.8	20.8	14.4	17.2	18.0	18.1	27.9	60.6	73.5	38.3
Given but stopped before 24 hours	5.0	5.4	4.9	3.7	4.5	2.8	2.9	2.6	1.3	3.1
Given within 24 hours	65.5	58.9	64.6	62.9	59.8	63.7	54.1	33.7	22.4	47.8
Given but details unknown	13.7	14.9	16.0	16.1	17.7	15.3	15.2	3.1	2.8	10.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: *Not stated data are excluded from per cent calculations.*
Maternal data for babies of a multiple birth are presented for each registrant.

Multiple gestation

Multiple gestation pregnancies are often associated with labour and delivery complications, an increased risk of premature birth, low birthweight infants as well as an increased risk of perinatal mortality and morbidity. In 2023, 15.5% of ANZNN registrants were reported as being from a multiple gestation pregnancy, and of these, the greatest percentage were twins (95.0%). Of the 2023 ANZNN registrants from multiple gestation pregnancies, 43.5% were born before 32 weeks gestation and 94.2% were born before 37 weeks gestation (Table 7). The 10-year trend (2014–2023) for multiple gestation pregnancies is represented by Figure 13 in Appendix 1.

TABLE 7: Plurality of level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)								
Plurality	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
					Number				
Singletons	n.p.	313	471	679	968	1,080	1,956	n.p.	10,855
Twins	36	106	124	233	325	435	521	114	1,894
Triplets and higher orders	<5	0	11	8	22	43	11	<5	100
Total	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
Singletons	n.p.	74.7	77.7	73.8	73.6	69.3	78.6	n.p.	84.5
Twins	25.7	25.3	20.5	25.3	24.7	27.9	20.9	2.1	14.7
Triplets and higher orders	n.p.	0.0	1.8	0.9	1.7	2.8	0.4	n.p.	0.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.

Method of birth

Data on method of birth are presented for each baby. Method of birth can be dependent upon gestational age, presenting part of the baby and maternal factors. For three in five (62.7%) of the 2023 registrants, the method of birth was caesarean section with 64.6% of caesarean sections occurring before the onset of labour. Nearly one-third of registrants (30.3%) were non-instrumental vaginal births (Table 8). The rate of birth by caesarean section has gradually increased from 49.8%, since the first data collection in 1995, to 62.7% in 2023.

The most common method of birth for registrants born before 24 weeks gestation was non-instrumental vaginal birth (60.0%) (Table 8). The 10-year trend (2014–2023) for method of birth is represented by Figure 14 in Appendix 1.

TABLE 8: Method of birth for level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)								
Method of birth	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
					Number				
Vaginal birth	n.p.	148	158	244	307	390	n.p.	1,937	3,879
Vaginal instrumental birth	<5	8	10	10	36	56	n.p.	656	897
Caesarean section in labour	28	113	166	235	304	286	481	1,234	2,847
Caesarean section no labour	27	150	270	430	664	825	1,269	1,557	5,192
Not stated	0	0	2	1	4	1	7	19	34
Total	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
Vaginal birth	n.p.	35.3	26.2	26.6	23.4	25.0	n.p.	36.0	30.3
Vaginal instrumental birth	n.p.	1.9	1.7	1.1	2.7	3.6	n.p.	12.2	7.0
Caesarean section in labour	20.0	27.0	27.5	25.6	23.2	18.4	19.4	22.9	22.2
Caesarean section no labour	19.3	35.8	44.7	46.8	50.6	53.0	51.1	28.9	40.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not stated data are excluded from per cent calculations.*

Place of birth

In line with standard clinical practice guidelines, clinicians endeavour to have all births at less than 33 weeks gestation occur in a perinatal centre equipped with an NICU. In 2023, 81.3% of all babies and 90.1% of babies less than 32 weeks gestation at birth were born in a tertiary centre equipped with an NICU; 17.5% of all ANZNN registrants were born in a non-tertiary hospital; while 1.3% of registrants were not born in a hospital (Table 9).

TABLE 9: Level of hospital of birth for level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)								
Level of birth hospital	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
					Number				
Tertiary hospital	127	384	553	827	1,169	1,330	1,995	4,050	10,435
Non-tertiary hospital	13	30	n.p.	83	n.p.	213	473	1,239	2,241
Not born in a hospital[(a)]	0	5	<5	9	<5	13	19	111	164
Not stated	0	0	0	1	2	2	1	3	9
Total	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
Tertiary hospital	90.7	91.6	91.3	90.0	89.0	85.5	80.2	75.0	81.3
Non-tertiary hospital	9.3	7.2	n.p.	9.0	n.p.	13.7	19.0	22.9	17.5
Not born in a hospital[(a)]	0.0	1.2	n.p.	1.0	n.p.	0.8	0.8	2.1	1.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
(a) These babies were either born before arrival to hospital or born at home.
Note: *Not stated data are excluded from per cent calculations.*

Transport after birth to a level III NICU

Transport after birth to a level III NICU is required if there is insufficient time before birth to allow the mother to be transferred to a tertiary centre, if a cot is not available in the hospital of birth or if the hospital of birth is unable to manage the degree of immaturity and/or compromise of the newborn.

In 2023, 20.8% of ANZNN registrants were transferred to an NICU after birth. Of these the greatest percentage (88.3%) were transported by a specialist team with 6.7% transported by a non-specialist team (Table 10). The 10-year trend (2014–2023) for mode of transport to a level III NICU is represented by Figure 15 and Figure 16 in Appendix 1.

TABLE 10: Mode of transport to level III NICU after birth for level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)								
Mode of Transport	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
					Number				
Not transported	127	383	550	816	1,157	1,291	1,895	3,774	9,993
Specialist retrieval team	n.p.	22	48	85	130	224	n.p.	1,309	2,318
Non-specialist team	<5	7	<5	<5	8	10	27	116	176
Other	0	6	<5	n.p.	13	13	n.p.	63	132
Not stated	0	1	1	4	7	20	56	141	230
Total	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
Not transported	90.7	91.6	90.9	89.1	88.5	83.9	77.9	71.7	79.2
Specialist retrieval team	n.p.	5.3	7.9	9.3	9.9	14.6	n.p.	24.9	18.4
Non-specialist team	n.p.	1.7	n.p.	n.p.	0.6	0.7	1.1	2.2	1.4
Other	0.0	1.4	n.p.	n.p.	1.0	0.8	n.p.	1.2	1.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not stated data are excluded from per cent calculations.*

Breastfeeding at discharge

Data on breastfeeding at discharge were available for 99.0% of the babies born at less than 32 weeks gestation and/or less than 1,500 grams at birth who survived to discharge to home. Among registrants who provided data on breastfeeding, 72.7% were breastfed at discharge. The rate of breastfeeding at discharge of surviving extremely preterm babies (born at less than 28 weeks gestation) was 66.2% compared to 74.9% for surviving very preterm babies (born at least 28 weeks and less than 32 weeks gestation).

4. Characteristics of level III registrants

Sex of baby

Male births exceeded female births in Australia and New Zealand and accounted for 51.4% of combined live births in both countries in 2023 (Australian Bureau of Statistics 2024; Statistics New Zealand 2024). The percentage was higher among ANZNN registrants with male births representing 58.9%. For registrants born at less than 32 weeks gestation, 56.2% were male; of births at term, 60.7% were male.

Resuscitation in delivery suite

The type of resuscitation given to babies immediately after birth ranges from the least severe, suction to the most severe, external cardiac massage and ventilator support. For the purpose of this audit, the ANZNN only collected data on babies on whom endotracheal intubation was performed; in 2023, 11.1% of registrants were intubated in the delivery suite to establish independent respiration and heart rate. For babies born before 32 weeks the percentage was 24.6% and for babies born at term the percentage was 7.1%.

Apgar score at birth

The Apgar score gives a clinical indication of a baby's condition immediately after birth. It is a numerical score based on five characteristics: heart rate, respiratory condition, muscle tone, reflexes and colour with a maximum possible score of 10. A low score (less than 4) at one minute of age indicates a baby is considerably compromised and requires specialised resuscitation.

An Apgar score of less than 4 at one minute of age was recorded for 16.6% of ANZNN registrants, with 3.8% of registrants recording an Apgar score of less than 4 at five minutes of age. Among the babies who had low Apgar scores of less than 4 at one minute, 33.1% of babies were born at less than 32 weeks and 42.5% were born at term (Table 11).

TABLE 11: Apgar scores at birth for level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)								
Apgar score	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
				Apgar score at 1 minute					
Median	4	5	6	6	7	7	8	8	**7**
IQR	2–5	3–6	3–7	5–8	5–8	5–9	6–9	5–9	**5–9**
				Apgar score at 5 minutes					
Median	6	7	8	8	9	9	9	9	**9**
IQR	4.5–8	6–8	6–9	7–9	8–9	8–9	7–9	7–9	**7–9**

Note: *IQR = Interquartile range*

Admission temperature

The body temperature at admission to the NICU, or temperature nearest to admission to the registration unit, was reported for 94.5% of ANZNN registrants in 2023. The rectal temperature is preferred; however, if it is not available the axilla temperature is recorded.

For babies born before 32 weeks gestation, the admission temperature together with the base excess, sex, gestation and birthweight is used to calculate the Clinical Risk Index for Babies (CRIB) II score. The CRIB II score is a risk-adjustment instrument widely used in NICUs to measure initial illness severity and is a predictor of survival until discharge.

The median temperature at admission to the NICU was 36.7°C; the median temperature increased slightly with increasing gestational age at birth. The lowest median temperature recorded was 36.5°C by the youngest babies, i.e. those born at less than 24 weeks gestation (Table 12).

TABLE 12: Admission body temperature for level III registrants by gestational age, ANZNN 2023

Gestational age (weeks)	Number of babies	Temperature (°C)	
		Median	Interquartile range
<24	140	36.5	35.9–37.1
24–25	419	36.7	36.2–37.2
26–27	606	36.8	36.4–37.2
28–29	920	36.8	36.4–37.1
30–31	1,315	36.7	36.4–37.0
32–33	1,558	36.6	36.3–37.0
34–36	2,488	36.6	36.3–36.9
37–44	5,403	36.7	36.4–37.1
Total	**12,849**	**36.7**	**36.4–37.0**

Indication for respiratory support

In 2023, only 1.5% of all ANZNN registrants did not receive any form of respiratory support. For the remaining registrants, non-specific respiratory distress was the most common indication for respiratory support at 40.6%. Hyaline membrane disease (HMD) accounted for 37.1% of babies, while meconium aspiration and congenital anomalies each accounted for 3.3% (Table 13).

For babies born before 37 weeks gestation, HMD (58.4%) remained the most common indication for respiratory support. For babies born at term, non-specific respiratory distress (54.1%) was the most common indication followed by meconium aspiration syndrome (7.8%) (Table 13). The 10-year trend (2014–2023) for mode of assisted ventilation is represented by Figure 17 in Appendix 1.

TABLE 13: Indication for respiratory support for level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)								
Indication for respiratory support	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
					Number				
No respiratory support	0	0	0	<5	43	52	38	n.p.	193
Non-specific respiratory distress	<5	n.p.	42	93	277	561	1,300	2,910	5,205
Hyaline membrane disease	136	394	552	796	930	822	715	415	4,760
Meconium aspiration syndrome	0	0	0	0	0	<5	n.p.	417	428
Pneumonia	0	0	0	0	0	<5	n.p.	195	211
Persistent pulmonary hypertension	0	<5	<5	<5	5	<5	41	175	233
Apnoea	<5	<5	<5	<5	14	20	46	90	180
Congenital anomaly	0	0	<5	10	n.p.	25	74	303	425
Other	0	1	3	12	33	52	129	403	633
Peri-surgery	0	0	<5	0	<5	9	79	n.p.	314
Newborn encephalopathy	0	0	0	0	<5	5	n.p.	188	231
Not stated	0	0	0	0	0	4	7	25	36
Total	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
No respiratory support	0.0	0.0	0.0	n.p.	3.3	3.3	1.5	n.p.	1.5
Non-specific respiratory distress	n.p.	n.p.	6.9	10.1	21.1	36.1	52.4	54.1	40.6
Hyaline membrane disease	97.1	94.0	91.1	86.5	70.7	52.9	28.8	7.7	37.1
Meconium aspiration syndrome	0.0	0.0	0.0	0.0	0.0	n.p.	n.p.	7.8	3.3
Pneumonia	0.0	0.0	0.0	0.0	0.0	n.p.	n.p.	3.6	1.6
Persistent pulmonary hypertension	0.0	n.p.	n.p.	n.p.	0.4	n.p.	1.7	3.3	1.8
Apnoea	n.p.	n.p.	n.p.	n.p.	1.1	1.3	1.9	1.7	1.4
Congenital anomaly	0.0	0.0	n.p.	1.1	n.p.	1.6	3.0	5.6	3.3
Other	0.0	0.2	0.5	1.3	2.5	3.3	5.2	7.5	4.9
Peri-surgery	0.0	0.0	n.p.	0.0	n.p.	0.6	3.2	n.p.	2.5
Newborn encephalopathy	0.0	0.0	0.0	0.0	n.p.	0.3	n.p.	3.5	1.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not stated data are excluded from per cent calculations.*

Exogenous surfactant

Exogenous surfactant administered to babies with moderate to severe HMD has been shown to reduce the severity of the disease, the ventilation requirements and the risk of air leaks. Exogenous surfactant can be administered for both prevention and cure. For babies born at less than 31 weeks gestation, most benefit is gained by early administration of exogenous surfactant (within two hours of birth). For babies born at 31 or more weeks gestation, exogenous surfactant is usually only administered to those with a confirmed diagnosis of HMD.

In 2023, nearly a quarter of ANZNN registrants (23.2%) were administered exogenous surfactant (Table 14). Of these, 57.3% received one dose and 35.5% received two doses of surfactant. There were 1,947 babies who received intermittent positive pressure ventilation for HMD in 2023. Exogenous surfactant was given to 1,782 of these babies (91.5%). There were 165 babies diagnosed with HMD who were not given exogenous surfactant.

TABLE 14: Exogenous surfactant use for level III registrants by gestational age, ANZNN 2023

Exogenous surfactant	Gestational age (weeks) <24	24–25	26–27	28–29	30–31	32–33	34–36	37–44	Total
					Number				
None	<5	21	121	425	903	1,236	2,140	n.p.	9,866
Surfactant given	n.p.	398	485	495	412	322	348	n.p.	2,983
▪ via endotracheal tube	130	308	330	302	243	199	248	331	2,091
▪ via catheter	7	77	149	181	162	108	82	33	799
▪ via other or unknown method	<5	13	6	12	7	15	18	n.p.	93
Total	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
None	n.p.	5.0	20.0	46.2	68.7	79.3	86.0	n.p.	76.8
Surfactant given	n.p.	95.0	80.0	53.8	31.3	20.7	14.0	n.p.	23.2
▪ via endotracheal tube	92.9	73.5	54.5	32.8	18.5	12.8	10.0	6.1	16.3
▪ via catheter	5.0	18.4	24.6	19.7	12.3	6.9	3.3	0.6	6.2
▪ via other or unknown method	n.p.	3.1	1.0	1.3	0.5	1.0	0.7	n.p.	0.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not stated data are excluded from per cent calculations.*

Type of assisted ventilation

Assisted ventilation requires specialised nursing, medical and paramedical care and utilises a large component of the available resources. Of the babies registered to the ANZNN in 2023, 98.5% required assisted ventilation for four or more hours.

Two major groups of assisted ventilation are used, those given via endotracheal tube (intermittent positive pressure ventilation (IPPV)) and those without endotracheal tube (continuous positive airway pressure (CPAP), nasal ventilation and nasal high flow (NHF)). For the purposes of this audit, CPAP includes nasal ventilation (CPAP with ventilator breaths). The 10-year trend (2014–2023) for assisted ventilation is represented in Figures 17 to 19 in Appendix 1.

In 2023, IPPV was given for a total of 615,603 hours to ANZNN registrants, CPAP was given for 2,253,927 hours and NHF for 1,349,856 hours. The total number of hours of ventilation equates to each baby receiving 13.7 days of assisted ventilation. The median number of hours of assisted ventilation is inversely related to the gestational age at birth in babies born preterm (Table 15).

The most common form of ventilation given to ANZNN registrants in 2023 remains CPAP with 47.9% of registrants receiving CPAP only, 4.8% receiving NHF only, 5.1% receiving IPPV only and 23.1% received both invasive (IPPV) and non-invasive (CPAP or NHF) ventilation.

In addition to IPPV, CPAP and NHF, babies may have received high frequency oscillatory ventilation (HFOV), nitric oxide or extracorporeal membrane oxygenation (ECMO). For the purposes of this audit, HFOV includes high frequency jet ventilation. HFOV is administered via an endotracheal tube and is usually given in conjunction with IPPV. In 2023, 23.2% of registrants who received IPPV also received HFOV. The use of HFOV among individual units varied between 0.4% and 14.4% with the highest percentage of babies receiving HFOV born at less than 24 weeks (82.7%) followed by babies born at 24–25 weeks gestation (65.2%) (Table 16). The 10-year trend (2014–2023) for HFOV is represented in Figure 20 in Appendix 1.

TABLE 15: Duration of assisted ventilation use for level III registrants by gestational age, ANZNN 2023

Duration of assisted ventilation	Gestational age (weeks)								
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–44	Total
					IPPV (hours)				
Median	503.5	302.5	87.5	36	23	24	44	55	**58**
IQR	164–945	114.5–694.5	22.5–227.5	13–113	9–76	11–72	18–108	22–117	**20–166**
					CPAP (hours)				
Median	1,080	1,188	966	408	107.5	44	25	18	**37**
IQR	711–1,512	757–1,526	647–1,232	167–798	49–208	20–89	12–54	9–36	**14–130**
					NHF (hours)				
Median	528.5	522.5	480	408	220	97	53.5	42	**143**
IQR	367–786.5	336–754	291–710	242–647	119–409	49–197	24.5–113	20–88	**45–408**

Note: *IQR = Interquartile range. IPPV = intermittent positive pressure ventilation. CPAP = continuous positive airway pressure. NHF = nasal high flow.*

In 2023, 36 registrants received ECMO of whom the majority were born at term. The percentage of ANZNN registrants who received nitric oxide was 5.3%. The use of nitric oxide continues to have a U-shaped distribution with the highest percentage of babies to receive nitric oxide born at less than 24 weeks (33.8%) (Table 16). The 10-year trend (2014–2023) for nitric oxide is represented in Figure 21 in Appendix 1.

TABLE 16: Assisted ventilation for level III registrants by gestational age, ANZNN 2023

Ventilation type	Gestational age (weeks)								
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–44	Total
					Number				
Invasive ventilation	139	379	418	383	280	271	481	1,273	3,624
▪ HFOV given	115	247	139	77	48	31	55	167	879
▪ IPPV given	139	379	418	383	280	271	481	1,273	3,624
Nitric oxide given	47	89	63	42	33	22	60	321	677
CPAP given	91	374	588	907	1,231	1,412	2,170	4,387	11,160
NHF given	72	318	517	726	627	445	605	1,523	4,833
Total in each age group	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
IPPV given	99.3	90.5	69.0	41.6	21.3	17.4	19.3	23.6	28.2
CPAP given	65.0	89.3	97.0	98.6	93.6	90.6	87.2	81.2	86.9
NHF given	51.4	75.9	85.3	78.9	47.7	28.6	24.3	28.2	37.6
					Per cent of babies given invasive ventilation				
HFOV given[(a)]	82.7	65.2	33.3	20.1	17.1	11.4	11.4	13.1	24.3
Nitric oxide given[(a)]	33.8	23.5	15.1	11.0	11.8	8.1	12.5	25.2	18.7

(a) Denominator is babies given ventilation via endotracheal tube (IPPV and/or HFOV).
Note: *Groups are not mutually exclusive.*
HFOV = high frequency oscillatory ventilation. IPPV = intermittent positive pressure ventilation. CPAP = continuous positive airway pressure. NHF = nasal high flow.

Ventilation in babies born at less than 32 weeks gestation

The major indication for assisted ventilation in babies born at less than 32 weeks gestation was hyaline membrane disease. Among the 3,400 babies born before 32 weeks gestation, 98.7% were given assisted ventilation in the form of IPPV, CPAP or NHF. For registrants in this age group CPAP was the only form of ventilation for 19.1%, NHF was the only form of ventilation for 0.4% and IPPV was the only form of ventilation for 4.1% of registrants. Both invasive (IPPV) and non-invasive (CPAP or NHF) were given to 42.9% of registrants.

The total duration of IPPV for these very preterm babies was 402,772 hours, the duration of CPAP was 1,797,271 hours and the duration of NHF was 1,067,112 hours.

Of the babies born before 32 weeks gestational age and given IPPV in 2023, 37.5% were given HFOV while 17.1% of these babies were given nitric oxide (Table 16).

Among 2023 ANZNN registrants born at less than 32 weeks gestation, 3,199 (94.1%) survived to day 28. Of these, 64.1% of registrants received respiratory support (airway support or supplemental oxygen therapy) at 28 days of age, with 20.6% of them discharged on home oxygen (Table 17).

Ventilation in babies born at 32 to 36 weeks gestation

Among the babies born at 32–36 weeks gestation, 97.7% received assisted ventilation. Non-specific respiratory distress was the main reason for ventilation. Total duration of IPPV use by registrants in this gestational age group was 76,057 hours, CPAP use was 231,441 hours and 151,261 hours for NHF.

Of the babies born at 32–36 weeks gestation and given IPPV in 2023, 10.4% were given HFOV while 10.9% of these babies were given nitric oxide (Table 16).

Ventilation in babies born at term

The main indication for respiratory support in term babies was non-specific respiratory distress (53.9%). This group required 136,774 hours of IPPV, 225,215 hours of CPAP and 131,483 hours of NHF.

Of the babies born at term and given IPPV in 2023, 12.7% were given HFOV while 25.2% of these babies were given nitric oxide (Table 16). There were 31 babies born at term who received ECMO.

Respiratory support

Respiratory support is critical for the survival of some babies, especially those with respiratory problems and those born prematurely. Babies requiring treatment in a level III unit commonly require long-term respiratory support as part of their specialised care. The duration of respiratory support varies between babies, from as little as a few hours to several weeks or months. For the ANZNN audit, four consecutive hours in any single 24-hour period of CPAP, nasal high flow, IPPV, HFOV or supplemental oxygen therapy constitutes the use of respiratory support on that day. The continued use of respiratory support at 28 days of age is a predictor of postneonatal morbidity and the need for continued oxygen therapy after discharge.

Among the 2023 ANZNN registrants, 12,499 babies survived to day 28 and of these, 19.6% were reported as having received respiratory support on day 28 or later. Of the registrants who received respiratory support on day 28 and survived to discharge to home, 21.1% were discharged on home oxygen (Table 17).

TABLE 17: Respiratory support (airway support or supplemental oxygen therapy) for level III registrants who survived to day 28 by gestational age, ANZNN 2023

Respiratory support (airway support or oxygen)	Gestational age (weeks)								
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–44	Total
					Number				
No respiratory support on day 28	0	<5	8	206	918	n.p.	2,318	5,116	9,961
Respiratory support on day 28	86	n.p.	562	701	374	n.p.	127	200	2,536
▪ survived to discharge home	71	328	543	686	369	142	116	181	2,436
▪ died before discharge	15	n.p.	19	15	5	<5	11	19	100
Not stated	0	0	0	0	0	1	0	1	2
Total in each age group	**86**	**344**	**570**	**907**	**1,292**	**1,538**	**2,445**	**5,317**	**12,499**
					Number				
Respiratory support on day 28 and given home oxygen	47	134	103	92	50	22	23	34	505
					Per cent				
No respiratory support on day 28	0.0	n.p.	1.4	22.7	71.1	n.p.	94.8	96.2	79.7
Respiratory support on day 28	100.0	n.p.	98.6	77.3	28.9	n.p.	5.2	3.8	20.3
▪ survived to discharge home	82.6	95.6	96.6	97.9	98.7	99.3	91.3	90.5	96.1
▪ died before discharge	17.4	n.p.	3.4	2.1	1.3	n.p.	8.7	9.5	3.9
					Per cent				
Respiratory support on day 28 and given home oxygen[(a)]	66.2	40.9	19.0	13.4	13.6	15.5	19.8	18.8	20.7

n.p. Data not published to maintain confidentiality of small numbers.
(a) Denominator is babies who received respiratory support on day 28 and survived to discharge to home.
Note: *Not stated data are excluded from per cent calculations.*

Parenteral nutrition

Intravenous parenteral nutrition is common in very preterm babies because of the need for optimal nutrition from day one when enteral nutrition is difficult, whilst recovery from acute illness or from an intervention occurs, or due to poor weight gain. Of the 3,738 ANZNN registrants born at less than 32 weeks gestation and/or less than 1,500g at birth, 3,377 (90.4%) received parenteral nutrition during admission (Table 18). The median duration of parenteral nutrition reported was 184 hours.

Some babies are discharged home with a nasogastric tube in place to allow gavage or infusion feeding at home. Of those who received parenteral nutrition, 12.1% of babies were discharged home on gavage feeds.

TABLE 18: Parenteral nutrition for level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)										
Parenteral nutrition	**<24**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**≥32[a]**	**Total**
						Number					
Parenteral nutrition	135	n.p.	n.p.	n.p.	n.p.	419	473	505	563	267	3,377
No parenteral nutrition	5	<5	<5	<5	<5	13	15	89	158	69	359
Not stated	0	0	0	0	0	0	0	0	0	2	2
Total	**140**	**174**	**245**	**269**	**337**	**432**	**488**	**594**	**721**	**338**	**3,738**
						Number					
Home gavage feeding	21	n.p.	n.p.	n.p.	n.p.	52	47	49	43	23	407
						Per cent					
Parenteral nutrition	96.4	97.7	99.6	99.3	99.1	97.0	96.9	85.0	78.1	79.5	90.4
No parenteral nutrition	3.6	2.3	0.4	0.7	0.9	3.0	3.1	15.0	21.9	20.5	9.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
						Per cent					
Home gavage feeding[b]	15.6	22.4	17.6	16.9	13.8	12.4	9.9	9.7	7.6	8.6	12.1

n.p. Data not published to maintain confidentiality of small numbers.
(a) These babies were less than 1,500g at birth.
(b) Denominator is babies who received parenteral nutrition.
Note: *Not stated data are excluded from per cent calculations.*

Chronic lung disease

Chronic lung disease (CLD) is a complication of premature lung development and the trauma of early respiratory support (supplemental oxygen and/or assisted ventilation). CLD is currently defined by the ANZNN as a continued need for any form of respiratory support (supplemental oxygen and/or assisted ventilation) at 36 weeks post menstrual age (PMA) (post menstrual age is calculated by adding the baby's age in weeks to the gestational age at birth in weeks).

For ANZNN registrants, 9.3% of babies in 2023 were reported to have had respiratory support at 36 weeks PMA, and of these, 29 (2.4%) died prior to discharge to home. The prevalence of CLD continues to be highest in babies born less than 27 weeks gestation (Table 19). The highest percentage was in those babies born at 24 weeks gestation who survived to 36 weeks PMA. Not all babies survived to 36 weeks PMA and therefore CLD status could not be defined in these babies. The 10-year trend (2014–2023) for CLD is represented by Figure 22 in Appendix 1.

TABLE 19: Chronic lung disease at 36 weeks post menstrual age for level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)									
Chronic lung disease (CLD)	**<24**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**Total**
					Number					
No CLD	<5	7	44	67	146	214	320	433	n.p.	1,813
CLD	n.p.	120	159	174	165	181	135	107	n.p.	1,196
Did not survive to 36 weeks PMA	62	45	37	25	24	12	7	14	9	235
Not stated	0	2	5	3	2	25	26	40	53	156
Total	**140**	**174**	**245**	**269**	**337**	**432**	**488**	**594**	**721**	**3,400**
					Per cent					
No CLD	n.p.	5.5	21.7	27.8	46.9	54.2	70.3	80.2	n.p.	60.3
CLD	n.p.	94.5	78.3	72.2	53.1	45.8	29.7	19.8	n.p.	39.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not stated data and babies who did not survive to 36 weeks PMA are excluded from per cent calculations.*
PMA = Post menstrual age

Of the ANZNN registrants born at less than 32 weeks, 350 (10.3%) babies were treated with systemic corticosteroids. Of these, 311 were reported to have had respiratory support at 36 weeks, while 39 (11.1%) reported no CLD.

Pulmonary air leak

A pulmonary air leak is a collection of air in the space around the lungs which can cause difficulty in breathing. There are several types of pulmonary air leak and while some produce only minor symptoms, a number of them require treatment by the insertion of a drainage tube. For the purposes of this report, the presence of any form of air leak that required drainage (either transient or continuous drainage) is reported for ANZNN registrants (Table 20).

TABLE 20: Pulmonary air leak requiring drainage for level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)								
Air leak	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
					Number				
Air leak	15	27	22	35	24	43	81	221	468
No air leak	125	392	584	885	1,291	1,515	2,407	5,182	12,381
Total	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
Air leak	10.7	6.4	3.6	3.8	1.8	2.8	3.3	4.1	3.6
No air leak	89.3	93.6	96.4	96.2	98.2	97.2	96.7	95.9	96.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Neonatal sepsis

Each episode of sepsis is recorded as either early or late onset. Early onset sepsis is defined as the presence of at least one episode of systemic sepsis where the initial symptoms occurred within the first 48 hours after birth that is, in babies aged from 0 to 47 hours. Late onset sepsis is the presence of at least one episode of systemic sepsis with the initial symptoms occurring among babies aged 48 or more hours. Episodes of sepsis involving the same organism separated by at least 14 days are considered to be new episodes of infection.

Symptomatic, blood culture positive septicaemia was reported in 4.4% of ANZNN registrants in 2023. Of these babies, 50.4% were born at less than 28 weeks gestation, 71.2% were born at less than 32 weeks gestation and 99.6% of registrants survived up to 2 days of life (Table 21). Episodes of both early and late sepsis were reported in several babies. The 5-year trends (2019–2023) for early and late sepsis are represented by Figure 25 and Figure 26 respectively in Appendix 1.

TABLE 21: Neonatal sepsis for level III registrants by gestational age, ANZNN 2023

	Gestational age (weeks)								
Sepsis	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
					Number				
No sepsis	100	286	495	843	1,275	1,535	2,443	5,309	12,286
Sepsis at <48 hrs[a]	<5	10	12	9	n.p.	7	14	44	110
Sepsis at ≥48 hrs[a]	n.p.	124	100	68	n.p.	16	32	50	456
Babies alive on day 2	n.p.	408	599	915	n.p.	1,553	2,474	5,383	12,771
Babies who did not survive to day 2	n.p.	11	7	5	<5	5	14	20	78
Total in each age group	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
No sepsis[b]	71.4	68.3	81.7	91.6	97.0	98.5	98.2	98.3	95.6
Sepsis at <48 hrs[b]	n.p.	2.4	2.0	1.0	n.p.	0.4	0.6	0.8	0.9
Sepsis at ≥48 hrs[c]	n.p.	30.4	16.7	7.4	n.p.	1.0	1.3	0.9	3.6

n.p. Data not published to maintain confidentiality of small numbers.
(a) Groups are not mutually exclusive.
(b) Denominator is all registrants.
(c) Denominator is registrants alive at 48 hours.

Viral infection for the purposes of this audit is defined as the presence of at least one episode of viral infection with initial symptoms occurring following 48 hours after birth. Symptomatic viral infection was reported in 298 (2.3%) of ANZNN registrants in 2023, as identified by isolation or identification of an organism by polymerase chain reaction (PCR) testing, immunofluorescence or similar technology from an appropriate body fluid.

Retinopathy of prematurity

The classification of retinopathy of prematurity (ROP) for ANZNN registrants are those recommended by the Committee for the Classification of Retinopathy of Prematurity (1984). The examination criteria for ROP vary between units within ANZNN. As in previous reports, the prevalence of ROP screening in 2023 was assessed among registrants with a gestational age of less than 31 weeks and/or a birthweight of less than 1,250 grams. Among the 2023 registrants, 22.3% were eligible for ROP examination and of these eligible registrants, 84.2% were examined and had the results of their eye examination recorded.

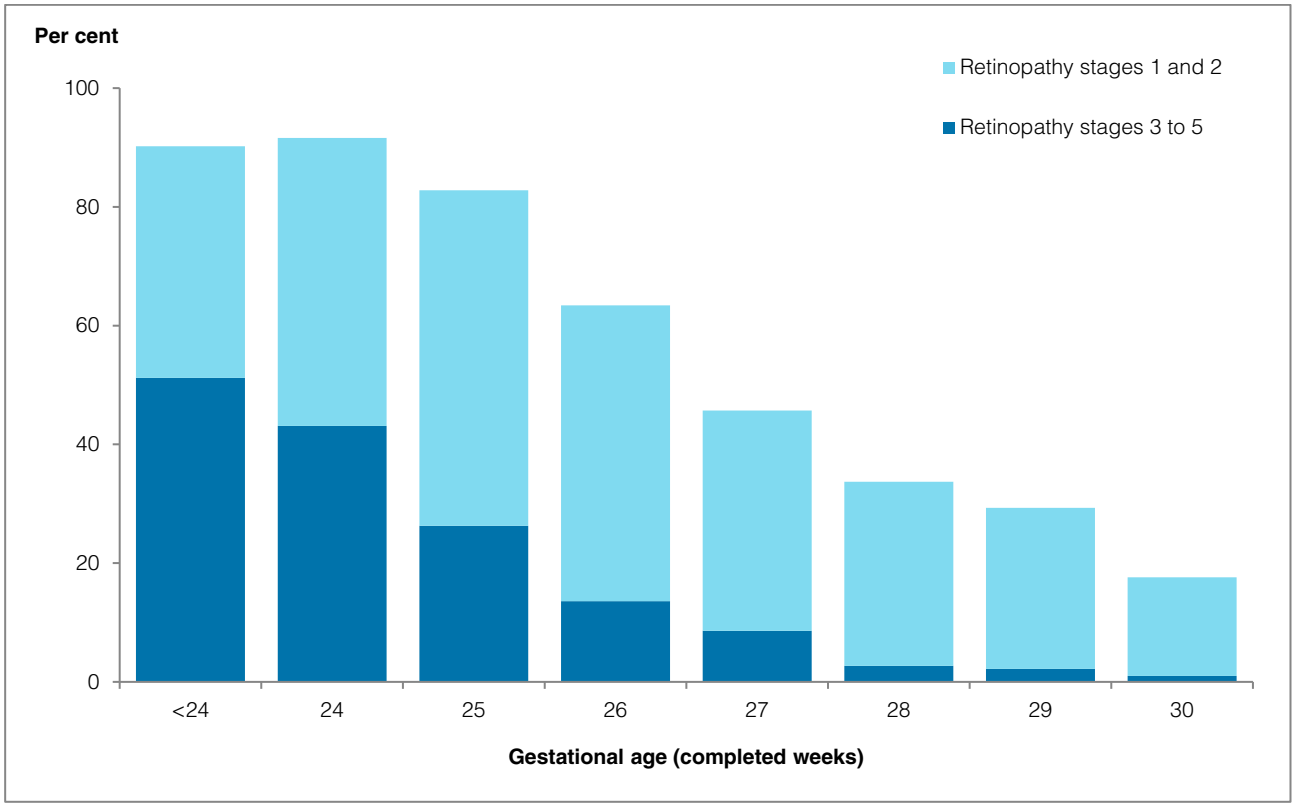
Of those ANZNN registrants who were eligible for an eye examination, 219 died before their ROP status could be determined. Of those examined, 9.9% had stage 3 to 5 ROP (Table 22, Figure 6) and of these babies, 27.6% received surgical treatment and 40.6% received anti-VEGF treatment. The 10-year trend (2014–2023) for stages 3 to 5 ROP and treatment are represented by Figure 23 in Appendix 1.

TABLE 22: Retinopathy of prematurity for level III registrants by gestational age, ANZNN 2023

Retinopathy of prematurity (ROP)	Gestational age (weeks)									
	<24	24	25	26	27	28	29	30	≥31[(a)]	Total
	Number									
No ROP	n.p.	11	36	89	171	274	324	n.p.	125	1,376
Stage 1	<5	n.p.	36	52	54	67	82	56	20	383
Stage 2	28	51	n.p.	n.p.	63	61	42	12	<5	412
Stage 3	42	55	54	32	27	11	10	<5	<5	n.p.
Stage 4 to 5	0	<5	<5	<5	0	0	0	0	0	<5
Not examined	58	44	36	26	22	19	30	183	33	451
Not stated	0	0	0	0	0	0	0	1	0	1
Total	**140**	**174**	**245**	**269**	**337**	**432**	**488**	**594**	**183**	**2,862**
	Per cent									
No ROP	n.p.	8.5	17.2	36.6	54.3	66.3	70.7	n.p.	83.3	57.1
Stage 1	n.p.	n.p.	17.2	21.4	17.1	16.2	17.9	13.7	13.3	15.9
Stage 2	34.1	39.2	n.p.	n.p.	20.0	14.8	9.2	2.9	n.p.	17.1
Stage 3	51.2	42.3	25.8	13.2	8.6	2.7	2.2	n.p.	n.p.	n.p.
Stage 4 to 5	0.0	n.p.	n.p.	n.p.	0.0	0.0	0.0	0.0	0.0	n.p.
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
(a) These babies were less than 1,250g at birth.
Note: *Not stated and not examined data are excluded from per cent calculations.*

FIGURE 6: Retinopathy of prematurity for level III registrants by gestational age, ANZNN 2023



Intraventricular haemorrhage

An initial cerebral ultrasound is generally performed during the first week of life to detect signs of intraventricular haemorrhage (IVH) which is graded according to an internationally recognised method in which severity increases with higher grade (Papile et al. 1978).

There were 3,400 babies born at less than 32 weeks gestation eligible for a cerebral ultrasound, of which 3,338 survived to day 3 and 94.0% had an examination recorded. A normal report was recorded for 75.6% of these 2023 ANZNN registrants.

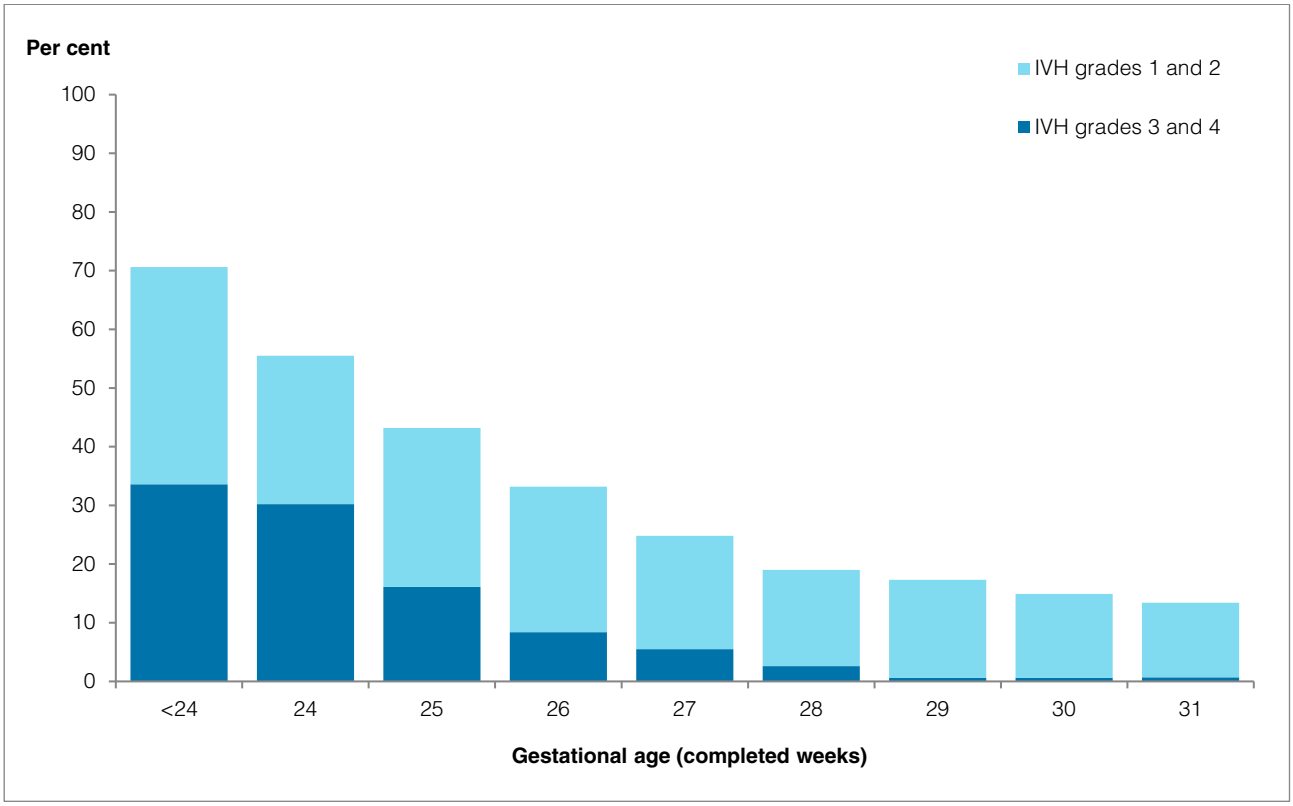
There were 188 babies reported to have grade 3 or 4 IVH representing 5.6% of the babies born before 32 weeks gestation. Of the babies who had a grade 3 IVH, 21.3% were unilateral, while 75.9% of grade 4 IVH cases were unilateral. The incidence of IVH, particularly of severe grades, is shown to be inversely related to gestation. The highest percentage of babies who had grade 4 IVH were born before 26 weeks gestational age, with the majority (69.7%) of these babies born before 25 weeks gestation (Table 23, Figure 7). The 10-year trend (2014–2023) for registrants with grades 3 and 4 IVH who survived to day 3 is represented in Figure 24 in Appendix 1.

TABLE 23: Intraventricular haemorrhage for level III registrants born before 32 weeks and survived to day 3, by gestational age, ANZNN 2023

	Gestational age (weeks)									
Intraventricular haemorrhage	**<24**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**Total**
					Number					
None	35	72	134	175	246	346	390	454	519	2,371
Grade 1	18	25	39	43	41	53	66	60	67	412
Grade 2	26	16	25	22	22	17	13	16	9	166
Grade 3	11	9	8	<5	7	5	<5	<5	<5	47
Grade 4	29	40	30	n.p.	11	6	<5	<5	<5	141
Not examined	1	3	1	2	2	1	14	57	120	201
Total	**120**	**165**	**237**	**264**	**329**	**428**	**486**	**590**	**719**	**3,338**
					Per cent					
None	29.4	44.4	56.8	66.8	75.2	81.0	82.6	85.2	86.6	75.6
Grade 1	15.1	15.4	16.5	16.4	12.5	12.4	14.0	11.3	11.2	13.1
Grade 2	21.8	9.9	10.6	8.4	6.7	4.0	2.8	3.0	1.5	5.3
Grade 3	9.2	5.6	3.4	n.p.	2.1	1.2	n.p.	n.p.	n.p.	1.5
Grade 4	24.4	24.7	12.7	n.p.	3.4	1.4	n.p.	n.p.	n.p.	4.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not examined data are excluded from per cent calculations.*

FIGURE 7: Intraventricular haemorrhage in level III registrants born at less than 32 weeks gestation and survived to day 3, by gestational age, ANZNN 2023



Late cerebral ultrasound

Late cerebral ultrasound data are based on changes seen in brain tissue at the cerebral ultrasound scan nearest to six weeks of age. As noted above there were 3,400 babies born at less than 32 weeks gestation eligible for a cerebral ultrasound, 3,338 survived until day 3 and late ultrasound results were available for 2,422 (72.6%) of these babies. A normal report of no cysts was recorded for 96.7% of these registrants, 1.5% reported porencephalic cysts and 1.8% reported periventricular leukomalacia (PVL) (Table 24). Of the 44 babies who were reported with PVL, 16 had extensive leukomalacia involving two or more of the anterior frontal, posterior frontal, parietal, temporal or occipital regions.

TABLE 24: Late cerebral ultrasound results for level III registrants born before 32 weeks by gestational age, ANZNN 2023

	Gestational age (weeks)									
Cerebral ultrasound results	**<24**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**Total**
					Number					
No cysts	74	103	189	207	n.p.	n.p.	395	389	353	2,337
Porencephalic cysts	<5	6	<5	6	8	<5	<5	<5	<5	37
Periventricular leukomalacia	<5	10	<5	7	<5	8	<5	<5	<5	44
Not stated	59	55	50	49	53	67	87	200	362	982
Total	**140**	**174**	**245**	**269**	**337**	**432**	**488**	**594**	**721**	**3,400**
					Per cent					
No cysts	91.4	86.6	96.9	94.1	n.p.	n.p.	98.5	98.7	98.3	96.7
Porencephalic cysts	n.p.	5.0	n.p.	2.7	2.8	n.p.	n.p.	n.p.	n.p.	1.5
Periventricular leukomalacia	n.p.	8.4	n.p.	3.2	n.p.	2.2	n.p.	n.p.	n.p.	1.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not stated data are excluded from per cent calculations.*

Therapeutic hypothermia

Therapeutic hypothermia is the intentional cooling of an infant to a core temperature of less than 35°C (generally 33–34°C). The evidence in support for controlled hypothermia, initiated before 6 hours of age, as a means of limiting the reperfusion injury that follows perinatal asphyxia in term infants has been evolving over the last 10 years.

Hypothermia begins at the onset of cooling and ends at the onset of warming. Cooling is normally for 72 hours with a period of up to 6 hours of rewarming. In 2023, 359 (5.1%) of the ANZNN registrants born at more than 34 weeks gestation received therapeutic hypothermia, and of these, 82.2% were cooled for at least 72 hours. Of those babies who did not receive cooling for a full 72 hours, information on the principal reason for non-completion of the full 72 hours of therapeutic hypothermia was available for 81.5% of babies.

Necrotising enterocolitis

Necrotising enterocolitis (NEC) is a gastrointestinal disease affecting premature infants that can be life threatening and is a leading cause of mortality and morbidity among infants in NICUs. There is no definitive cause identified for NEC although infection, empirical use of antibiotics for more than five days and enteral artificial formula feeding are thought to be involved. With an early diagnosis, NEC can be treated medically through cessation of feeds, use of parenteral nutrition and antibiotic treatment. If medical treatment is unsuccessful, surgery may be required to remove the affected bowel.

For ANZNN registrants in 2023, the percentage of babies with confirmed NEC was 1.4%. Of these babies, 60.8% were born before 28 weeks gestation with 52.7% of them undergoing surgery, and 25.4% were born between 28–31 weeks gestation with surgery required for 50.0% of them. In total, 44 registrants died from NEC. The number of registrants with confirmed NEC was more than in 2022 (Table 25).

TABLE 25: Necrotising enterocolitis in level III registrants by year of birth, ANZNN 2014–2023

	Year of birth									
Necrotising enterocolitis	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
	Number									
Babies born at <28 weeks										
▪ NEC	64	81	95	108	96	80	92	87	100	110
▪ No NEC	1,039	981	1,124	1,044	1,055	1,102	1,049	1,105	1,028	1,053
▪ Not stated	3	4	2	0	1	0	0	0	1	2
Babies born at 28-31 weeks										
▪ NEC	21	40	37	25	28	30	29	35	33	46
▪ No NEC	2,484	2,383	2,353	2,325	2,252	2,202	2,246	2,329	2,244	2,189
▪ Not stated	2	6	1	1	0	0	0	0	0	0
Babies born at ≥32 weeks										
▪ NEC	26	27	30	27	30	28	17	25	31	25
▪ No NEC	6,515	6,267	6,832	7,153	7,202	7,752	8,101	8,646	8,925	9,422
▪ Not stated	4	9	1	1	3	0	0	0	3	2
Total in each birth year	**10,158**	**9,798**	**10,475**	**10,684**	**10,667**	**11,194**	**11,534**	**12,227**	**12,365**	**12,849**
	Per cent									
NEC <28 weeks[(a)]	5.8	7.6	7.8	9.4	8.3	6.8	8.1	7.3	8.9	9.5
NEC 28-31 weeks[(b)]	0.8	1.7	1.5	1.1	1.2	1.3	1.3	1.5	1.4	2.1
NEC ≥32 weeks[(c)]	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.3	0.3	0.3

(a) Denominator is babies born at <28 weeks.
(b) Denominator is babies born at 28-31 weeks.
(c) Denominator is babies born at ≥32 weeks.
Note: *Not stated data are excluded from per cent calculations.*

Spontaneous intestinal perforation

Spontaneous intestinal perforation is distinct from NEC and usually involves a single perforation of the intestine. In 2023, 61 (0.5%) of ANZNN registrants had a confirmed diagnosis of spontaneous intestinal perforation. Of these, two babies were also reported to have a confirmed NEC diagnosis. Of babies born before 28 weeks gestation, 34 (2.9%) had a confirmed diagnosis of spontaneous intestinal perforation.

Neonatal surgery

The information given in this report includes the registrant's first admission to an NICU before their first discharge home after birth. Babies who were discharged home and re-admitted for surgery during the neonatal period are not included in this audit.

In 2023, there were 1,066 ANZNN registrants who had major surgery, of whom over half (53.2%) were born at term. Of registrants born in a hospital, 79.2% were born in a hospital with tertiary care facilities. Of registrants who had major surgery, 69.7% also had a congenital anomaly present with 61.5% of these diagnosed during the antenatal period. 9.1% had surgery for proven NEC. The median length of stay for survivors was 40 days (Table 26).

TABLE 26: Characteristics of level III registrants who underwent surgery by gestational age, ANZNN 2023

	Gestational age (weeks)								
Characteristics	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
					Number				
Male	8	52	53	33	24	36	104	324	634
Female	10	30	22	24	12	21	70	243	432
Congenital anomaly present	<5	10	19	19	19	35	n.p.	487	743
Congenital anomaly diagnosed antenatally	0	<5	<5	<5	6	25	106	313	457
Proven NEC	11	32	15	15	n.p.	<5	7	5	97
Hospital of birth:									
▪ Tertiary	18	n.p.	69	n.p.	31	43	140	403	838
▪ Non-tertiary	0	<5	5	<5	5	14	34	158	220
Median length of stay for survivors (days)	158	137	115	113	86	58	40	24	40
Died before discharge home	7	14	11	8	<5	<5	10	17	73
Total in each age group	**18**	**82**	**75**	**57**	**36**	**57**	**174**	**567**	**1,066**
					Per cent				
Male	44.4	63.4	70.7	57.9	66.7	63.2	59.8	57.1	59.5
Female	55.6	36.6	29.3	42.1	33.3	36.8	40.2	42.9	40.5
Congenital anomaly present	n.p.	12.2	25.3	33.3	52.8	61.4	n.p.	85.9	69.7
Congenital anomaly diagnosed antenatally	0.0	n.p.	n.p.	n.p.	16.7	43.9	60.9	55.2	42.9
Proven NEC	61.1	39.0	20.0	26.3	n.p.	n.p.	4.0	0.9	9.1
Hospital of birth:									
▪ Tertiary	100.0	n.p.	92.0	n.p.	86.1	75.4	80.5	71.1	78.6
▪ Non-tertiary	0.0	n.p.	6.7	n.p.	13.9	24.6	19.5	27.9	20.6
Died before discharge home	38.9	17.1	14.7	14.0	n.p.	n.p.	5.7	3.0	6.8

n.p. Data not published to maintain confidentiality of small numbers.

The median age of mothers of neonates who received major surgery was 31 years. Within the 2023 surgical cohort, 10.1% of pregnancies resulted from assisted conception, compared with 9.5% in the whole cohort. Of the 2023 ANZNN registrants who received major surgery, gastrointestinal procedures were the most commonly performed (58.4%) followed by cardiac procedures (25.4%).

There were 73 (0.6%) babies born in 2023 who received surgery to repair a gastroschisis before discharge to home. Over half of these babies were male (54.8%) and two in three were born at more than 35 weeks gestation (68.5%). In 2023, 65 babies received surgery to repair a congenital diaphragmatic hernia, of which 53.8% were male and 67.7% were born at more than 37 weeks gestation.

Congenital anomalies

In 2023, 1,403 ANZNN registrants (10.9%) had one or more major congenital anomalies. For registrants who had a major congenital anomaly, 16.0% were born before 32 weeks gestation, 26.8% were born between 32 and 36 weeks gestation and nearly three in five of registrants (57.2%) were born at term.

Of the ANZNN registrants with major congenital anomalies, half (50.2%) were diagnosed during the antenatal period with 7.8% of babies recorded as having a fatal congenital anomaly. A higher proportion of babies with congenital anomalies were male (58.9%).

Transfer from level III NICUs to other units

Once intensive care is no longer required, babies are often 'down' transferred to a level II unit, sometimes referred to as a 'special care baby unit', either within the same hospital or to another hospital for convalescence before discharge home. In 2023, nearly three in ten ANZNN registrants (28.8%) were transferred from a level III NICU to a level II unit in another hospital before discharge home. The ability to down transfer for any level III unit will depend on the availability of receiving level II hospitals and this is a limiting factor in some regions (e.g. South Australia). Two in five registrants (39.5%) transferred from level III to level II or level I units were born at less than 32 weeks gestation compared to 18.6% born at term.

Some level III registrants required transfer to a specialist children's hospital and in 2023 these accounted for 4.3% of registrants. Overall, 64.1% of level III registrants were not transferred after registration (Table 27).

TABLE 27: Transfer after registration of level III registrants by level of destination hospital and gestational age, ANZNN 2023

	Gestational age (weeks)								
Transfer status	**<24**	**24–25**	**26–27**	**28–29**	**30–31**	**32–33**	**34–36**	**37–44**	**Total**
					Number				
Not transferred	89	203	292	378	531	755	1,580	4,356	8,184
Level III hospital	8	38	60	55	70	41	42	50	364
Level II or I hospital	23	109	215	444	678	729	781	692	3,671
Children's hospital	15	59	37	41	35	30	69	257	543
Not stated	5	10	2	2	1	3	16	48	87
Total	**140**	**419**	**606**	**920**	**1,315**	**1,558**	**2,488**	**5,403**	**12,849**
					Per cent				
Not transferred	65.9	49.6	48.3	41.2	40.4	48.6	63.9	81.3	64.1
Level III hospital	17.0	26.7	35.6	48.4	51.6	46.9	31.6	12.9	2.9
Level II or I hospital	5.9	9.3	9.9	6.0	5.3	2.6	1.7	0.9	28.8
Children's hospital	11.1	14.4	6.1	4.5	2.7	1.9	2.8	4.8	4.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: *Not stated data are excluded from per cent calculations.*

Length of stay until discharge home

Factors that influence a baby's length of stay in hospital include gestational age, birthweight and plurality. Preterm and low birthweight babies require more intensive care, lengthening their hospital stay. Extremely preterm babies are usually discharged home by the time they reach 40 weeks corrected age.

In the ANZNN, the length of stay includes all the time the baby spends in hospital, from the first day of their first admission up to and including the day of their discharge home. The length of stay has added together the time spent in all hospitals, which includes level III and subsequent level II or I hospitals or children's hospitals. It does not include the time spent in hospital in any subsequent admissions from home, nor does it include periods spent in 'Hospital in the Home' programs. Discharge information was available for 99.4% of ANZNN registrants in 2023 who survived to discharge to home. The median length of stay was 19 days with an interquartile range of 6–46 days (Table 28). Length of stay is inversely related to gestational age, with the very preterm and extremely preterm babies having a longer stay in hospital than those babies born at or near term.

Babies born at less than 32 weeks gestation spent 238,710 days in hospital, babies born between 32 and 36 weeks spent 104,731 days and babies born at term spent 64,482 days in hospital.

TABLE 28: Length of stay for level III registrants who survived until discharge home by gestational age, ANZNN 2023

Gestational age (weeks)	Number of babies	Median length of stay (days)	Interquartile range (days)
<24	71	142	128–159
24	126	131	118–152
25	203	113	100–133
26	240	100	88–115
27	311	85	74–100
28	414	74	64–90
29	478	62	53–76
30	578	51	44–62
31	709	42	36–51
32	784	34	29–43
33	752	26	21–34
34	803	20	15–27
35	741	14	9–21
36	890	11	6–18
37	1,135	7	4–15
38	1,208	6	3–14
39	1,397	5	3–12
40	957	5	3–10
41	535	5	3–9
≥42	65	5	3–10
Total	**12,397**	**19**	**6–46**

Note: *Gestational ages ≥42 weeks have been combined to maintain confidentiality of small numbers.*

Survival

In 2023, 96.5% of ANZNN registrants survived to go home. These data include babies who were transferred to level II or level I units, those transferred to another level III unit and those babies transferred to a children's hospital. The survival rate to discharge home, as shown in Table 29, does not encompass the following: fetal deaths, neonatal deaths that occurred on a labour ward, babies born in level II hospitals, and babies not transferred to an NICU or children's hospital.

During 2023, there were 452 neonatal deaths, of which 203 occurred in the early neonatal period that is within seven days of birth (Table 29). Mortality was highest among babies born before 28 weeks gestation with a survival rate at discharge increasing week on week from 50.7% for babies born before 24 weeks to 95.8% for babies born at 28 weeks (Table 29, Figure 8). A similar pattern of increasing survival with increasing birthweight is seen in Figure 9. The 10-year trend (2014–2023) for survival to discharge to home of registrants is represented in Figure 27 in Appendix 1.

Lethal congenital anomaly was the cause of death for 0.9% of registrants, with most occurring in babies born between 36–39 weeks gestation (Table 29).

TABLE 29: Survival to discharge home for level III registrants by gestational age, ANZNN 2023

Gestational age (weeks)	Number of babies	Lethal congenital anomalies	Babies alive on day 7	Babies alive on day 28	Survived to discharge to home	Per cent survival at discharge to home
<24	140	0	109	86	71	50.7
24	174	0	153	131	126	72.4
25	245	<5	230	213	203	82.9
26	269	<5	257	251	240	89.2
27	337	<5	328	319	311	92.3
28	432	5	425	423	414	95.8
29	488	<5	485	484	478	98.0
30	594	5	588	580	578	97.3
31	721	6	715	712	709	98.3
32	797	5	789	785	784	98.4
33	761	<5	757	753	752	98.8
34	823	10	815	807	803	97.6
35	754	7	748	744	741	98.3
36	911	12	898	894	890	97.7
37	1,162	14	1,150	1,139	1,135	97.7
38	1,235	16	1,220	1,216	1,208	97.8
39	1,421	14	1,415	1,404	1,397	98.3
40	971	5	960	958	957	98.6
41	545	<5	539	535	535	98.2
≥42	69	0	65	65	65	94.2
Total	**12,849**	**110**	**12,646**	**12,499**	**12,397**	**96.5**

Note: *Gestational ages ≥42 weeks have been combined to maintain confidentiality of small numbers*

FIGURE 8: Survival of level III registrants to discharge home (with 95% CI) by gestational age, ANZNN 2023

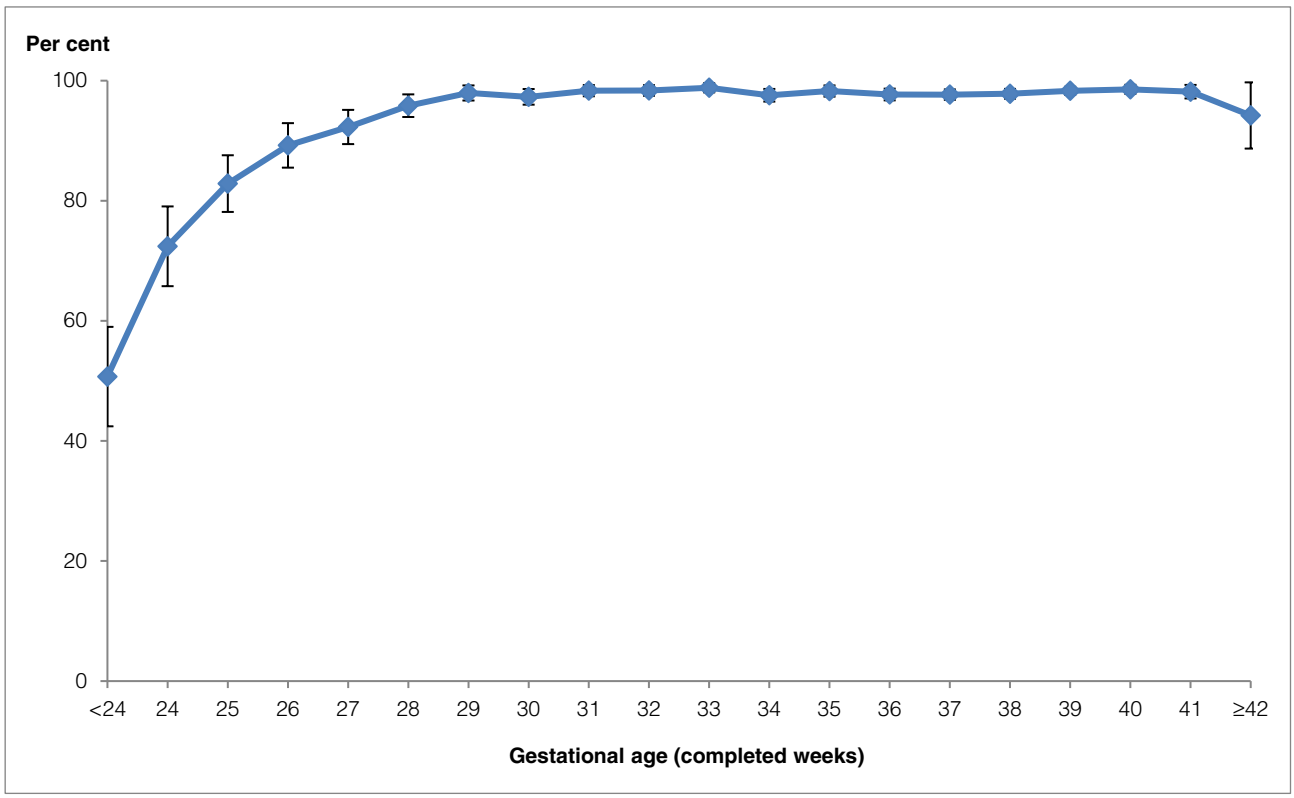
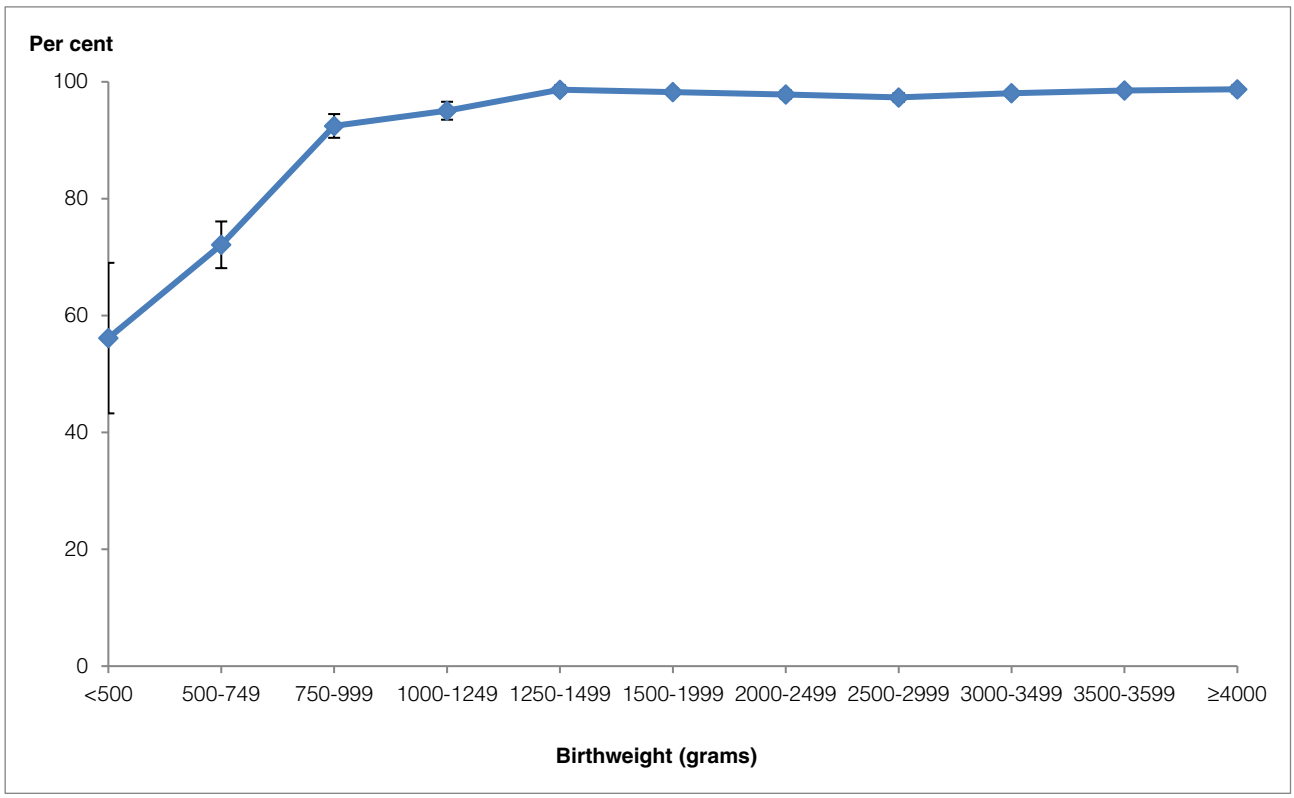


FIGURE 9: Survival of level III registrants to discharge home (with 95% CI) by birthweight group, ANZNN 2023



5. Babies registered to level II units

Overview

Neonatal units with facilities to manage mild or moderately ill babies are known as 'level II units' or 'special care baby units'. The classification of the level of care for perinatal hospitals is changing and the new classifications for 'level II' are now often 'level IV and V'. For the purposes of this report at this time, the term "level II" has been retained. Individual units may have varying levels of resources for giving special care. The ANZNN registration criteria for level II and level III units are the same. Babies born in a level II unit and transferred to a level III unit within 28 days of birth are registered to that level III unit. Babies are registered to a level II unit if their hospital stay was entirely within non-tertiary centre units, or if they were transferred to a level III NICU after 28 days, or they were transferred to a level II neonatal unit from a children's hospital without first having been admitted to a level III unit.

There are 16 level II units in New Zealand and 18 in Australia that are members of the ANZNN. Altogether, 29 level II units contributed data for this 2023 report.

In 2023, 2,408 babies fulfilled the ANZNN criteria for registration to a level II unit. Of those babies, 3.3% were born at less than 32 weeks gestation and 2.5% weighed less than 1,500 grams at birth (Table 30 and Table 31). The highest number of babies registered to a level II unit in 2023 was just over 240.

TABLE 30: Level II registrants by gestational age, ANZNN 2023

Gestational age (weeks)	Number of babies	Per cent	Cumulative per cent
<30	11	0.5	0.5
30–31	68	2.8	3.3
All babies <32 weeks gestation	**79**	**3.3**	
32–33	277	11.5	14.8
34–36	604	25.1	39.9
37–44	1,448	60.1	100.0
Total	**2,408**	**100.0**	

Note: *Gestational ages below 30 weeks have been combined to maintain confidentiality of small numbers.*

TABLE 31: Level II registrants by birthweight, ANZNN 2023

Birthweight (grams)	Number of babies	Per cent	Cumulative per cent
<1,300	14	0.6	0.6
1,300–1,399	15	0.6	1.2
1,400–1,499	30	1.2	2.4
All babies <1,500g birthweight	**59**	**2.4**	
1,500–1,999	225	9.3	118
2,000–2,499	381	15.8	27.6
2,500–2,999	459	19.1	46.7
3,000–3,499	551	22.9	69.6
3,500–3,999	451	18.7	88.3
≥4,000	282	11.7	100.0
Total	**2,408**	**100.0**	

Note: *Birthweight groups below 1,300g have been combined to maintain confidentiality of small numbers.*

Of the level II registrants in 2023, 1,285 babies (53.4%), were born to Caucasian mothers, 41.4% of whom were born preterm. The number of registrants born to Māori mothers was 262 (10.9%), and of these, 104 (39.7%) were born preterm. There were 66 babies (2.7%) born to Pacific peoples mothers.

There were 1,511 male (62.7%) and 895 female (37.2%) registrants in the audit. Sex was not recorded for two registrants. Non-specific respiratory distress was the major reason for assisted ventilation for level II registrants.

Maternal, pregnancy and birth characteristics

Of the mothers of level II registrants, 38.0% did not present with any maternal complications. Among babies born before 37 weeks, 34.9% of mothers had presented with preterm labour (Table 32).

TABLE 32: Mothers of level II registrants presenting antenatal problem by gestational age, ANZNN 2023

	Gestational age (weeks)				
Presenting antenatal problem	**<32**	**32–33**	**34–36**	**37–44**	**Total**
No antenatal problems	0	0	0	905	905
Preterm pre-labour rupture of membranes	19	70	138	16	243
Preterm labour	36	n.p.	199	<5[(a)]	338
Hypertension in pregnancy	9	40	65	56	170
Antepartum haemorrhage	10	35	49	20	114
Intrauterine growth restriction	<5	7	40	n.p.	92
Fetal distress	<5	8	n.p.	190	239
Other problem	0	16	71	187	274
Congenital anomalies	<5	<5	<5	n.p.	8
Not stated	0	0	1	24	25
Total	**79**	**277**	**604**	**1,448**	**2,408**
			Per cent		
No antenatal problems	0.0	0.0	0.0	63.6	38.0
Preterm pre-labour rupture of membranes	24.1	25.3	22.9	1.1	10.2
Preterm labour	45.6	n.p.	33.0	n.p.	14.2
Hypertension in pregnancy	11.4	14.4	10.8	3.9	7.1
Antepartum haemorrhage	12.7	12.6	8.1	1.4	4.8
Intrauterine growth restriction	n.p.	2.5	6.6	n.p.	3.9
Fetal distress	n.p.	2.9	n.p.	13.3	10.0
Other problem	0.0	5.8	11.8	13.1	11.5
Congenital anomalies	n.p.	n.p.	n.p.	n.p.	0.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
(a) These mothers presented with preterm labour, then went on to deliver at term.
Note: *Not stated data are excluded from per cent calculations.*
Maternal data for babies of a multiple birth are presented for each registrant.

Previous preterm births were reported by 168 (7.0%) mothers of level II registrants and 77 (3.2%) mothers had had a previous perinatal death(s).

Most mothers (90.7%) of level II registrants had booked into a level II hospital for delivery. Of the level II registrants born before 34 weeks gestation, 75% of the mothers were given antenatal corticosteroids within seven days prior to the birth (Table 33).

TABLE 33: Antenatal corticosteroid use by mothers of level II registrants by gestational age, ANZNN 2023

	Gestational age (weeks)				
Antenatal corticosteroids	**<32**	**32–33**	**34–36**	**37–44**	**Total**
None	15	42	377	1,389	1,823
Incomplete course	n.p.	90	54	<5	175
Complete course within 7 days of birth	31	n.p.	112	<5	261
Given >7 days prior to birth	<5	n.p.	41	n.p.	74
Not stated	1	3	20	51	75
Total	**79**	**277**	**604**	**1,448**	**2,408**
			Per cent		
None	19.2	15.3	64.6	99.4	78.1
Incomplete course	n.p.	32.8	9.2	n.p.	7.5
Complete course within 7 days of birth	39.7	n.p.	19.2	n.p.	11.2
Given >7 days prior to birth	n.p.	n.p.	7.0	n.p.	3.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not stated data are excluded from per cent calculations.*
Maternal data for babies of a multiple birth are presented for each registrant.

Caesarean section was the method of delivery for just over half (51.5%) of level II registrants (Table 34). Of those who were delivered by caesarean section, nearly three in five (57.7%) occurred before the onset of labour.

TABLE 34: Method of delivery for level II registrants by gestational age, ANZNN 2023

	Gestational age (weeks)				
Method of delivery	**<32**	**32–33**	**34–36**	**37–44**	**Total**
Vaginal birth[(a)]	33	110	222	786	1,151
Caesarean section[(b)]	46	167	375	634	1,222
Not stated	0	0	7	28	35
Total	**79**	**277**	**604**	**1,448**	**2,408**
			Per cent		
Vaginal birth	41.8	39.7	37.2	55.4	48.5
Caesarean section	58.2	60.3	62.8	44.6	51.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Vaginal and instrumental vaginal births have been combined to maintain confidentiality of small numbers.
(b) Caesarean section deliveries in labour and no labour have been combined to maintain confidentiality of small numbers.

Characteristics of level II babies

Among the 2,408 babies registered to level II units, 248 were from multiple gestation pregnancies (10.3%). There were 1,511 (62.7%) male births and two babies whose sex was not recorded.

A low Apgar score of less than 4 at one minute of age was recorded for 14.7% of babies and 4.8% of them required endotracheal intubation in the labour ward to assist in their adaptation to extrauterine life.

Non-specific respiratory distress (81.7%) was the major reason for assisted ventilation for level II registrants, followed by hyaline membrane disease (7.9%) (Table 35).

For level II registrants, the median duration of assisted ventilation by intermittent positive pressure ventilation (IPPV) was 16.5 hours, 79 hours by continuous positive airway pressure (CPAP) and 49 hours by nasal high flow (NHF) (Table 36).

TABLE 35: Indication for respiratory support for level II registrants by gestational age, ANZNN 2023

	Gestational age (weeks)				
Indication for respiratory support	**<32**	**32–33**	**34–36**	**37–44**	**Total**
No respiratory support	<5	<5	5	0	10
Non-specific respiratory distress	42	185	501	1,225	1,953
Hyaline membrane disease	33	76	60	20	189
Meconium aspiration syndrome	0	<5	<5	110	114
Pneumonia	0	<5	6	n.p.	n.p.
Persistent pulmonary hypertension	0	0	5	10	15
Apnoea	0	n.p.	5	<5	15
Congenital anomaly	0	0	0	<5	<5
Other	<5	<5	n.p.	30	47
Peri-surgery	0	0	0	<5	<5
Newborn encephalopathy	<5	0	0	<5	5
Not stated	0	3	5	9	17
Total	**79**	**277**	**604**	**1,448**	**2,408**
			Per cent		
No respiratory support	n.p.	n.p.	0.8	0.0	0.4
Non-specific respiratory distress	53.2	67.5	83.6	85.1	81.7
Hyaline membrane disease	41.8	27.7	10.0	1.4	7.9
Meconium aspiration syndrome	0.0	n.p.	n.p.	7.6	4.8
Pneumonia	0.0	n.p.	1.0	n.p.	n.p.
Persistent pulmonary hypertension	0.0	0.0	0.8	0.7	0.6
Apnoea	0.0	n.p.	0.8	n.p.	0.6
Congenital anomaly	0.0	0.0	0.0	n.p.	n.p.
Other	n.p.	n.p.	n.p.	2.1	2.0
Peri-surgery	0.0	0.0	0.0	n.p.	n.p.
Newborn encephalopathy	n.p.	0.0	0.0	n.p.	0.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not stated data are excluded from per cent calculations.*

TABLE 36: Duration of assisted ventilation use for level II registrants by gestational age, ANZNN 2023

Duration of assisted ventilation	Gestational age (weeks) <32	32–33	34–36	37–44	Total
			IPPV (hours)		
Median	15	20.5	17	16	**16.5**
IQR	4–33	14–24	9–43	8–25	**9–25**
			CPAP (hours)		
Median	65	29	18	13	**16**
IQR	31–113	17–52	10–36	7–23	**9–30**
			NHF (hours)		
Median	200	79	59	38	**49**
IQR	90–338	45–142	25–97.5	17–67	**23–98**

Note: *IQR = Interquartile range. IPPV = intermittent positive pressure ventilation. CPAP = continuous positive airway pressure. NHF = nasal high flow.*

Eye examination

Screening for retinopathy of prematurity (ROP) was reported for only 22 of the 29 eligible babies born at less than 31 weeks gestational age and/or weighing less than 1,250 grams at birth (75.9% compared to 84.2% of eligible level III registrants). All were reported as normal except for three babies who had stage 1 ROP and one baby who had stage 2 ROP.

Cerebral ultrasound

Of the 79 babies born at less than 32 weeks, 63 (79.7%) had a cerebral ultrasound in the first week after birth. 48 of them were reported as normal, that is, no intraventricular haemorrhage (IVH), 13 reported a grade 1 IVH and the remaining two reported a grade 2 IVH. Most babies who did not have an early cerebral ultrasound reported at this time were born at 31 weeks gestation. A late cerebral ultrasound nearest to six weeks of age was reported for 41 babies, of whom all had normal reports except for seven babies who had distended ventricles.

Other morbidities

Septicaemia was proven in eleven babies, including seven before day two, that is, less than 48 hours of age. There were four cases of necrotising enterocolitis. Major congenital anomalies were reported for 18 babies, of which none required major surgery.

Level II transfers

In total, 107 level II registrants were transferred to other units, 77 were transferred to a level I or another level II unit, 24 were transferred to a level III unit and the remaining six to a children's hospital.

Survival

There were 2,401 level II registrants who survived to discharge to home (99.7%). Six babies died within the first seven days of birth (Table 37). Survival was unknown for one baby.

TABLE 37: Survival to discharge home for level II registrants by gestational age, ANZNN 2023

Gestational age (weeks)	All babies	Babies alive on day 7	Babies alive on day 28	Survived to discharge to home	Per cent survival at discharge to home
<32	79	76	76	76	96.2
32–33	277	277	277	276	99.6
34–36	604	604	604	604	100.0
37–44	1,448	1,445	1,445	1,445	99.8
All babies	**2,408**	**2,402**	**2,402**	**2,401**	**99.7**

Note: *Survival status was not provided for one baby.*

6. Extremely preterm follow-up, 2017–2020 births

Data for 2020 births was not available for inclusion at the time of publication.

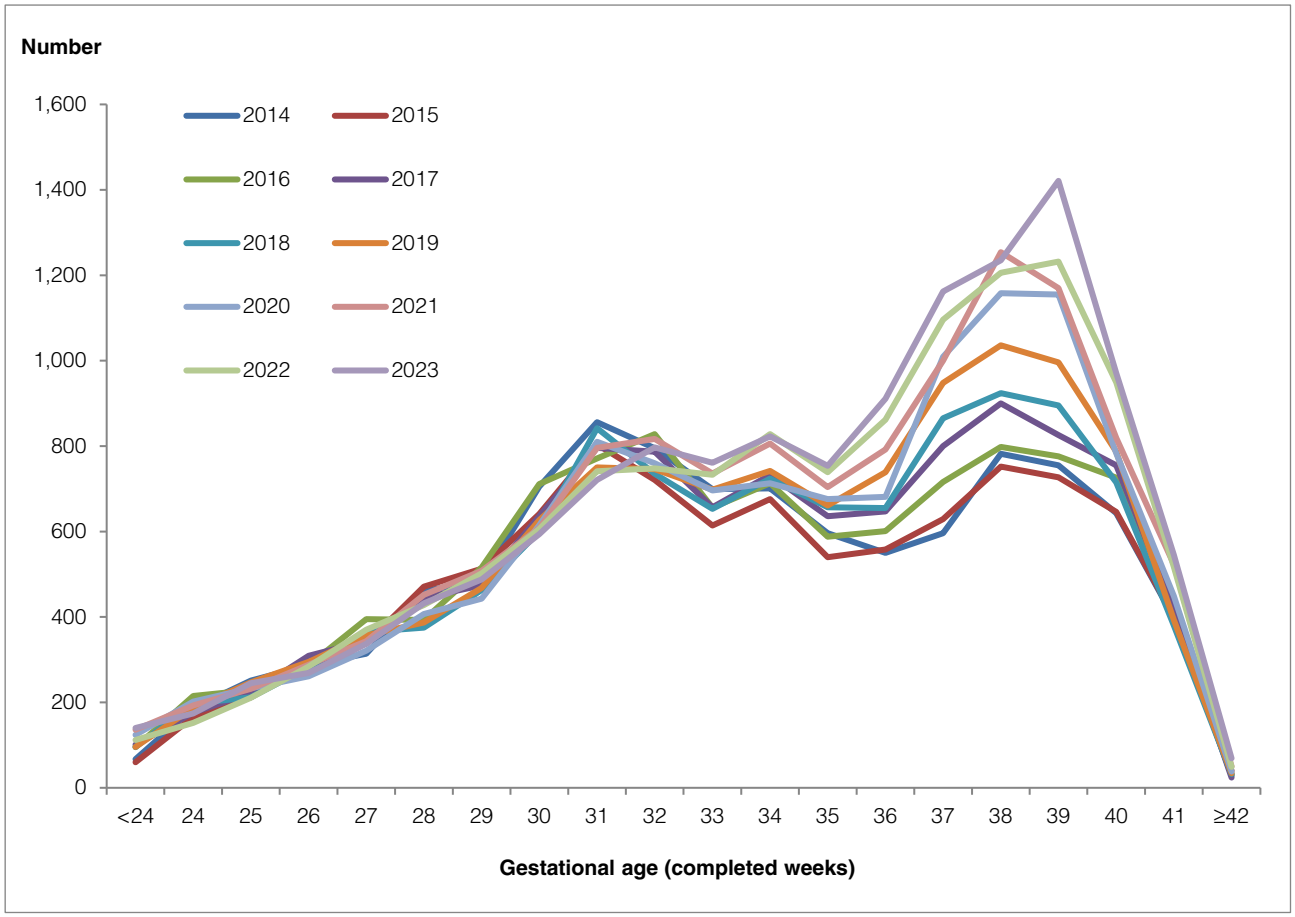
This report will be updated to include this chapter when data is available.

APPENDICES

Appendix 1: Trends

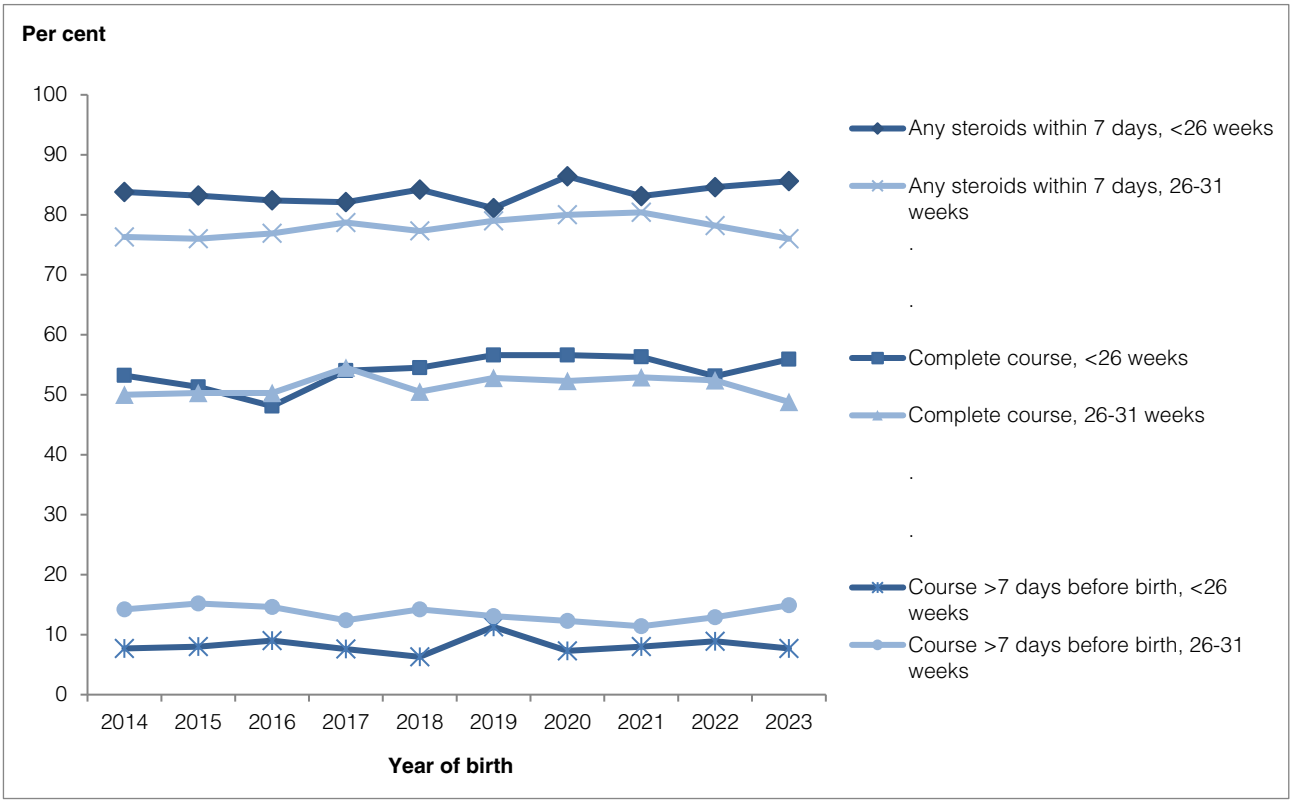
Babies registered to level III units

FIGURE 11: Trends in gestational age at birth of level III registrants, ANZNN 2014–2023



Please refer to www.anznn.net for colour version.

FIGURE 12: Trends in the use of corticosteroids for mothers of babies less than 32 weeks gestation, ANZNN 2014–2023



Note: *Corticosteroid treatment to enhance fetal lung maturation is considered 'complete' when two doses are given, the first dose more than 24 hours and less than 8 days before the baby's birth.*
'Any steroids within 7 days' includes babies who received a 'complete course' as well as babies who received their first dose of corticosteroids at less than 24 hours prior to birth.

FIGURE 13: Trends in multiple births of level III registrants by gestational age, ANZNN 2014–2023

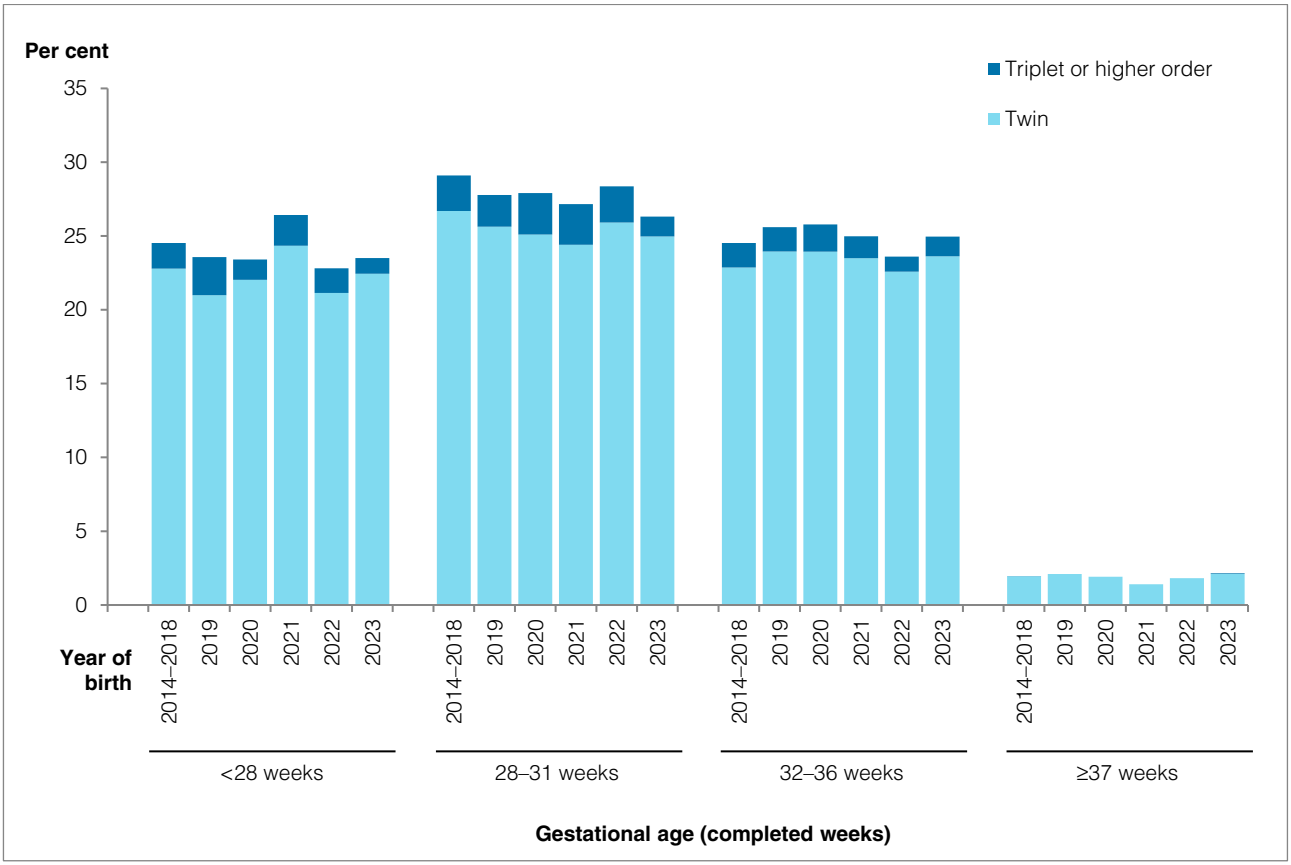


FIGURE 14: Trends in method of birth for level III registrants by year of birth, ANZNN 2014–2023

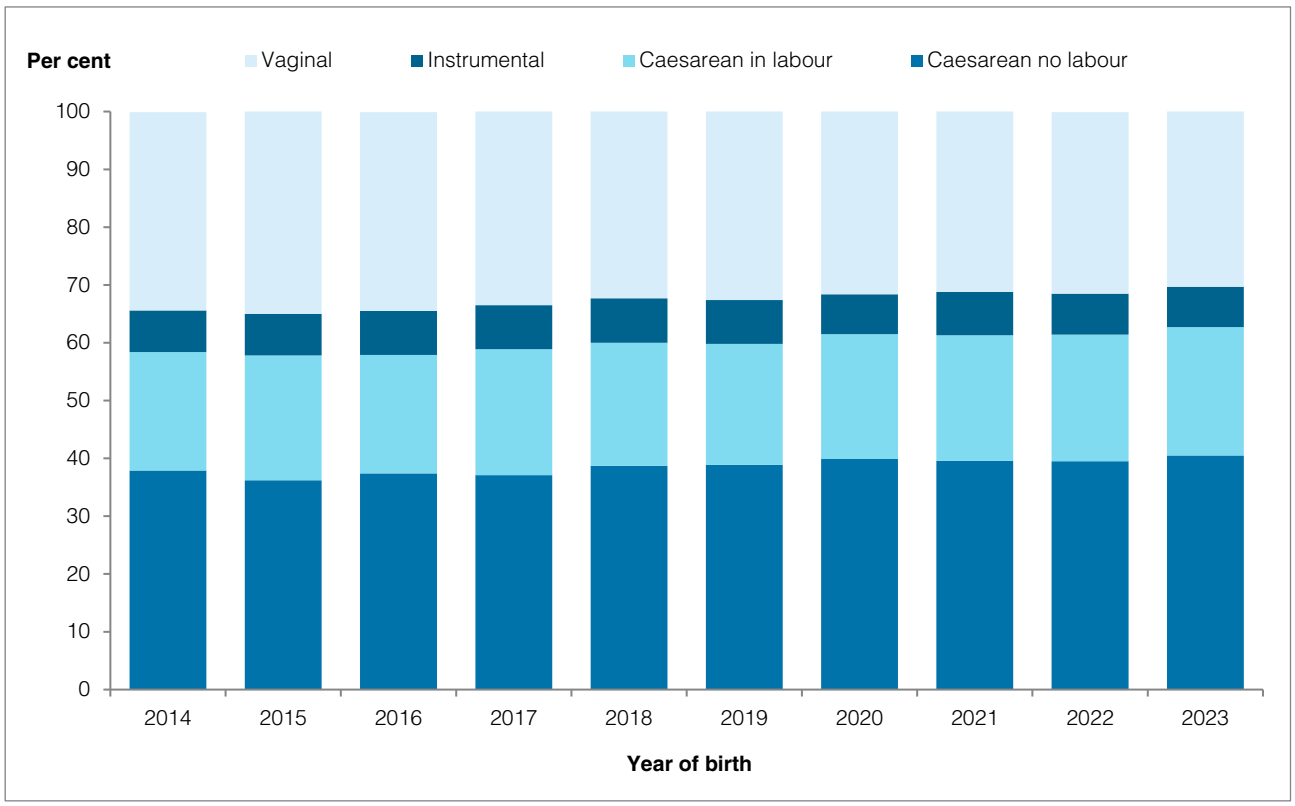


FIGURE 15: Trends in referral source to level III NICU by year of birth, ANZNN 2014–2023

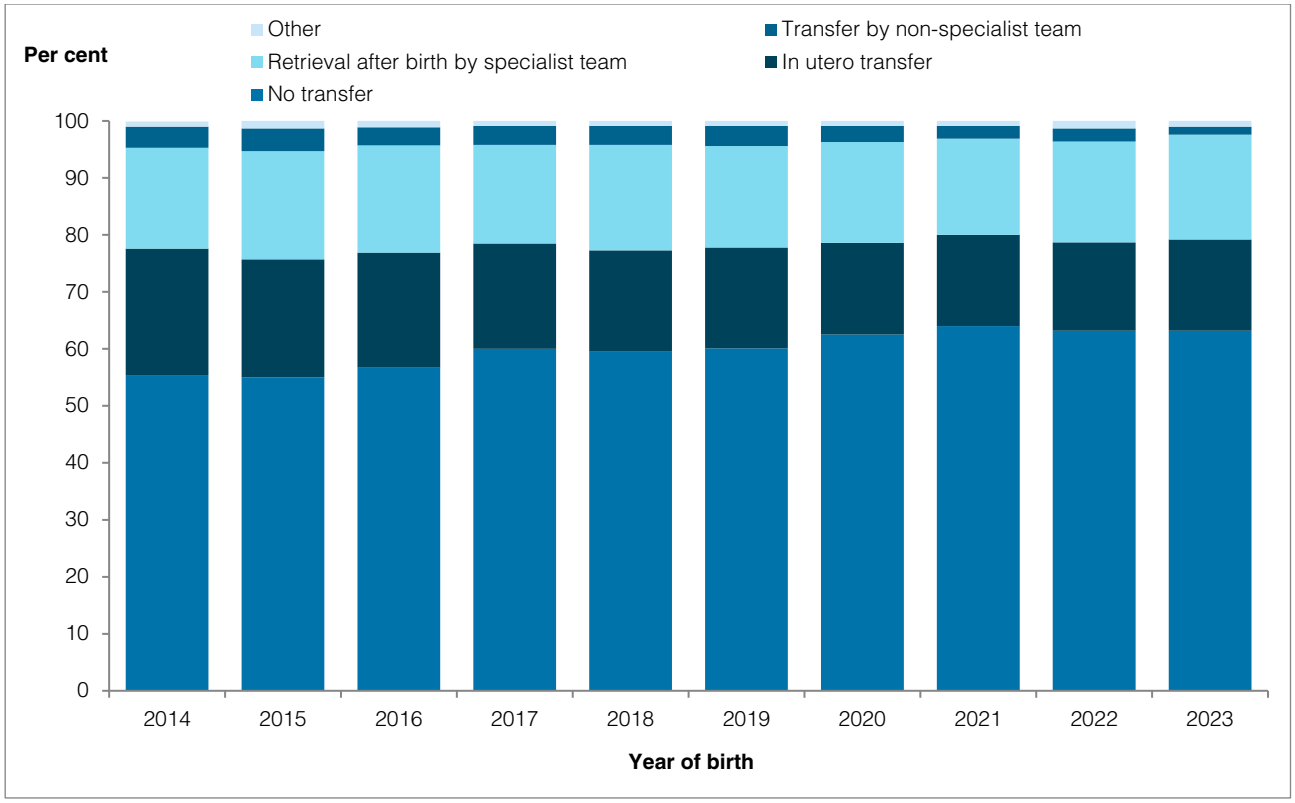


FIGURE 16: Trends in mode of transport to level III NICU, ANZNN 2014–2023

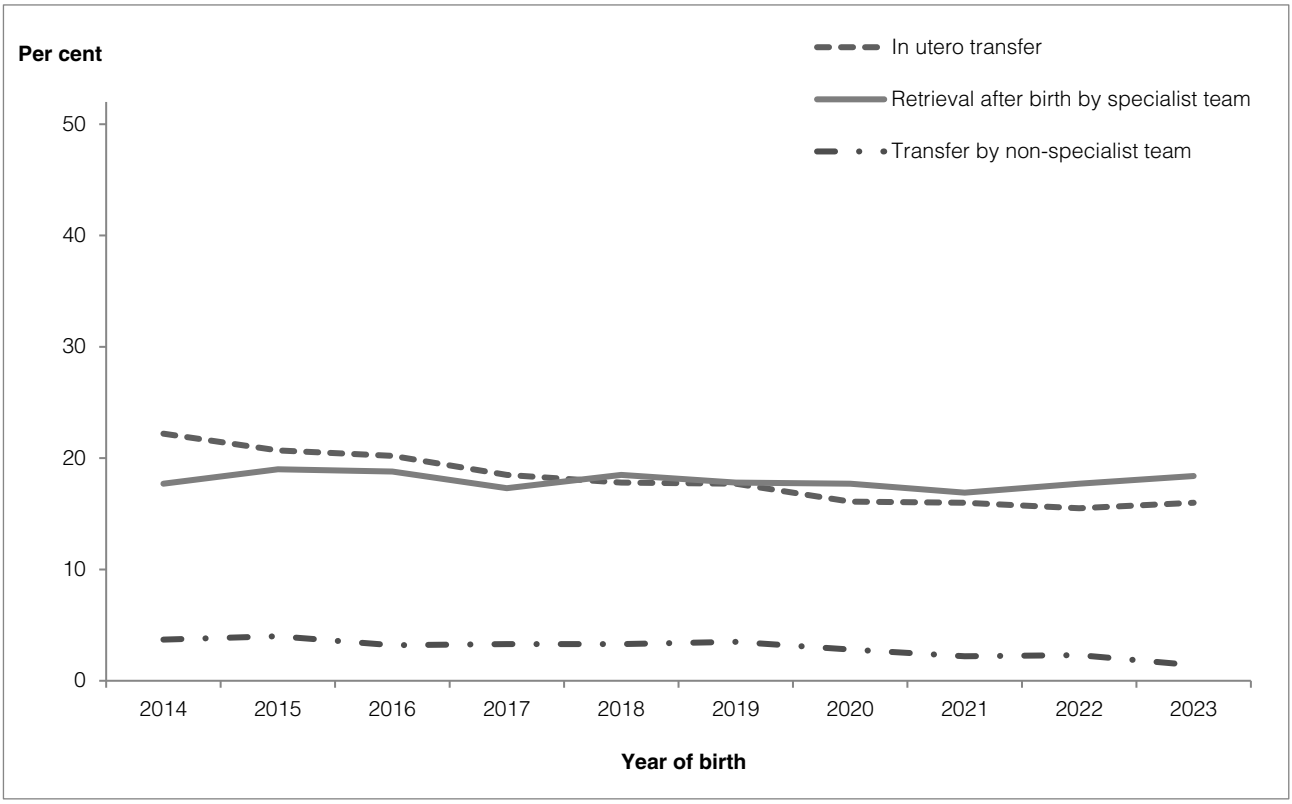
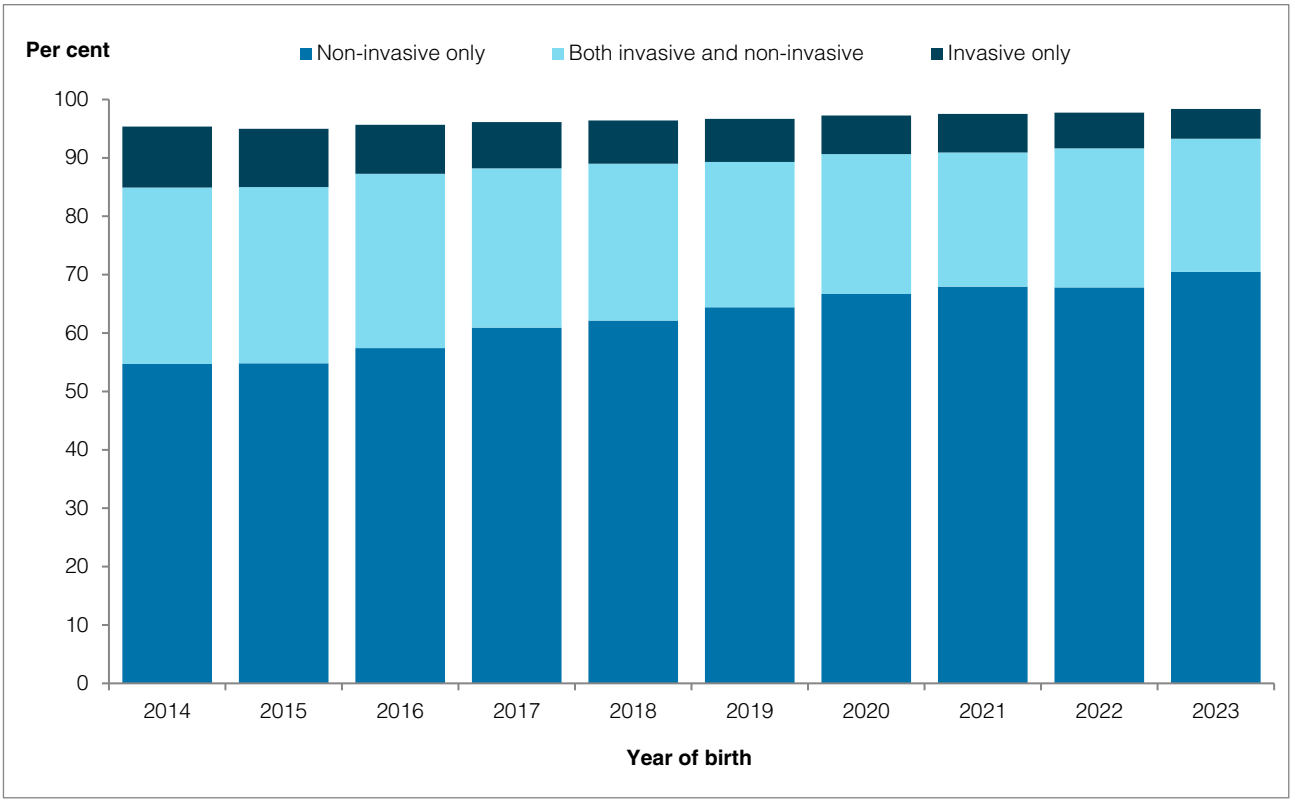
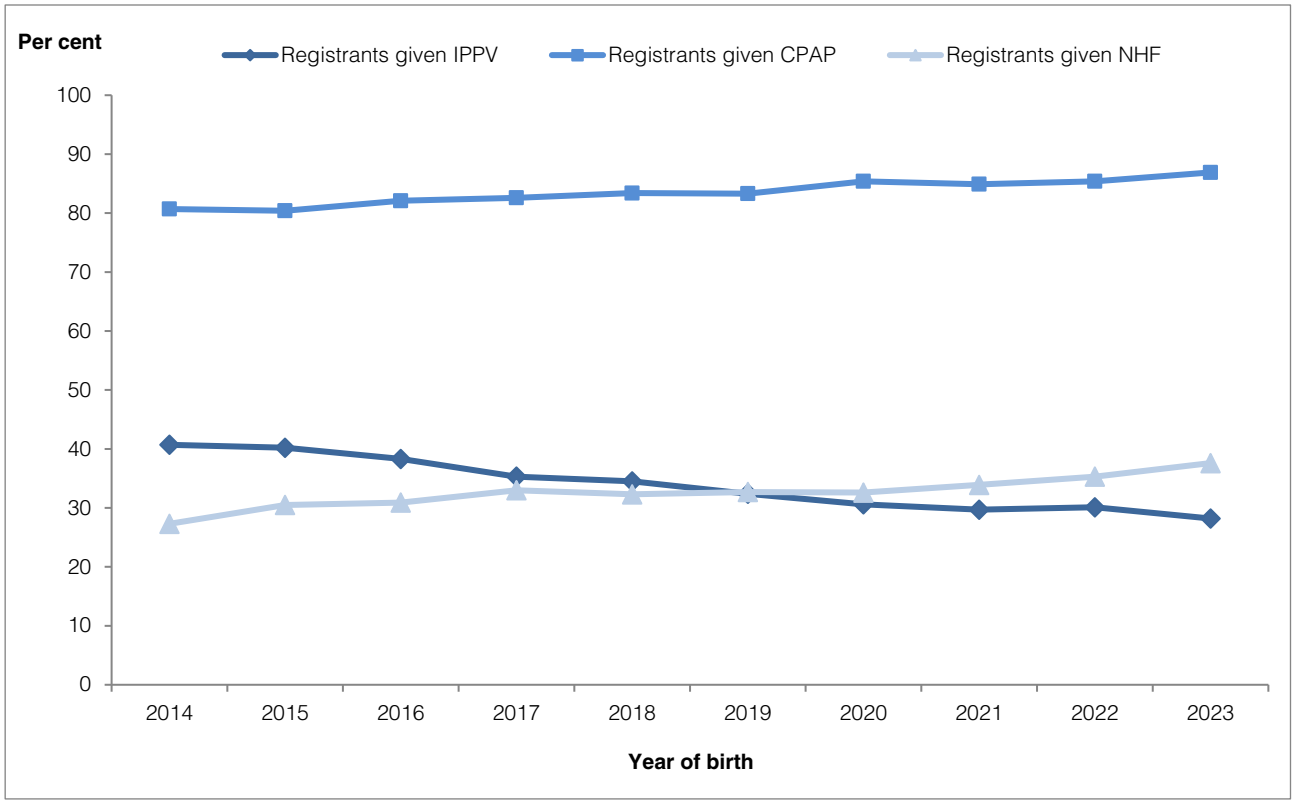


FIGURE 17: Trends in mode of assisted ventilation for level III registrants, ANZNN 2014–2023



Note: *Non-invasive ventilation = continuous positive airway pressure (CPAP) or nasal high flow (NHF).*
Invasive ventilation = intermittent positive pressure ventilation (IPPV).

FIGURE 18: Trends in provision of intermittent positive pressure ventilation, continuous positive airway pressure and nasal high flow by year of birth for level III registrants ventilated, ANZNN 2014–2023



Note: *Groups are not mutually exclusive.*
IPPV = intermittent positive pressure ventilation. CPAP = continuous positive airway pressure. NHF = nasal high flow.

FIGURE 19: Trends in the use of ventilation not requiring endotracheal tube (continuous positive airway pressure or nasal high flow) as the only form of ventilation by gestational age for level III registrants, ANZNN 2014, 2017, 2020–2023

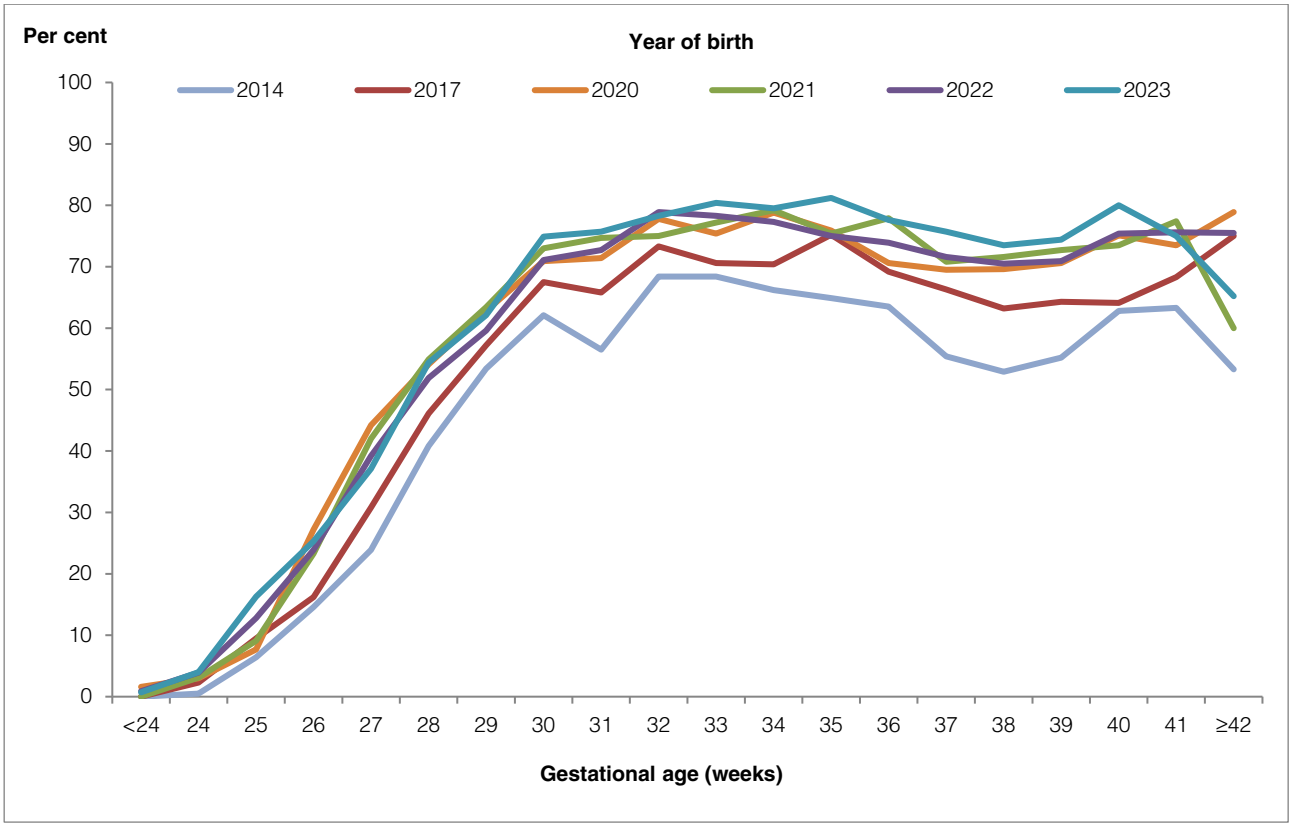
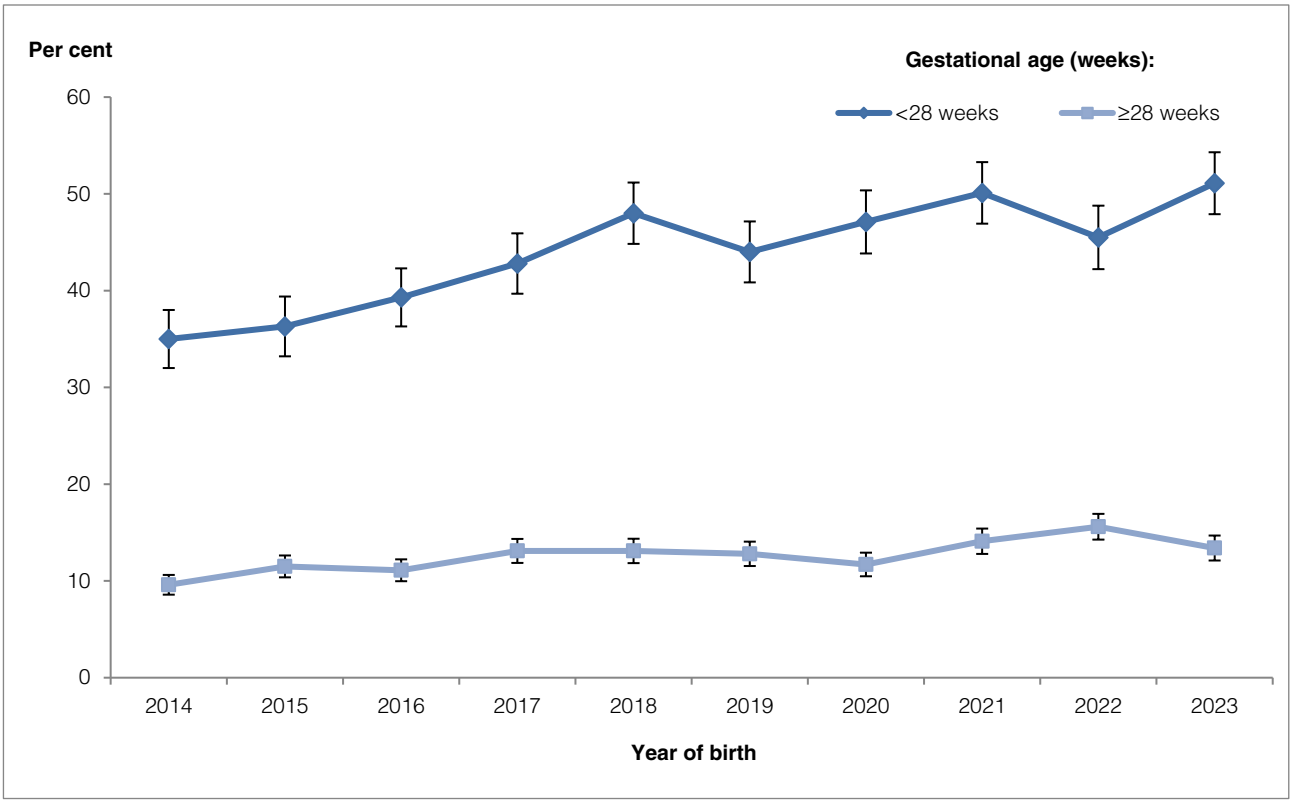
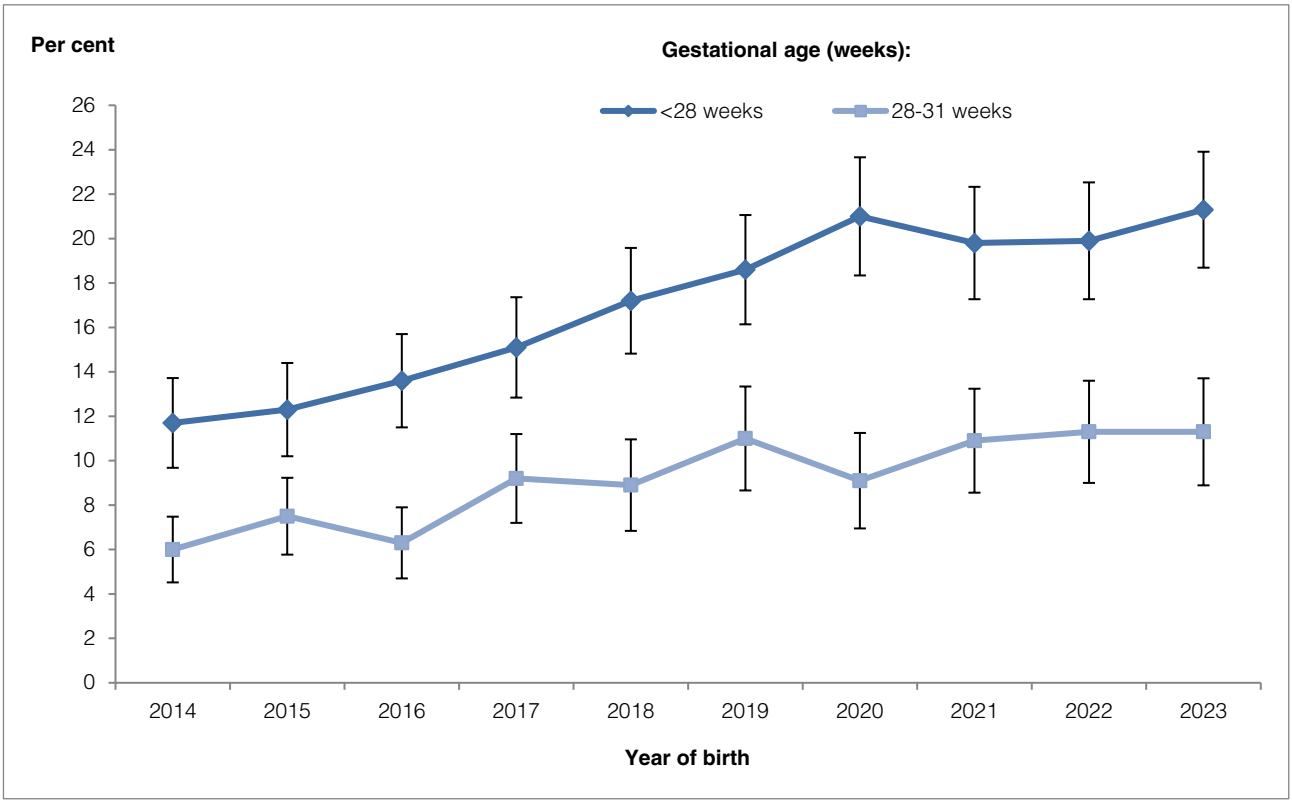


FIGURE 20: Trends in provision of high frequency oscillatory ventilation (with 95% CI) for level III registrants born before 28 weeks and at 28 or more weeks gestation, ANZNN 2014–2023



Note: *Results are given as the percentage of babies given intermittent positive pressure ventilation.*

FIGURE 21: Trends in nitric oxide (with 95% CI) provision for level III registrants born before 28 weeks and 28-31 weeks gestation, ANZNN 2014–2023



Note: *Results are given as the percentage of babies given intermittent positive pressure ventilation.*

FIGURE 22: Trends in chronic lung disease (with 95% CI) for level III registrants who survived to 36 weeks post menstrual age, ANZNN 2014–2023

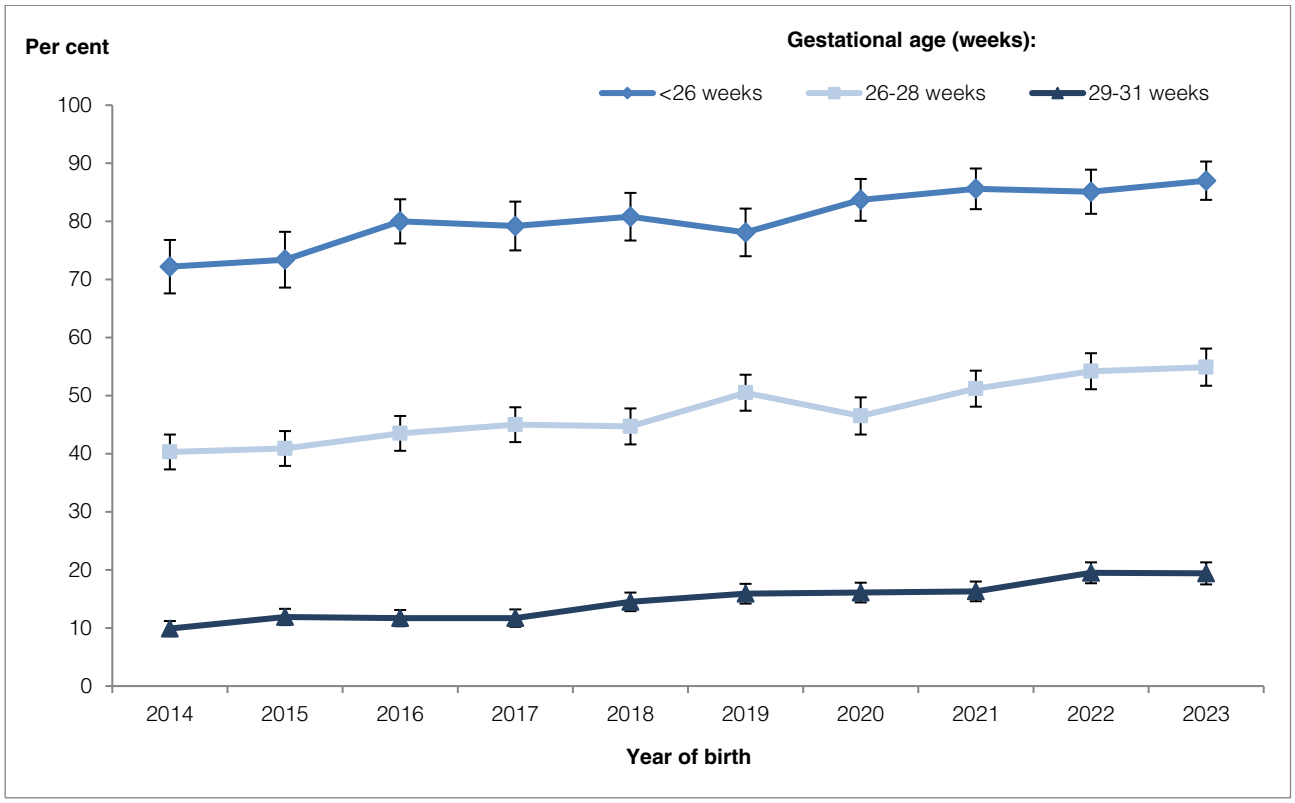


FIGURE 23: Trends in stage 3 to 5 retinopathy of prematurity and surgically treated retinopathy among babies born before 31 weeks gestation and/or birthweight of less than 1,250 grams who survived to 36 weeks post menstrual age for level III registrants, ANZNN 2014–2023

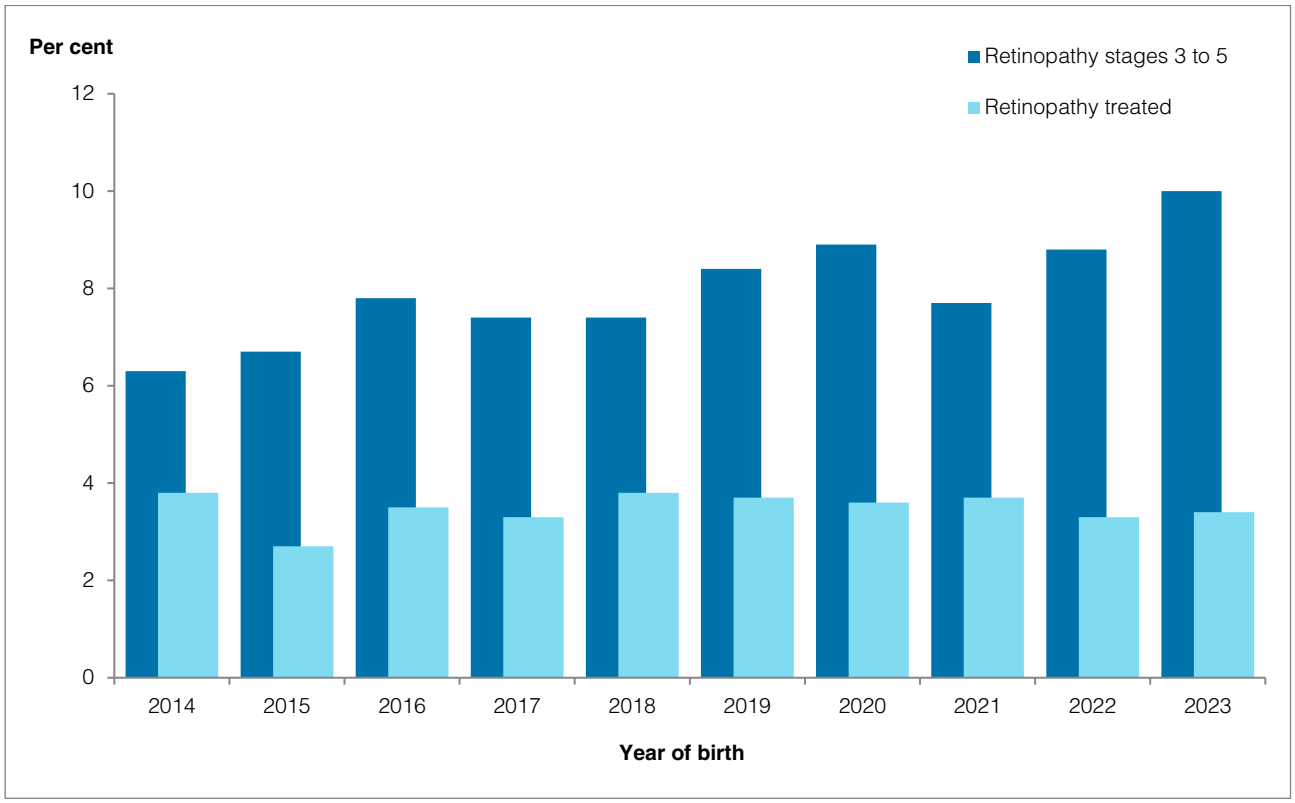


FIGURE 24: Trends in grade 3 or 4 intraventricular haemorrhage (with 95% CI) in babies born at less than 32 weeks gestation who survived to day 3 for level III registrants, ANZNN 2014–2023

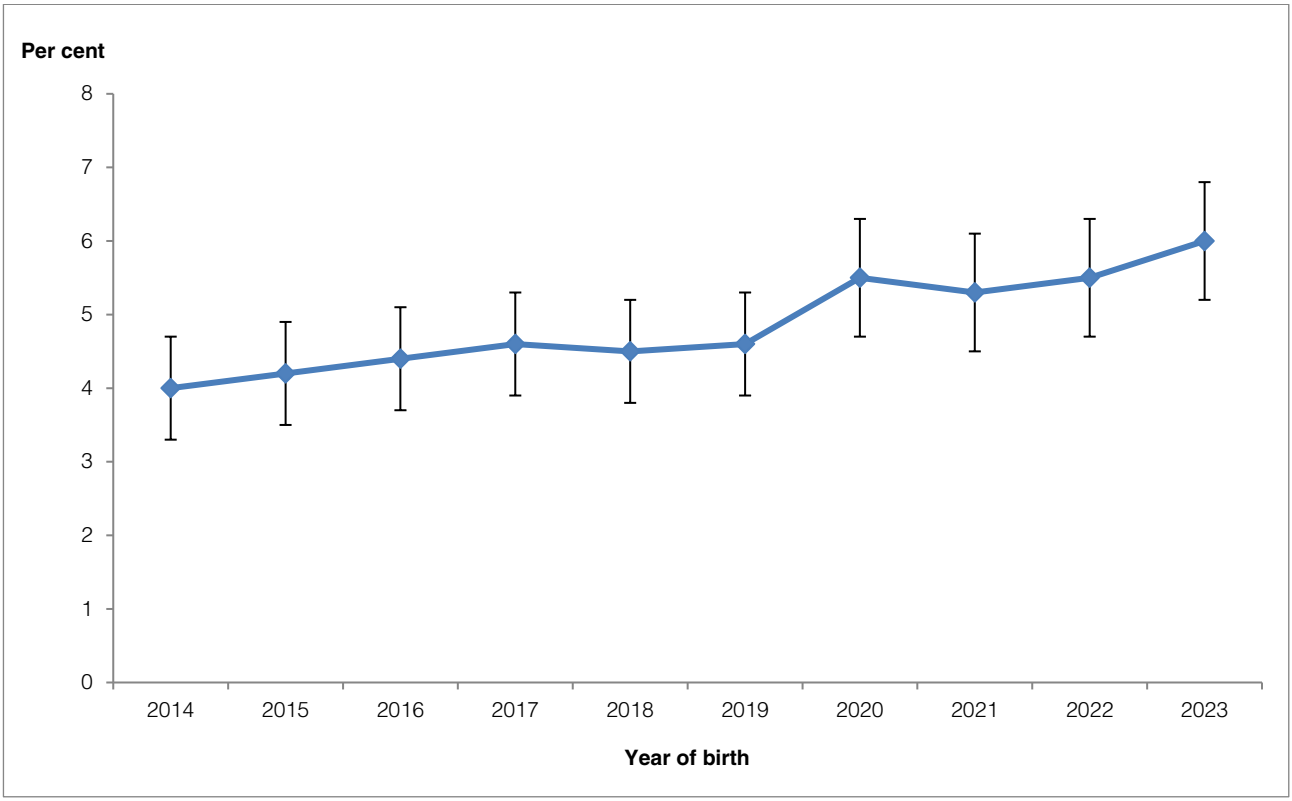


FIGURE 25: Trends in incidence of early sepsis for level III registrants by gestational age, ANZNN 2019–2023

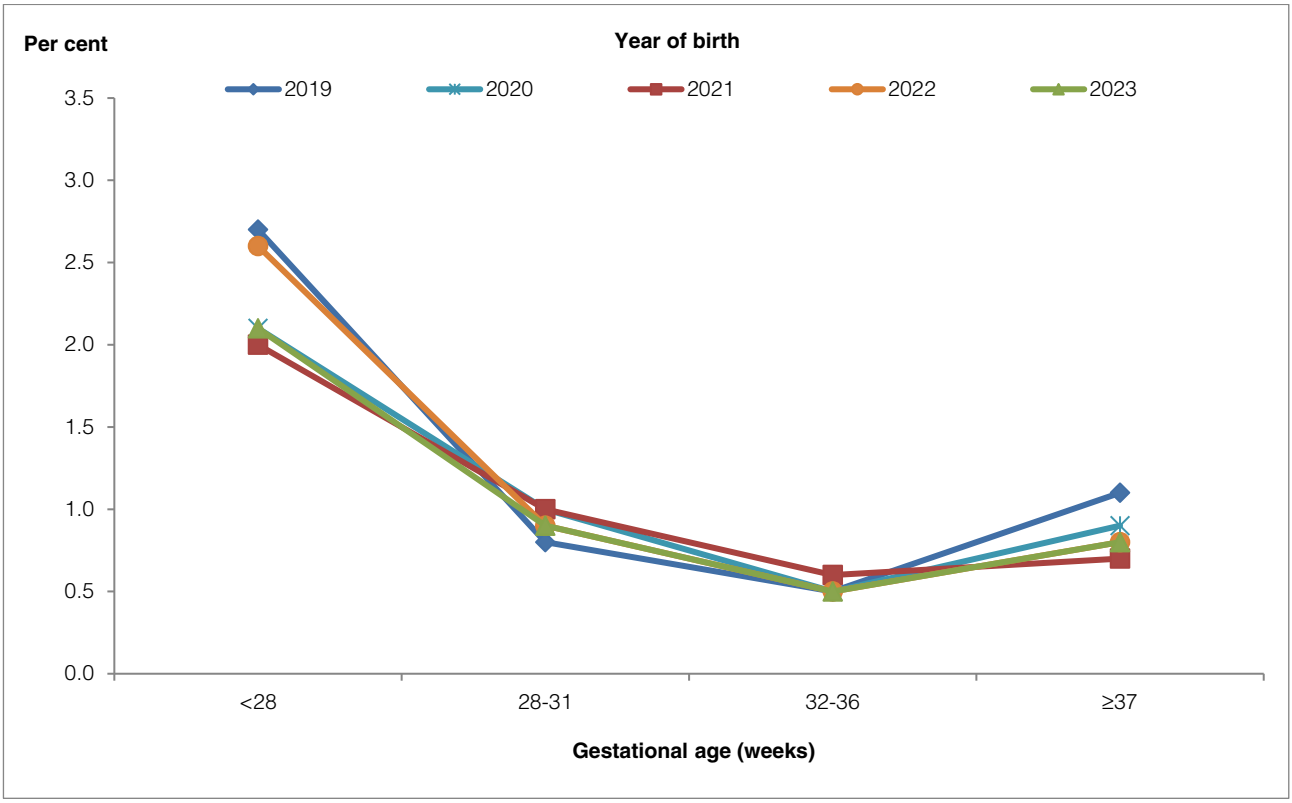


FIGURE 26: Trends in incidence of late sepsis for level III registrants by gestational age, ANZNN 2019–2023

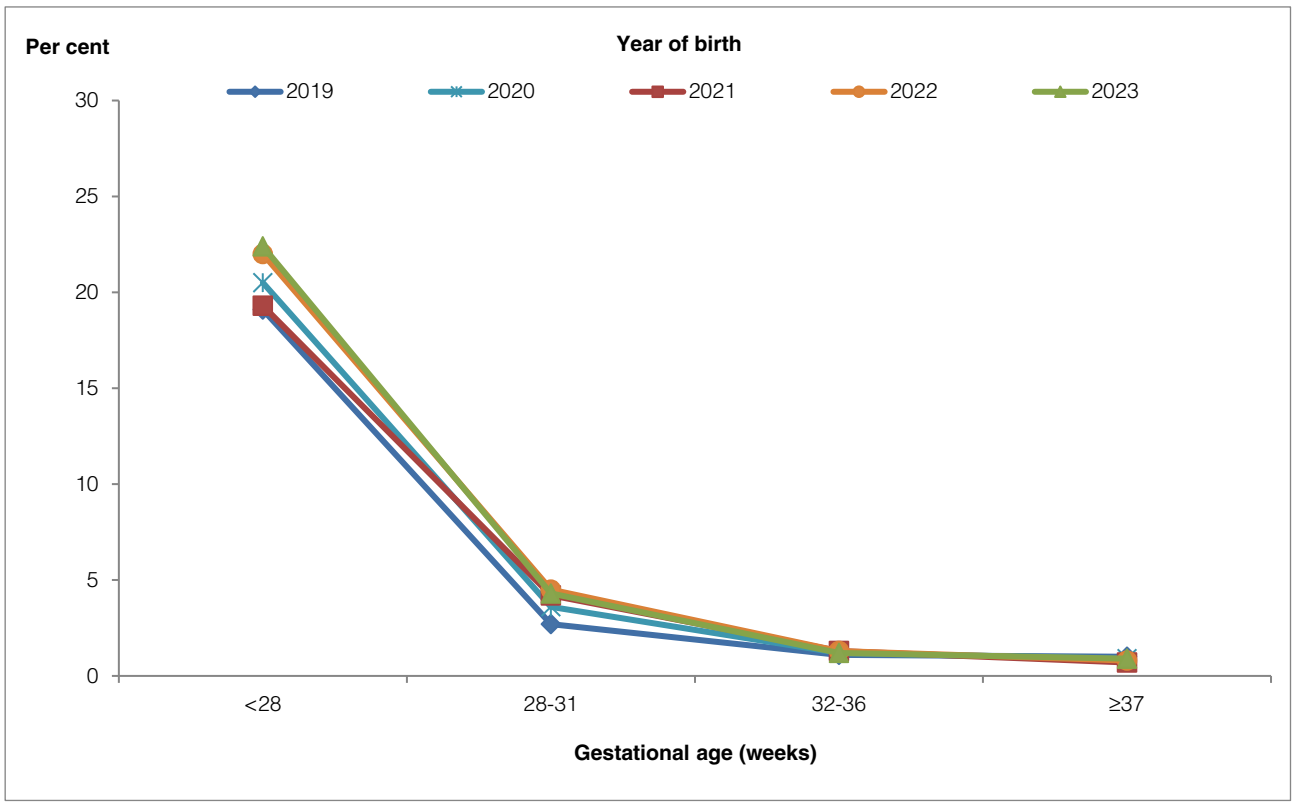
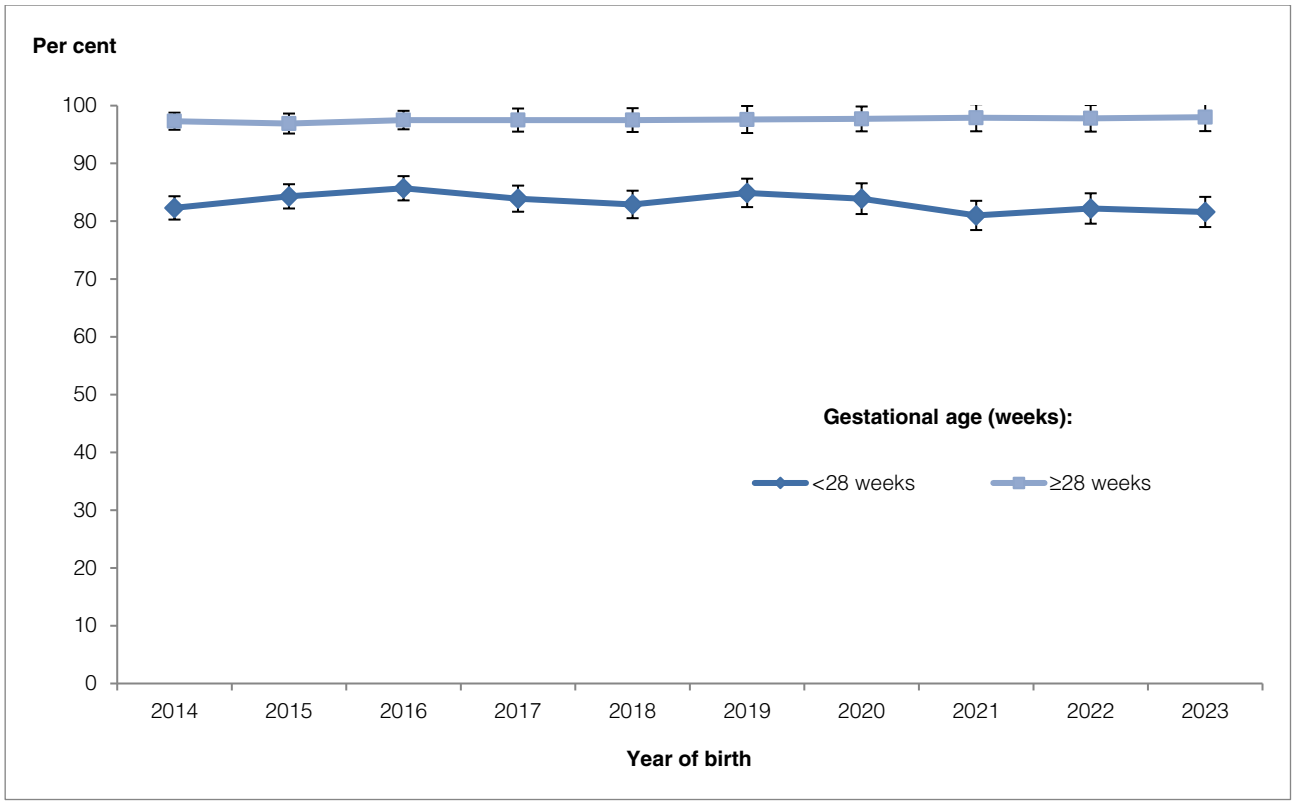


FIGURE 27: Trends in survival to discharge to home for level III registrants, ANZNN 2014–2023



Extremely Preterm Follow-up

Data for 2020 births was not available for inclusion at the time of publication.

This report will be updated to include these trends when data is available.

Appendix 2: Data tables by birthweight

TABLE 52: Antenatal corticosteroid use for level III registrants by birthweight, ANZNN 2023

Antenatal corticosteroids	Birthweight (grams)											
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	Total
	Number											
None	<5	22	43	70	117	324	799	n.p.	1,729	1,427	797	6,671
Incomplete course	14	125	169	194	217	480	299	n.p.	23	9	<5	1,616
Complete course within 7 days of birth	39	281	348	387	469	710	330	128	43	14	7	2,756
Given >7 days prior to birth	<5	54	87	115	154	235	165	78	47	17	<5	958
Not stated	1	2	2	2	5	23	69	126	262	224	132	848
Total	**57**	**484**	**649**	**768**	**962**	**1,772**	**1,662**	**1,759**	**2,104**	**1,691**	**941**	**12,849**
	Per cent											
None	n.p.	4.6	6.6	9.1	12.2	18.5	50.2	n.p.	93.9	97.3	98.5	55.6
Incomplete course	25.0	25.9	26.1	25.3	22.7	27.4	18.8	n.p.	1.2	0.6	n.p.	13.5
Complete course within 7 days of birth	69.6	58.3	53.8	50.5	49.0	40.6	20.7	7.8	2.3	1.0	0.9	23.0
Given >7 days prior to birth	n.p.	11.2	13.4	15.0	16.1	13.4	10.4	4.8	2.6	1.2	n.p.	8.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not stated data are excluded from per cent calculations.*

TABLE 53: Plurality of level III registrants by birthweight, ANZNN 2023

Plurality	Birthweight (grams)											
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	Total
	Number											
Singleton	n.p.	n.p.	507	565	675	1,195	1,267	n.p.	2,049	n.p.	n.p.	10,855
Twins	13	119	132	189	271	536	381	195	n.p.	<5	<5	1,894
Triplets and higher orders	<5	<5	10	14	16	41	14	<5	<5	0	0	100
Total	**57**	**484**	**649**	**768**	**962**	**1,772**	**1,662**	**1,759**	**2,104**	**1,691**	**941**	**12,849**
	Per cent											
Singleton	n.p.	n.p.	78.1	73.6	70.2	67.4	76.2	n.p.	97.4	n.p.	n.p.	84.5
Twins	22.8	24.6	20.3	24.6	28.2	30.2	22.9	11.1	n.p.	n.p.	n.p.	14.7
Triplets and higher orders	n.p.	n.p.	1.5	1.8	1.7	2.3	0.8	n.p.	n.p.	0.0	0.0	0.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.

TABLE 54: Method of birth for level III registrants by birthweight, ANZNN 2023

	Birthweight (grams)											
Method of birth	**<500**	**500-749**	**750-999**	**1000-1249**	**1250-1499**	**1500-1999**	**2000-2499**	**2500-2999**	**3000-3499**	**3500-3999**	**≥4000**	**Total**
						Number						
Vaginal birth	n.p.	n.p.	145	172	219	468	494	559	728	616	317	3,879
Vaginal instrumental birth	<5	<5	11	6	20	63	88	128	256	221	99	897
Caesarean section in labour	5	92	156	173	225	378	372	380	472	374	220	2,847
Caesarean section no labour	38	240	335	414	498	858	705	684	641	479	300	5,192
Not stated	0	0	2	3	0	5	3	8	7	1	5	34
Total	**57**	**484**	**649**	**768**	**962**	**1,772**	**1,662**	**1,759**	**2,104**	**1,691**	**941**	**12,849**
						Per cent						
Vaginal birth	n.p.	n.p.	22.4	22.5	22.8	26.5	29.8	31.9	34.7	36.4	33.9	30.3
Vaginal instrumental birth	n.p.	n.p.	1.7	0.8	2.1	3.6	5.3	7.3	12.2	13.1	10.6	7.0
Caesarean section in labour	8.8	19.0	24.1	22.6	23.4	21.4	22.4	21.7	22.5	22.1	23.5	22.2
Caesarean section no labour	66.7	49.6	51.8	54.1	51.8	48.6	42.5	39.1	30.6	28.3	32.1	40.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not stated data are excluded from per cent calculations.*

TABLE 55: Level of hospital of birth for level III registrants by birthweight, ANZNN 2023

	Birthweight (grams)											
Level of birth hospital	**<500**	**500-749**	**750-999**	**1000-1249**	**1250-1499**	**1500-1999**	**2000-2499**	**2500-2999**	**3000-3499**	**3500-3999**	**≥4000**	**Total**
						Number						
Tertiary	n.p.	451	n.p.	691	851	1,544	1,320	1,351	1,579	1,268	722	10,435
Non-tertiary	<5	n.p.	41	72	104	214	315	381	498	393	190	2,241
Not born in a hospital[(a)]	0	<5	<5	5	5	13	26	25	27	29	28	164
Not stated	0	1	0	0	2	1	1	2	0	1	1	9
Total	**57**	**484**	**649**	**768**	**962**	**1,772**	**1,662**	**1,759**	**2,104**	**1,691**	**941**	**12,849**
						Per cent						
Tertiary	n.p.	93.4	n.p.	90.0	88.6	87.2	79.5	76.9	75.0	75.0	76.8	81.3
Non-tertiary	n.p.	n.p.	6.3	9.4	10.8	12.1	19.0	21.7	23.7	23.3	20.2	17.5
Not born in a hospital[(a)]	0.0	n.p.	n.p.	0.7	0.5	0.7	1.6	1.4	1.3	1.7	3.0	1.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
(a) These babies were either born before arrival to hospital or born at home.
Note: *Not stated data are excluded from per cent calculations.*

TABLE 56: Mode of transport for level III registrants to level III unit after birth by birthweight, ANZNN 2023

	Birthweight (grams)											
Mode of transport	**<500**	**500-749**	**750-999**	**1000-1249**	**1250-1499**	**1500-1999**	**2000-2499**	**2500-2999**	**3000-3499**	**3500-3999**	**≥4000**	**Total**
						Number						
Not transported	n.p.	450	600	680	841	1,507	1,254	1,255	n.p.	1,186	685	9,993
Specialist retrieval team	<5	n.p.	36	75	100	212	347	403	525	402	189	2,318
Non-specialist team	0	<5	5	6	6	20	14	34	n.p.	33	23	176
Other	0	3	6	5	8	19	21	17	20	22	11	132
Not stated	0	2	2	2	7	14	26	50	46	48	33	230
Total	**57**	**484**	**649**	**768**	**962**	**1,772**	**1,662**	**1,759**	**2,104**	**1,691**	**941**	**12,849**
						Per cent						
Not transported	n.p.	93.4	92.7	88.8	88.1	85.7	76.7	73.4	n.p.	72.2	75.4	79.2
Specialist retrieval team	n.p.	n.p.	5.6	9.8	10.5	12.1	21.2	23.6	25.5	24.5	20.8	18.4
Non-specialist team	0.0	n.p.	0.8	0.8	0.6	1.1	0.9	2.0	n.p.	2.0	2.5	1.4
Other	0.0	0.6	0.9	0.7	0.8	1.1	1.3	1.0	1.0	1.3	1.2	1.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Not stated data are excluded from per cent calculations.*

TABLE 57: Exogenous surfactant use for level III registrants by birthweight, ANZNN 2023

	Birthweight (grams)											
Exogenous surfactant	**<500**	**500-749**	**750-999**	**1000-1249**	**1250-1499**	**1500-1999**	**2000-2499**	**2500-2999**	**3000-3499**	**3500-3999**	**≥4000**	**Total**
						Number						
None	<5	42	180	383	641	1,343	1,389	1,530	n.p.	1,574	879	9,866
Surfactant given	n.p.	442	469	385	321	429	273	229	n.p.	117	62	2,983
▪ via endotracheal tube	47	351	318	250	186	256	199	161	167	102	54	2,091
▪ via catheter	n.p.	82	138	n.p.	126	162	61	57	n.p.	10	n.p.	799
▪ via other or unknown method	<5	9	13	<5	9	11	13	11	n.p.	5	<5	93
Total	**57**	**484**	**649**	**768**	**962**	**1,772**	**1,662**	**1,759**	**2,104**	**1,691**	**941**	**12,849**
						Per cent						
None	n.p.	8.7	27.7	49.9	66.6	75.8	83.6	87.0	n.p.	93.1	93.4	76.8
Surfactant given	n.p.	91.3	72.3	50.1	33.4	24.2	16.4	13.0	n.p.	6.9	6.6	23.2
▪ via endotracheal tube	82.5	72.5	49.0	32.6	19.3	14.4	12.0	9.2	7.9	6.0	5.7	16.3
▪ via catheter	n.p.	16.9	21.3	n.p.	13.1	9.1	3.7	3.2	n.p.	0.6	n.p.	6.2
▪ via other or unknown method	n.p.	1.9	2.0	n.p.	0.9	0.6	0.8	0.6	n.p.	0.3	n.p.	0.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.

TABLE 58: Assisted ventilation for level III registrants by birthweight, ANZNN 2023

Ventilation type	Birthweight (grams) <500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	Total
						Number						
Invasive ventilation	56	425	407	306	239	350	382	426	524	353	156	3,624
▪ HFOV given	51	279	153	77	32	42	45	50	83	43	24	879
▪ IPPV given	56	425	407	306	239	350	382	426	524	353	156	3,624
Nitric oxide given	22	110	55	44	24	26	47	81	128	85	55	677
CPAP given	40	411	627	731	850	1,639	1,464	1,490	1,755	1,394	759	11,160
NHF given	34	337	547	560	503	630	427	455	543	469	328	4,833
Total in each birthweight group	**57**	**484**	**649**	**768**	**962**	**1,772**	**1,662**	**1,759**	**2,104**	**1,691**	**941**	**12,849**
						Per cent						
IPPV given	98.2	87.8	62.7	39.8	24.8	19.8	23.0	24.2	24.9	20.9	16.6	28.2
CPAP given	70.2	84.9	96.6	95.2	88.4	92.5	88.1	84.7	83.4	82.4	80.7	86.9
NHF given	59.6	69.6	84.3	72.9	52.3	35.6	25.7	25.9	25.8	27.7	34.9	37.6
						Per cent of babies given invasive ventilation						
HFOV given[(a)]	91.1	65.6	37.6	25.2	13.4	12.0	11.8	11.7	15.8	12.2	15.4	24.3
Nitric oxide given[(a)]	39.3	25.9	13.5	14.4	10.0	7.4	12.3	19.0	24.4	24.1	35.3	18.7

(a) Denominator is babies given ventilation via endotracheal tube (IPPV and/or HFOV).
Note: *Groups are not mutually exclusive.*
HFOV = high frequency oscillatory ventilation. IPPV = intermittent positive pressure ventilation. CPAP = continuous positive airway pressure. NHF = nasal high flow.

TABLE 59: Duration of assisted ventilation use for level III registrants by birthweight, ANZNN 2023

Duration of assisted ventilation	Birthweight (grams) <500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	Total
						IPPV (hours)						
Median	520	293	115	41	26	25	42	50	53	51	42	**58**
IQR	166–1,097	114–717	33–338	13–130	12–75	11–77	16–113.5	21–116	22–120	22–100	19–98	**20–166**
						CPAP (hours)						
Median	890.5	1,137.5	952	389	142	56	31	24	18	17	18	**37**
IQR	662.5–1,405.5	712–1,464	456–1,282	129–870	57–336	23–132	15–67	11–51	9–40	9–34	9–36	**14–130**
						NHF (hours)						
Median	735.5	523	476	396	311	145	70	48	45	42.5	39	**143**
IQR	434–957	358–762	286–698	234–628.5	149–548	70–330	28–137	23–110	22–92	20–86	21–74	**45–408**

Note: *IQR = Interquartile range. IPPV = intermittent positive pressure ventilation. CPAP = continuous positive airway pressure. NHF = nasal high flow.*

TABLE 60: Chronic lung disease at 36 weeks post menstrual age for level III registrants by birthweight, ANZNN 2023

Chronic lung disease (CLD)	Birthweight (grams)							
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	≥2000	Total
				Number				
No CLD	<5	45	206	394	510	n.p.	54	1,813
CLD	n.p.	317	377	241	144	n.p.	7	1,196
Not stated	0	4	11	28	48	60	5	156
Ineligible[(a)]	22	118	55	105	260	1,033	8,091	9,684
Total	**57**	**484**	**649**	**768**	**962**	**1,772**	**8,157**	**12,849**
				Per cent				
No CLD	n.p.	12.4	35.3	62.0	78.0	n.p.	88.5	60.3
CLD	n.p.	87.6	64.7	38.0	22.0	n.p.	11.5	39.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
(a) Includes babies who did not survive to 36 weeks post menstrual age and babies born at 32 or more weeks gestational age.
Note: *Not stated and ineligible data are excluded from per cent calculations.*

TABLE 61: Respiratory support (airway support or supplemental oxygen therapy) for level III registrants who survived to day 28 by birthweight, ANZNN 2023

Respiratory support (airway support or oxygen)	Birthweight (grams)											
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	Total
						Number						
No respiratory support on day 28	0	<5	40	210	570	1,456	1,517	1,633	n.p.	1,617	912	9,961
Respiratory support on day 28	37	n.p.	571	533	384	288	117	91	n.p.	55	18	2,536
▪ survived to discharge home	32	348	560	520	379	n.p.	109	79	n.p.	49	n.p.	2,436
▪ died before discharge	5	n.p.	11	13	5	<5	8	12	<5	6	<5	100
Not stated	0	0	0	0	0	0	1	0	1	0	0	2
Total in each birthweight group	**37**	**383**	**611**	**743**	**954**	**1,744**	**1,635**	**1,724**	**2,066**	**1,672**	**930**	**12,499**
						Number						
Respiratory support on day 28 and given home oxygen	20	151	131	62	38	n.p.	17	17	n.p.	14	n.p.	505
						Per cent						
No respiratory support on day 28	0.0	n.p.	6.5	28.3	59.7	83.5	92.8	94.7	n.p.	96.7	98.1	79.7
Respiratory support on day 28	100.0	n.p.	93.5	71.7	40.3	16.5	7.2	5.3	n.p.	3.3	1.9	20.3
▪ survived to discharge home	86.5	91.1	98.1	97.6	98.7	n.p.	93.2	86.8	n.p.	89.1	n.p.	96.1
▪ died before discharge	13.5	n.p.	1.9	2.4	1.3	n.p.	6.8	13.2	n.p.	10.9	n.p.	3.9
						Per cent						
Respiratory support on day 28 and given home oxygen[(a)]	62.5	43.4	23.4	11.9	10.0	13.7	15.6	21.5	19.0	28.6	29.4	20.7

n.p. Data not published to maintain confidentiality of small numbers.
(a) Denominator is babies who received respiratory support on day 28 and survived to discharge to home.
Note: *Not stated data are excluded from per cent calculations.*

TABLE 62: Transfer after registration of level III registrants by level of destination hospital by birthweight, ANZNN 2023

Transfer status	Birthweight (grams)											
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	Total
						Number						
Not transferred	29	243	298	353	384	817	977	1,286	1,651	1,378	768	8,184
Level III hospital	5	41	68	43	43	73	33	18	21	13	6	364
Level II or I hospital	13	116	241	348	505	832	589	363	305	222	137	3,671
Children's hospital	7	71	40	24	28	48	52	77	101	70	25	543
Not stated	3	13	2	0	2	2	11	15	26	8	5	87
Total	**57**	**484**	**649**	**768**	**962**	**1,772**	**1,662**	**1,759**	**2,104**	**1,691**	**941**	**12,849**
						Per cent						
Not transferred	53.7	51.6	46.1	46.0	40.0	46.2	59.2	73.7	79.5	81.9	82.1	64.1
Level III hospital	9.3	8.7	10.5	5.6	4.5	4.1	2.0	1.0	1.0	0.8	0.6	2.9
Level II or I hospital	24.1	24.6	37.2	45.3	52.6	47.0	35.7	20.8	14.7	13.2	14.6	28.8
Children's hospital	13.0	15.1	6.2	3.1	2.9	2.7	3.1	4.4	4.9	4.2	2.7	4.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Note: *Not stated data are excluded from per cent calculations.*

TABLE 63: Retinopathy of prematurity for level III registrants by birthweight, ANZNN 2023

Retinopathy of prematurity (ROP)	Birthweight (grams)						
	<500	500-749	750-999	1000-1249	1250-1499	≥1500	Total
				Number			
No ROP	<5	76	n.p.	470	430	n.p.	1,689
Stage 1 ROP	<5	n.p.	121	122	n.p.	32	389
Stage 2 ROP	14	128	135	86	40	13	416
Stage 3 ROP	16	122	73	21	<5	<5	n.p.
Stage 4 to 5 ROP	0	<5	<5	0	0	0	<5
Not examined	21	112	51	69	419	9,091	9,763
Not stated	0	0	0	0	2	350	352
Total	**57**	**484**	**649**	**768**	**962**	**9,929**	**12,849**
				Per cent			
No ROP	n.p.	20.4	n.p.	67.2	79.5	n.p.	61.8
Stage 1 ROP	n.p.	n.p.	20.2	17.5	n.p.	6.6	14.2
Stage 2 ROP	38.9	34.4	22.6	12.3	7.4	2.7	15.2
Stage 3 ROP	44.4	32.8	12.2	3.0	n.p.	n.p.	n.p.
Stage 4 to 5 ROP	0.0	n.p.	n.p.	0.0	0.0	0.0	n.p.
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
Note: *Weight criterion less than 1,250 grams for ANZNN but 1,500 grams for some individual units.*
Not stated and not examined data are excluded from per cent calculations.

TABLE 64: Intraventricular haemorrhage for level III registrants who survived to day 3 by birthweight, ANZNN 2023[a]

Intraventricular haemorrhage	Birthweight (grams) <500	500-749	750-999	1000-1249	1250-1499	≥1500	Total
				Number			
None	34	253	436	589	708	1,084	3,104
Grade 1	7	65	86	96	85	114	453
Grade 2	<5	52	42	29	n.p.	22	177
Grade 3	<5	17	12	9	<5	6	48
Grade 4	5	59	55	14	6	9	148
Not examined	0	6	6	23	130	8,638	8,803
Not stated	34	253	436	589	708	1,084	3,104
Total	**51**	**452**	**637**	**760**	**960**	**9,873**	**12,733**
				Per cent			
None	66.7	56.7	69.1	79.9	85.3	87.8	79.0
Grade 1	13.7	14.6	13.6	13.0	10.2	9.2	11.5
Grade 2	n.p.	11.7	6.7	3.9	n.p.	1.8	4.5
Grade 3	n.p.	3.8	1.9	1.2	n.p.	0.5	1.2
Grade 4	9.8	13.2	8.7	1.9	0.7	0.7	3.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

n.p. Data not published to maintain confidentiality of small numbers.
(a) Weight criterion for IVH is a birthweight of less than 1,500 grams.
Note: *Not stated and not examined data are excluded from per cent calculations.*

TABLE 65: Neonatal sepsis for level III registrants by birthweight, ANZNN 2023

Sepsis	Birthweight (grams) <500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	Total
						Number						
No sepsis	40	348	528	702	919	1,729	1,629	1,730	2,073	1,665	923	12,286
Sepsis at <48 hrs[a]	<5	10	10	8	9	n.p.	12	8	14	14	13	110
Sepsis at ≥48 hrs[a]	16	127	112	58	34	32	22	21	17	12	5	456
Babies alive on day 2	n.p.	465	640	762	n.p.	n.p.	1,654	1,749	2,093	1,686	n.p.	12,771
Babies who did not survive to day 2	<5	19	9	6	<5	<5	8	10	11	5	<5	78
Total in each birthweight group	**57**	**484**	**649**	**768**	**962**	**1,772**	**1,662**	**1,759**	**2,104**	**1,691**	**941**	**12,849**
						Per cent						
No sepsis[b]	70.2	71.9	81.4	91.4	95.5	97.6	98.0	98.4	98.5	98.5	98.1	95.6
Sepsis at <48 hrs[b]	n.p.	2.1	1.5	1.0	0.9	n.p.	0.7	0.5	0.7	0.8	1.4	0.9
Sepsis at ≥48 hrs[c]	n.p.	27.3	17.5	7.6	3.5	n.p.	1.3	1.2	0.8	0.7	0.5	3.6

n.p. Data not published to maintain confidentiality of small numbers.
(a) Groups are not mutually exclusive.
(b) Denominator is all registrants.
(c) Denominator is registrants alive at 48 hours.

TABLE 66: Length of stay for level III registrants who survived until discharge home by birthweight, ANZNN 2023

Birthweight (grams)	Number of babies	Median length of stay (days)	Interquartile range (days)
<500	32	147	131–194
500-749	349	121	103–140
750-999	600	93	76–112
1,000-1,249	730	68	54–84
1,250-1,499	949	51	39–64
1,500-1,999	1,741	36	27–47
2,000-2,499	1,626	20	14–30
2,500-2,999	1,712	11	5–19
3,000-3,499	2,063	6	4–13
3,500-3,999	1,666	5	3–11
≥4,000	929	5	3–11
Total	**12,397**	**19**	**6–46**

TABLE 67: Survival to discharge home for level III registrants by birthweight, ANZNN 2023

Birthweight (grams)	Number of babies	Lethal congenital anomalies	Babies alive on day 7	Babies alive on day 28	Survived to discharge to home	Percent survival at discharge home
<500	57	0	45	37	32	56.1
500-749	484	<5	433	383	349	72.1
750-999	649	<5	628	611	600	92.4
1,000-1,249	768	9	751	743	730	95.1
1,250-1,499	962	5	957	954	949	98.6
1,500-1,999	1,772	13	1,759	1,744	1,741	98.3
2,000-2,499	1,662	22	1,645	1,635	1,626	97.8
2,500-2,999	1,759	28	1,740	1,724	1,712	97.3
3,000-3,499	2,104	16	2,077	2,066	2,063	98.1
3,500-3,999	1,691	8	1,676	1,672	1,666	98.5
≥4,000	941	<5	935	930	929	98.7
Total	**12,849**	**110**	**12,646**	**12,499**	**12,397**	**96.5**

Appendix 3: Methods used in this report

The ANZNN data collection was moved to the then-named Perinatal & Reproductive Epidemiology Research Unit, School of Women's & Children's Health, University of New South Wales in June 2008. The historical ANZNN data were received as a Microsoft Access database and archived as a Microsoft SQL Server database.

Data for the ANZNN audit of babies born in 2023 who qualified as high-risk neonates were requested from each participating unit in March 2024 with a deadline of July 2024. The data was submitted to the ANZNN by each participating unit through an online Data Capture System (DCS), which uses a series of queries to ensure quality, consistency and completeness of data. Units are unable to submit data if mandatory data items are missing or contain non-compliant data values. For all other data items, outliers flagged by the program may only be submitted by designated supervisors at each unit.

An extract from the database was made in November 2025. Apart from grouping, the data presented in the report reflect the database at that time with one exception: a series of derived data items were generated. These are listed below.

Derived data items:

Survival to day n	The number of days between the date of birth and the date of death was calculated and records flagged if this was less than n days.
Survival to 36 weeks post menstrual age	This item is for babies born at less than 36 weeks gestation only. The day the baby reaches 36 weeks post menstrual age is considered to be the infant's gestational age (completed weeks) plus chronological age in days. For example, a baby born at '28 weeks and four days' gestation on 1 January is 36 weeks post menstrual age on 26 February.
Chronic lung disease (CLD)	This item is for babies born at less than 32 weeks gestation only. The baby received any respiratory support (supplemental oxygen or intermittent positive pressure ventilation (IPPV) or continuous positive airway pressure (CPAP) or nasal high flow for a chronic pulmonary disorder on the day the baby reached 36 weeks post menstrual age. Date of final added respiratory support must be: > Date of birth or {[(Hours of IPPV + Hours of CPAP + Hours of nasal high flow)/168] + Gestational age} > 35.9 weeks
Length of stay	The total number of days a baby spent in hospital during their first admission from birth. The total may include stays in more than one hospital.

All data manipulations and analysis for the 2023 report were carried out using Microsoft SQL Server software, and tabulations and figures were produced using Microsoft Excel.

Appendix 4: Confidentiality guidelines

Confidentiality guidelines provide an unambiguous framework for the handling of data that met the strict criteria of governing bodies. Confidentiality guidelines for the collection, processing and analysis of data from the minimum data collection of ANZNN were devised and agreed to by the Advisory Committee at the ANZNN Advisory Committee Meeting, Auckland, New Zealand on 2 April 1995. The summary below incorporates modifications agreed in the Memorandum of Understanding (MOU) between ANZNN and the National Perinatal Epidemiology and Statistics Unit, School of Women's and Children's Health, the University of New South Wales.

The purpose of these guidelines is to set out the principles under which the National Minimum Data Collection (NMDC) for neonatal intensive care units (NICUs) is formulated and the conditions that apply to the use of these data and release to parties internal and external to the ANZNN.

The essential purpose of the NMDC is to provide national unit record tabulations on babies meeting specified criteria who have been admitted to NICUs or affiliated nurseries in Australia and New Zealand. In general, this will be achieved through distribution of an annual report containing summary tables without identifying characteristics, either of a personal, institutional or state, territory or national nature. In certain other instances, data may be provided internally in the following manner:

- as de-identified summary tables not provided in the annual report, but available upon request
- as de-identified unit record data for analytical purposes as approved by the ANZNN
- as NICU identifiable summary and/or unit record data for clinical audit purposes by the respective NICU providing the data. These guidelines will cover the collection and provision of data retrospectively from 1 January 1994.

Principles of ownership and maintenance of data

- The National Perinatal Epidemiology and Statistics Unit (NPESU) agrees to house and maintain the ANZNN Data Collection through electronic data submission from neonatal intensive care units and special care nurseries during the period 1 January 2008 to 31 December 2018. A renewed agreement extends this period to 31 December 2027.
- The ANZNN Data Collection will be housed at NPESU. It will be managed according to existing data security procedures as for other data collections at NPESU. The Data Custodian is the Director of NPESU.

The ANZNN Data Collection Operation Committee ("ANZNN DCOC") was established in June 2008 to make decisions concerning the management, operation, data provision and reporting of the ANZNN Data Collection. The ANZNN DCOC is comprised of: three members appointed by the ANZNN Executive Committee and the ANZNN Advisory Council; two members appointed by the NPESU; and the Chairperson appointed by the ANZNN Executive Committee. The operations and progress of ANZNN Data Collection will be reported quarterly by ANZNN DCOC to the ANZNN Executive Committee.

The NPESU will ensure that the data structure of the ANZNN Data Collection will remain the same as the existing data collection. Any modification to the data structure will be a joint decision between the ANZNN Executive Committee and the NPESU. Issues such as data entry, collation, retrieval and analysis will be considered.

The ANZNN will be responsible for collection and maintenance of the data set and decision-making with respect to its use.

All queries related to the NMDC should be referred to the Data Custodian at NPESU who will address them personally or refer them to the appropriate source person.

Conditions for data collection

It is expected that all participating NICUs will collect the agreed-upon minimum set of data in a standardised format for eligible babies registered to the ANZNN audit in their unit. Data will be transferred securely to the ANZNN coordinator.

Conditions for data security

ANZNN data is maintained in a secure partition by the University of New South Wales. Access to the server is restricted to designated ports within the NPESU office and access is limited to authorised named staff and further protected by the use of high-level passwords. Access to the server is managed by UNSW IT department. Attempted security breaches are monitored and investigated. The NPESU is located in a restricted access UNSW managed building with all internal doors to the NPESU office accessible only via swipe card by authorised staff and students.

Small numbers

Cell values of less than five in tables have not been published, in accordance with ethical guidelines for protecting the privacy of individuals. Exceptions to this are small numbers in 'Other' and 'Not stated' categories. The cell with small numbers and at least one other cell in the same row and column are suppressed to prevent back calculation. Where n.p. (not published) has been used to protect confidentiality, the suppressed numbers are included in the totals.

Appendix 5: Minimum Data Set variables

Neonatal Minimum Data Set

Registration hospital

Definition: The hospital of registration is the first level III NICU that the baby remained in for four or more hours during the first 28 days of life. Babies who received their entire care in a level II hospital, or who were not transferred to a level III NICU during the first 28 days are registered to the first level II centre that they remain in for four or more hours.

Coding: Numeric code representing registration hospital

Guide for use: If a baby dies within four hours, they are registered to the unit where they died.

Maternal age

Definition: Age in completed years of the woman giving birth on the date of the baby's birth.

Coding: 2-digit number representing maternal age in completed years

Previous preterm birth

Definition: This mother has had a previous birth that was at less than 37 weeks gestation and more than 20 completed weeks, regardless of outcome.

Coding:

99: unknown.

0: no previous preterm birth.

-1: yes, there was a previous preterm birth.

Previous perinatal death

Definition: Mother has had a previous perinatal loss.

Coding:

99: unknown.

0: no previous perinatal death.

-1: yes, has had a previous perinatal death.

Guide for use: A perinatal loss is when a baby with a birthweight of more than 400 grams or a gestational age of more than 20 completed weeks died during the first 28 days of life.

Assisted conception in this pregnancy

Definition: The type of infertility treatment used during conception or used to conceive this pregnancy.

Coding:

0: unknown.

1: none – no infertility treatment used for this pregnancy.

2: hyperovulation – any hormone therapy used to stimulate ovulation.

3: IVF / GIFT etc. – any method of in vitro fertilisation. Including in vitro fertilisation, gamete intra-fallopian transfer, zygote intra-fallopian transfer and IC sperm injection.

4: other – infertility treatment used that is not mentioned above, including artificial insemination.

Guide for use: Disregard any treatment for any previous pregnancies.

Ethnicity of mother

Definition: Ethnic origin of the mother of baby, as identified by the mother.

Coding:

0: Unknown.

1: Aboriginal or Torres Strait Islander – is a person of Aboriginal or Torres Strait Islander descent who identifies as an Aboriginal or Torres Strait Islander and is accepted as such by the community with which she is associated.

2: Asian – all whose ethnic background originates from countries of Asia, South East Asia and Indian subcontinent (e.g. Fijian Indian).

3: Caucasian – all Caucasoid heritage, including, European, Russian, Middle Eastern and Arabic.

4: Other – includes Indigenous Africans, Inuit, African Americans, Native Americans, Melanesian.

5: Pacific peoples – all from Pacific peoples background, including Samoan, Cook Islands Māori, Niuean, Tokelauan, and other Pacific Islands groups (e.g. Hawaiian, Tahitian). Excludes Māori.

6: Māori – a person of New Zealand Māori descent who identifies as Māori.

Source of referral

Definition: Source of referral to registration unit.

Coding:

0: unknown.

1: booked at tertiary obstetric hospital – mother booked into a hospital with an NICU and was not transferred during the most recent admission.

2: in utero transfer from obstetric hospital – mother transferred during most recent admission, baby in utero.

3: ex utero retrieval – baby transferred from any hospital by a specialist retrieval team.

4: ex utero transfer – baby transferred from any hospital by non-specialist team, includes transport by ambulance.

5: other – born in transit or not booked.

6: booked at this level II unit – mother booked into this hospital, no NICU.

7: in utero transfer to this level II unit – mother transferred, baby in utero.

8: ex utero retrieval to this level II unit – baby 'retrieved' from any other hospital.

9: ex utero transfer to this level II unit.

Guide for use: Use most recent referral.

Presenting antenatal problem

Definition: The antenatal complication that the mother presented with in this pregnancy.

Coding:

0: unknown.

1: preterm pre-labour rupture of membranes – confirmed spontaneous rupture of membranes occurring prior to the onset of labour and before 37 weeks gestation.

2: preterm labour.

3: hypertension in pregnancy.

4: antepartum haemorrhage.

5: suspected intrauterine growth restriction.

6: fetal distress.

7: other.

8: none – no presenting problem. Born at term.

9: antenatal diagnosis of fetal malformation.

Sex

Definition: The sex of the patient.

Coding:

0: unknown.

1: male.

2: female.

3: ambiguous or indeterminate.

Infant weight

Definition: The first weight of the baby after birth.

Coding: A 4-digit number representing birthweight in grams.

Guide for use: The weight is usually measured to the nearest five grams and is obtained within one hour of birth, or shortly after the infant has been admitted.

Gestational age

Definition: The estimated gestational age of the baby in completed weeks.

Coding: A 2-digit number representing the number of completed weeks of gestation.

Guide for use: Derived from a clinical assessment of the baby when accurate information is not stated.

Place of birth

Definition: Place of baby's birth.

Coding:

0: unknown.

1: non-tertiary hospital – born in a hospital with no level III NICU.

2: tertiary hospital – born in a hospital with a level III NICU.

3: homebirth – planned.

4: born before arrival – unplanned birth at home, or in an ambulance, a car etc.

Presentation at birth

Definition: Presenting part of the fetus (at lower segment of the uterus) at birth.

Coding:

0: unknown.

1: cephalic – including face and brow.

2: breech – legs or feet were facing the cervix.

3: other – includes transverse.

Mode of birth

Definition: The method of complete expulsion or extraction from its mother of a product of conception.

Coding:

0: unknown.

1: vaginal – vaginal birth, includes breech.

2: instrument – vaginal birth using an instrument – forceps, rotations, vacuum extraction.

3: Caesarean section in labour – caesarean performed after the commencement of labour.

4: Caesarean section, no labour – caesarean section performed prior to labour commencing.

Antenatal corticosteroids

Definition: Corticosteroids given during the antenatal period via any route to the mother at a time likely to enhance fetal lung maturation.

Coding:

0: unknown.

1: none – steroids not given.

2: less than 24 hours – first dose given less than 24 hours prior to this baby's birth.

3: complete – more than 1 dose of steroids given, and 1st dose at more than 24 hours and less than 8 days before birth.

4: given at more than 7 days before baby's birth.

Guide for use: If two courses given, and one fulfils the 'complete' criteria, use 'complete'. If the time of doses given is not available, but two doses are known to have been given appropriately, also use 'complete'.

Magnesium sulphate

Definition: Magnesium sulphate ($MgSO_4$) provided to the mother during the 24 hours immediately before birth, either because of maternal preeclampsia or specifically for fetal neuro-protection.

Coding:

0: unknown – information not available.

1: $MgSO_4$ not given at all.

2: $MgSO_4$ course stopped > 24 hours before birth.

3: $MgSO_4$ commenced > 24 hours before birth and stopped < 24 hours before birth.

4: $MgSO_4$ commenced between 4 to 24 hours before birth.

5: $MgSO_4$ commenced within 4 hours of birth.

6: $MgSO_4$ given but details not known.

7: $MgSO_4$/placebo given for randomised trial.

Guide for use: In the case of planned birth, $MgSO_4$ is recommended to be commenced as close to four hours before birth as possible, however if birth is planned or expected to occur sooner than four hours, administration is recommended, as there is still advantage likely from administration within this time.

Plurality

Definition: The total number of births resulting from this pregnancy.

Coding:

0: singleton – only one baby born.

1: twins – two babies.

2: triplets – three babies.

3: quads – four babies.

4: more – quintuplets, sextuplets etc.

Guide for use: Determined by the number of live births or by the number of fetuses that remain in utero at 20 weeks gestation. If gestational age is unknown, only live births of any birthweight or gestation, or fetuses weighing ≥ 400 grams are taken into account. Fetuses aborted at < 20 weeks or fetuses compressed in the placenta at or more than 20 weeks are excluded.

Birth order

Definition: Order of each baby of a multiple birth.

Coding: Single-digit number representing birth order.

0: singleton.

1: first of a multiple birth.

2: second of a multiple birth.

3: third of a multiple birth etc.

4: other.

Date of birth

Definition: Date of birth of the patient.

Coding: DD / MM / YYYY

Admission date

Definition: The date on which an inpatient or same-day patient commences an episode of care.

Coding: DD / MM / YYYY

Apgar score (1 minute)

Definition: Numerical score to evaluate the baby's condition at one minute after birth.

Coding: 2-digit number representing Apgar score.

Guide for use: The score is based on the five characteristics of heart rate, respiratory condition, muscle tone, reflexes and colour.

Apgar score (5 minute)

Definition: Numerical score to evaluate the baby's condition at five minutes after birth.

Coding: 2-digit number.

Guide for use: As for Apgar score (1 minute).

Intubated at resuscitation

Definition: An active measure taken shortly after birth to establish independent respiration and heart rate, or to treat depressed respiratory effort by endotracheal intubation.

Coding:

99: unknown.

0: no, intubation was not necessary in labour ward.

-1: yes, intubation necessary in labour ward.

Guide for use: Does not include intubation for tracheal aspiration or intubation in the NICU after resuscitation is complete.

Congenital anomalies

Definition: Structural abnormalities (including deformations) present at birth and diagnosed prior to separation from care (discharge home).

Coding:

99: unknown.

0: no major congenital malformations noted.

-1: yes, major congenital malformation noted.

Specified congenital anomalies

Definition: Detail of the major congenital malformation.

Coding: Free text field representing congenital malformation coded by ICD-10-AM.

Temperature on admission

Definition: Temperature on admission to the NICU or closest to admission to registration unit. Use rectal temperature or, if not available, per axilla.

Coding: A 4-digit number representing temperature measured in degrees Celsius to 1 decimal place.

Guide for use: If the baby is transported by a specialist neonatal retrieval team, admission is considered to commence when the team arrive at the baby's bedside. If the baby is more than 12 hours of age when NICU care started, or if an admission temperature is not recorded, use '0' to denote missing.

Worst base excess

Definition: Worst base deficit recorded between admission to NICU and 12 hours after birth.

Coding: 3 digit numbered field representing base excess measured in mmol per litre. May be negative.

Guide for use: Use '99' to denote missing.

Main respiratory diagnosis

Definition: Main indication for respiratory support.

Coding:

0: unknown.

1: normal – no respiratory support.

2: non-specific – any non-specific respiratory distress in an infant requiring respiratory support (combines previous items transient tachypnoea of newborn and immature lung).

3: hyaline membrane disease – increasing respiratory distress or oxygen (O_2) requirements, or the need for ventilator support from the first six hours of life with a chest x-ray showing generalised reticulogranular pattern, plus or minus air bronchogram.

4: meconium aspiration – respiratory distress presenting from immediately after birth to 12 hours of age. Hypoxia, tachypnoea and gasping respirations are often signs of underlying asphyxia. Chest x-ray shows over-expansion of lungs with wide spread coarse, fluffy infiltrates.

5: pneumonia – respiratory distress with proven or suspected infection (toxic blood count), and chest x-ray showing persisting opacities.

6: persistent pulmonary hypertension – echocardiac (shunting) or clinical evidence – O_2 need unexplained by chest x-ray or loud P2, or differential pre/post ductal $TCPO_2$.

8: apnoea – recurrent pauses in breathing for more than 20 seconds, or for less than 20 seconds associated with bradycardia or any desaturation requiring intervention.

9: congenital malformation – malformation is the primary reason for respiratory distress, e.g. diaphragmatic hernia (list malformation in appropriate field).

10: other – unspecified other respiratory distress.

11: peri surgical – no respiratory distress, support given for surgical intervention.

12: newborn encephalopathy – a syndrome of disturbed neurological function in an infant with difficulties initiating or maintaining respiration, depression of tone reflexes or consciousness and often with seizures.

Guide for use: For a diagnosis other than 'normal' the baby must receive respiratory support. If more than one diagnosis is possible, use the most serious condition.

Exogenous surfactant

Definition: A dose of any type of exogenous surfactant was used to treat this baby.

Coding:

99: unknown.

0: no exogenous surfactant given to this baby.

-1: yes, exogenous surfactant given to this baby.

Guide for use: Includes incomplete administration.

Method of administration of first dose of surfactant

Definition: Method used to administer the first dose of surfactant.

Coding:

0: unknown.

1: endotracheal tube.

2: catheter (eg. MIST).

3: Other – eg. laryngeal mask, aerosolisation.

Air leak requiring drainage

Definition: Any form of pulmonary air leak requiring drainage (transient or continuous).

Coding:

99: unknown.

0: no air leak requiring drainage present.

-1: yes, air leak requiring drainage.

Hours of intermittent positive pressure ventilation (IPPV)

Definition: Total number of hours of IPPV given via an endotracheal tube, at any rate.

Coding: 4-digit number – IPPV hours.

Guide for use: The hours of all forms of assisted ventilation via an endotracheal tube are summed. The usual rounding up applies.

Hours of continuous positive airway pressure (CPAP)

Definition: Total number of hours of CPAP via any route, and nasopharyngeal ventilation.

Coding: 4-digit number – CPAP hours

Guide for use: The number of hours of any form of CPAP is summed for all instances of this therapy.

Hours of nasal high flow

Definition: Total number of hours of air and oxygen mix delivered through a high flow device in hours.

Coding: 4-digit number – nasal high flow hours

Guide for use: The number of hours of any form of CPAP is summed for all instances of this therapy.

Hours of high frequency oscillatory ventilation (HFOV)

Definition: Total number of hours of high frequency oscillatory ventilation given via an endotracheal tube, at > 4Hz

Coding: 4-digit number – HFOV hours

Guide for use: The number of hours of any form of HFOV is summed for all instances of this therapy.

Hours of high frequency jet ventilation (HFJV)

Definition: Total number of hours of high frequency jet ventilation given via an endotracheal tube, at > 4Hz

Coding: 4-digit number – HFJV hours

Guide for use: The number of hours of any form of HFJV is summed for all instances of this therapy.

Hours of nitric oxide

Definition: Total number of hours of nitric oxide therapy in any form or dose for respiratory support of the baby.

Coding: 4-digit number – nitric oxide hours

Guide for use: The number of hours of any form of nitric oxide is summed for all instances of this therapy.

Extracorporeal membrane oxygenation

Definition: An extracorporeal circuit was established to divert baby's blood to a membrane lung for oxygenation, was initiated for this baby.

Coding:

99: unknown.

0: no ECMO initiated.

-1: yes, ECMO initiated.

Date of final added respiratory support

Definition: Date supplemental oxygen (O_2), high flow, CPAP or mechanical ventilation ceased appropriately.

Coding: DD / MM / YYYY

Guide for use: Four consecutive hours in any 24-hour period constitutes a 'day'.

Respiratory support at 36 weeks post menstrual age

Definition: Status of respiratory support at 36 weeks and 0 days / post menstrual age 252 days.

Coding:

0: unknown.

1: no respiratory support.

2: low flow air +/- oxygen with feeds (≤1L/min).

3: low flow oxygen (≤1L/min).

4: oxygen via head box or incubator.

5: high flow >1L/min.

6: nasal CPAP.

7: nasal ventilation (includes nasal high frequency).

8: endotracheal CPAP or ventilation (includes high frequency).

9: endotracheal tube alone.

10: tracheostomy CPAP or ventilation (includes high frequency).

11: tracheostomy alone.

Guide for use: Supersedes "Chronic lung disease".

Post-natal steroids for chronic lung disease

Definition: The infant was treated with systemic corticosteroids by any route for chronic lung disease.

Coding:

99: unknown.

0: no systemic post-natal steroids for chronic lung disease.

-1: yes, the baby did have post-natal steroids for chronic lung disease.

Guide for use: Record if corticosteroids used with the objective of treating evolving CLD at any stage or to prevent development of CLD. It must not include corticosteroid use for the treatment of conditions such as post-extubation subglottic oedema or in the use for hypotension or any forms of corticosteroid deficiency.

Home oxygen therapy

Definition: Supplemental oxygen therapy was used at home after discharge from hospital.

Coding:

99: unknown.

0: no supplemental oxygen used at home.

-1: yes, home oxygen therapy given.

Guide for use: Must have required supplemental oxygen in hospital.

Neonatal surgery

Definition: This baby had surgery which involved opening a body cavity during this admission.

Coding:

99: unknown.

0: no major neonatal surgery.

-1: yes, major surgery took place during this admission.

Parenteral nutrition

Definition: Intravenous infusion of a nutria 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.

Coding:

99: unknown.

0: parenteral nutrition never initiated.

-1: yes, parenteral nutrition initiated.

Home gavage feeding

Definition: The baby was discharged home with a nasogastric tube in place to allow gavage / infusion feeding at home.

Coding:

99: unknown.

0: no, not discharged with gavage tube.

-1: yes, discharged to home with a gavage tube.

Guide for use: Must have required gavage feeding in hospital.

Proven necrotising enterocolitis

Definition: Diagnosis of proven necrotising enterocolitis (NEC) is definite.

Coding:

99: unknown.

0: no necrotising enterocolitis proven.

-1: yes, necrotising enterocolitis proven.

Guide for use: Has at least one of the following symptoms:

1. Diagnosis at surgery or post mortem.
2. Radiological diagnosis, a clinical history plus:
   - pneumatosis intestinalis, or
   - portal vein gas, or
   - a persistent dilated loop on serial X-rays.
3. Clinical diagnosis, a clinical history plus abdominal wall cellulitis and palpable abdominal mass.

Spontaneous intestinal perforation

Definition: Intestinal perforation not associated with NEC nor with any bowel obstruction/atresia, nor with any mechanical trauma.

Coding:

99: unknown.

0: no, the baby did not have spontaneous intestinal perforation.

-1: yes, the baby did have spontaneous intestinal perforation.

Guide for use: Record if SIP has occurred, without any radiological signs of NEC and/or without surgical diagnosis of NEC.

Therapeutic hypothermia

Definition: Intentional cooling of an infant of any gestational age to a core temperature <35.0°C (generally 33-34°C).

Coding:

99: unknown.

0: no.

-1: yes.

Guide for use: Record if therapeutic hypothermia has occurred.

Principal reason for non-completion of full 72 hours of hypothermia

Definition: The principal reason why therapeutic hypothermia was terminated early / before 72 hours of treatment had been completed.

Coding:

0: not ceased before 72 hours

1: palliation.

2: recognised as not fulfilling standard criteria for cooling.

3: fulfilled standard criteria for cooling but clinical improvement suggests no need.

4: qualification equivocal with change of clinical decision making.

5: severe coagulopathy not responding to blood products.

6: hypotension not responding to inotrope.

7: severe PPHN refractory to iNO.

8: arrhythmia.

9: reason for early cessation not known.

Guide for use: Hypothermia begins at the onset of cooling and ends at the onset of warming.

Bacterial, fungal or viral infection present

Definition: The presence of proven systemic bacterial or fungal sepsis or late onset nosocomial viral infection for this baby.

Coding:

99: unknown.

0: no, the baby did not have a proven bacterial, fungal or viral infection noted.

-1: yes, the baby did have a proven bacterial, fungal or viral infection noted.

Guide for use: Systemic sepsis is defined as a clinical picture consistent with sepsis, and either a positive bacterial or fungal culture of blood and/or cerebrospinal fluid (CSF). For each episode of sepsis, the following conditions must apply:

- Isolation of an organism from at least one blood or CSF culture or identification via polymerase chain reaction in CSF and,
- After consideration of clinical and laboratory evidence, a decision is made to give the patient antibiotics with therapeutic intent against this organism.

For each episode of infection, the following conditions must not apply:

- Mixed coagulase negative staphylococcus or other skin flora contaminant episode.

Viral infection should only be considered if initial symptoms occurred after 48 hours of birth.

- Clinical features consistent with viral infection
- Isolation or identification of an organism by PCR, immunofluorescence or similar technology from an appropriate body fluid eg mouth swab/saliva, rectal swab/faeces, nasopharyngeal aspirate, endotracheal aspirate, CSF, or other relevant tissues eg skin lesion
- Asymptomatic colonisation with rotavirus should be excluded.

Type of infection

Definition: The type of the proven systemic bacterial or fungal infection or nosocomial viral infection present.

Coding:

-1: early infection (bacterial or fungal infection) – the presence of systemic bacterial or fungal sepsis with initial symptoms occurring prior to 48 hours after birth.

0: late infection (bacterial or fungal infection) – the presence of blood or CSF infection with initial symptoms occurring from 48 hours after birth.

2: viral infection – the presence of at least one episode of viral infection with initial symptoms occurring following 48 hours after birth.

Guide for use: As for Bacterial, fungal or viral infection present. The same organism isolated from blood or CSF during previous 14 days-repeat isolate should not be included.

Date of collection of positive blood or CSF culture for systemic sepsis or date of onset of nosocomial viral infection occurring after 48 hours of birth

Definition: The date of the collection of blood or CSF culture for each episode of systemic sepsis, or the date of the onset of clinical illness caused by each episode of viral infection, with initial symptoms occurring after 48 hours of birth.

Coding: DD / MM / YYYY

Guide for use: Must be coded as "yes" for 'Bacterial, fungal or viral infection present'. The same organism isolated from blood or CSF during previous 14 days-repeat isolate should not be included. Leave blank when corresponding 'Type of infection' is coded as "Early infection".

Maximum grade of left sided periventricular haemorrhage

Definition: Worst level of periventricular haemorrhage seen on the left side of the head by imaging or post mortem examination during the first 14 days of life.

Coding:

0: none – ultrasound / post mortem shows no haemorrhage.

1: grade 1 – subependymal germinal matrix haemorrhage.

2: grade 2 – intraventricular haemorrhage.

3: grade 3 – intraventricular haemorrhage with ventricle distended with blood.

4: grade 4 – localised intraparenchymal haemorrhage.

5: grade 4 – extensive intraparenchymal haemorrhage.

9: not examined – by ultrasound or by post mortem examination.

Guide for use: Early ventricular dilatation may occur with or without haemorrhages. Mild ventricular dilatation without intraventricular blood distension is excluded (not grade 3). Localised intraparenchymal haemorrhage/ haemorrhagic infarction is defined as being solitary and mainly confined to one of the following territories: anterior frontal, posterior frontal, parietal, occipital, temporal, thalamus. Extensive intraparenchymal haemorrhage/haemorrhagic infarction is defined as involving two or more of the territories. Note: exclude echodensity which resolves within 10 days.

Maximum grade of right sided periventricular haemorrhage

Definition: Worst level of periventricular haemorrhage seen on the right side of the head by imaging or post mortem examination during the first 14 days of life.

Coding:

0: none – ultrasound / post mortem shows no haemorrhage.

1: grade 1 – subependymal germinal matrix haemorrhage.

2: grade 2 – intraventricular haemorrhage.

3: grade 3 – intraventricular haemorrhage with ventricle distended with blood.

4: grade 4 – localised intraparenchymal haemorrhage.

5: grade 4 – extensive intraparenchymal haemorrhage.

9: not examined- by ultrasound or by post mortem examination.

Guide for use: As for Maximum grade of left sided periventricular haemorrhage.

Cerebellar haemorrhage

Definition: Most extensive cerebellar haemorrhage noted by imaging or post mortem examination during the first 14 days of life.

Coding:

0: no cerebellar haemorrhage – mastoid ultrasound views undertaken and no cerebellar haemorrhage / post mortem shows no cerebellar haemorrhage.

1: left hemisphere haemorrhage only.

2: right hemisphere haemorrhage only.

3: haemorrhage in vermis only.

4: bilateral hemisphere haemorrhage.

5: haemorrhage in either or both hemispheres AND vermis.

9: not examined- by ultrasound or by post mortem examination.

Guide for use: Mastoid view is required for this detection.

Date of late head ultrasound

Definition: Date of the cerebral ultrasound scan nearest to six weeks of age.

Coding: DD / MM / YYYY

Guide for use: Data is confined to ultrasounds performed between four and eight weeks of age. Accept finding if transferred to Level II units between three and four weeks of age.

Ventricle size

Definition: Ventricular size measured by the ultrasound scan closest to six weeks (four to eight weeks) of age, as the largest measurement from either ventricle.

Coding: 4-digit number correct to one decimal place.

Guide for use: Record if the measurement for the largest ventricle. The lateral ventricle measurement is taken at the mid body in the coronal view at the foramen of Munroe.

Cerebral cysts (left)

Definition: Cystic change in left cerebral hemisphere measured by the ultrasound scan closest to six weeks of age. Record worst cystic periventricular leukomalacia severity (extensive or localised) if more cystic changes seen in four to eight week scans.

Coding:

0: no cysts – no cystic lesions seen on ultrasound.

1: porencephalic cyst(s).

2: periventricular leukomalacia primarily confined to one of the regions: anterior frontal, posterior frontal, parietal, temporal or occipital region (same as defined for periventricular haemorrhage).

3: extensive leukomalacia involving two or more of the above regions.

4: unknown – information not available, includes not scanned.

Guide for use: Ependymal cysts, cysts of the choroid plexus and conatal cysts are considered normal variants and are excluded. If any of these are present score as no cysts.

Cerebral cysts (right)

Definition: Cystic change in right cerebral hemisphere measured by the ultrasound scan closest to six weeks of age. Record worst cystic periventricular leukomalacia severity (extensive or localised) if more cystic changes seen in four to eight week scans.

Coding:

0: no cysts – no cystic lesions seen on ultrasound.

1: porencephalic cyst(s).

2: periventricular leukomalacia primarily confined to one of the regions: anterior frontal, posterior frontal, parietal, temporal or occipital region (same as defined for periventricular haemorrhage).

3: extensive leukomalacia involving two or more of the above regions.

4: unknown – information not available, includes not scanned.

Guide for use: As for Cerebral cysts (left)

Baby meets local criteria for ROP exam

Definition: The baby meets the criteria for eye examination for ROP.

Coding:

99: unknown.

0: no.

-1: yes, did meet local criteria.

Retinopathy of prematurity (ROP)

Definition: Worst stage of ROP in either eye prior to going home.

Coding:

0: none seen – no changes seen.

1: stage I – demarcation line.

2: stage II – ridge.

3: stage III – ridge with extraretinal fibro-vascular proliferation.

4: stage IV – retinal detachment.

5: not examined – no eye examination.

Surgical therapy for retinopathy of prematurity

Definition: Any surgical therapy used to treat retinopathy of prematurity (ROP), i.e. laser or cryotherapy.

Coding:

99: unknown.

0: no surgical therapy for ROP received.

-1: yes, surgical therapy given for ROP.

Died

Definition: The death of this baby occurred prior to discharge from hospital.

Coding:

99: unknown.

0: no, survived to discharge to home.

-1: yes, died.

Date of death

Definition: Date of death of the baby.

Coding: DD / MM / YYYY

Guide for use: If baby is known to have died after discharge, record date here and 'no' to died.

Post mortem

Definition: Post mortem examination performed.

Coding:

99: unknown.

0: no post mortem performed.

-1: yes, a post mortem was performed.

Immediate cause of death

Definition: The cause of death as stated on the death certificate.

Coding: unspecified free text field

Guide for use: To be described in morbid anatomical terms.

Death due to congenital anomaly

Definition: The death of the infant directly attributed to the congenital anomaly.

Coding:

99: unknown.

0: no.

-1: yes.

Guide for use: Must be coded as 'yes' for major congenital anomaly and 'yes' for died.

Transferred to another hospital

Definition: The baby was transferred to another hospital nursery before going home.

Coding:

99: unknown.

0: no, never transferred.

-1: yes, transferred.

Date of transfer

Definition: Date on which a baby completes an episode of care after birth in the hospital of registration.

Coding: DD / MM / YYYY

Guide for use: Use the most significant date.

Discharge date

Definition: Date on which a patient completes an episode of care.

Coding: DD / MM / YYYY

Comment: All data collection ceases on this date.

Extremely Preterm Follow-up Minimum Data Set

Date assessed

Definition: Date on which the two to three year follow-up developmental assessment was performed.

Coding: DD / MM / YYYY

Corrected age in months

Definition: Age in months corrected for prematurity based on the age the child would be if the pregnancy had gone to term (40 weeks).

Coding: Number representing the number of months to one decimal place

Guide for use: The age when performance is no longer influenced by prematurity and the need to use corrected age is controversial. However objective evidence supports the need to make this allowance up to approximately 8 years of age. To calculate corrected age in months, use the formula: (Date assessed – Estimated date of confinement) / (365.25 / 12)

Outcome for children at two to three years

Definition: Survival of the child at two to three years corrected age.

Coding:

99: unknown.

0: no, child died after discharge from hospital to home and prior to the two to three year follow-up.

-1: yes, survived to the two to three year follow-up.

Outcome for follow-up at two to three years

Definition: Outcome of the child for follow-up at two to three years of age.

Coding:

1: formal developmental assessment (e.g. Bayley III or Griffiths).

2: information obtained but formal assessment not done.

3: child is unable to be assessed due to severe developmental delay.

4: child is unable to be assessed due to behavioural disorder.

5: child is unable to be assessed due to non-compliance.

6: lost- the child is lost to follow-up.

Guide for use: If the child attended assessment but was uncooperative, child is recorded as "Child is unable to be assessed due to non-compliance (5)". If no contact with the child's parent(s)/guardian(s) could be made or if the child's parent(s)/guardian(s) were unwilling or unable to bring the child in for assessment, child is recorded as "Lost- the child has been lost to follow-up (6)".

Reason for lost to follow-up

Definition: Main reason child was lost to follow-up at two to three years corrected age.

Coding:

0: unknown.

1: could not be contacted.

2: refused/did not attend appointment.

3: moved from area – referral to another hospital for follow-up assessment unknown.

4: referred to another hospital for follow-up assessment – the registration hospital could not obtain follow-up outcomes from the referral hospital.

5: did not meet local criteria for follow-up assessment.

6: other.

7: COVID-19 impact – includes not attending appointment or appointment not offered due to COVD-19-related restrictions.

Guide for use: Only one outcome to be used. If child is referred to another hospital for follow-up assessment, the registration hospital should request any two to three year follow-up outcomes from the referral hospital. If the referral hospital fails to provide any follow-up outcomes, record as "Referred to another hospital for follow-up assessment - the registration hospital could not obtain follow-up outcomes from the referral hospital (4)".

Place of follow-up assessment

Definition: Place of two to three year follow-up assessment.

Coding:

0: unknown.

1: follow-up clinic at registration hospital.

2: follow-up clinic at another hospital.

3: paediatrician.

4: general practitioner.

5: outreach clinic.

6: other.

Guide for use: Only one outcome to be used.

Weight

Definition: The weight (body mass) of a child measured in kilograms.

Coding: A 2-4 digit number representing weight in kilograms.

Guide for use: If the weight of the child was measured either side of one month of the date of assessment then an extrapolated value should be provided as determined by the z-score.

Type of stature measurement

Definition: The type of stature measurement used at the two to three year follow-up assessment.

Coding:

99: unknown.

1: standing height.

2: recumbent length.

Stature

Definition: The stature of a child measured in centimetres.

Coding: A 2-4 digit number representing stature in centimetres.

Guide for use: If the stature of the child was measured either side of one month of the date of assessment then an extrapolated value should be provided as determined by the z-score.

Head circumference

Definition: The head circumference of a child aged between two and three years measured in centimetres.

Coding: A 2-4 digit number representing head circumference in centimetres.

Guide for use: If the head circumference of the child was measured either side of one month of the date of assessment then an extrapolated value should be provided as determined by the z-score.

Hearing aid

Definition: Hearing aid has been prescribed or not. Information as provided by parent or carer at the two to three year follow-up assessment.

Coding:

99: unknown.

0: no hearing aid prescribed.

1: unilateral hearing aid prescribed.

2: bilateral hearing aid prescribed.

Cochlear implant

Definition: Cochlear Implant has been inserted or not. Information as provided by parent or carer at the two to three year follow-up assessment.

Coding:

99: unknown.

0: no cochlear implant.

-1: yes, cochlear implant.

Blind

Definition: Ophthalmologist assessment has demonstrated that the child has blindness (<6/60 in better eye). This information may be provided by the parent or carer at the two to three year follow-up assessment.

Coding:

99: unknown.

0: no blindness.

-1: yes, blindness (<6/60 in better eye).

Respiratory support

Definition: At the time of the two to three year follow-up assessment, the type of therapy the child is receiving for respiratory disease.

Coding:

99: unknown.

0: no respiratory support.

1: continued ventilator support.

2: oxygen.

3: tracheostomy.

Gastrointestinal feeding

Definition: At the time of the two to three year follow-up assessment, the therapy the child requires for gastrointestinal disease, represented by a code.

Coding:

99: unknown.

0: no therapy.

1: nasogastric tube.

2: parenteral nutrition.

3: percutaneous endoscopic gastrostomy (PEG) feeding.

Cerebral palsy

Definition: Cerebral palsy diagnosed.

Coding:

99: unknown.

0: no cerebral palsy.

-1: yes, cerebral palsy.

Gross motor function classification system for cerebral palsy (GMFCS) (2-4 years)

Definition: The Gross Motor Function Classification System (GMFCS) classifies the movement ability of children with cerebral palsy. The Gross Motor Function Classification System (GMFCS) for cerebral palsy is based on self-initiated movement, with emphasis on sitting, transfers, and mobility, as represented by a code.

Coding:

1: Level I

2: Level II

3: Level III

4: Level IV

5: Level V

Bayley edition

Definition: The edition of the Bayley Scales of Infant and Toddler Development assessment used.

Coding:

0: unknown.

1: Bayley-III assessment.

2: Bayley 4 (A&NZ) assessment.

Cognitive composite score

Definition: The cognitive scale of the Bayley-III / Bayley 4 (A&NZ) assesses the sensory motor development, exploration and manipulation, object relatedness, concept formation, memory and other aspects of cognitive processing.

Coding: A 2-3 digit number representing the composite score from the cognitive scale.

Receptive communication scaled score

Definition: The receptive communication scale of the Bayley-III / Bayley 4 (A&NZ) includes items that assess preverbal behaviours, vocabulary development, such as being able to identify objects and pictures that are referenced; vocabulary related to morphological development, such as pronouns and prepositions; and understanding of morphological markers, such as plural –s, tense markings (-ing, -ed) and the possessive –'s.

Coding: A 1-2 digit number representing the scaled score from the receptive communication scale.

Expressive communication scaled score

Definition: The expressive communication scale of the Bayley-III / Bayley 4 (A&NZ) includes items that assess preverbal communication, such as babbling, gesturing, joint referencing, and turn taking, vocabulary development such as naming objects, pictures and attributes (e.g. colour and size); and morpho-syntactic development, such as using two-word utterances, plurals and verb tense.

Coding: A 1-2 digit number representing the scaled score from the expressive communication scale.

Language composite score

Definition: The language scale of the Bayley-III / Bayley 4 (A&NZ) is the sum of the receptive communication score and the expressive communication score. This sum is then used to calculate the composite score for the language scale.

Coding: A 2-3 digit number representing the composite score from the language scale.

Fine motor scaled score

Definition: The fine motor scale of the Bayley-III / Bayley 4 (A&NZ) includes skills associated with prehension, perceptual-motor integration, motor planning, and motor speed. Items measure young children's skills related to visual tracking, reaching, object manipulation and grasping. Children's

functional hand skills and responses to tactile information are also measured.

Coding: A 1-2 digit number representing the scaled score from the fine motor scale.

Gross motor scaled score

Definition: The gross motor scale of the Bayley-III / Bayley 4 (A&NZ) primarily measures the movement of the limbs and torso. Items assess static positioning (e.g., sitting, standing); dynamic movement, including locomotion and coordination; balance; and motor planning.

Coding: A 1-2 digit number representing the scaled score from the gross motor scale.

Motor composite score

Definition: The motor scale of the Bayley-III / Bayley 4 (A&NZ) is the sum of the fine motor score and the gross motor score. This sum is then used to calculate the composite score for the motor scale.

Coding: A 2-3 digit number representing the composite score from the motor scale.

Name of test administered

Definition: The name of the other development tests administered.

Coding: Free text field representing developmental test name.

Subscales of other developmental tests

Definition: Total number of the subscales for other developmental tests administered.

Coding: Number representing the total subscales of other developmental tests administered.

Score of other developmental tests

Definition: Score of other developmental tests administered.

Coding: Number representing the score of other developmental tests administered.

Level of development (months)

Definition: Level of development in months determined by other developmental tests administered.

Coding: Number representing level of development in months from the other developmental tests administered.

Reason for incomplete or no formal assessment

Definition: Main reason for incomplete or no formal developmental assessment at two to three years corrected age.

Coding:

0: unknown.

1: child too severely delayed.

2: child had a behavioural disorder.

3: child had a neurosensory impairment.

4: child was unwell.

5: child was uncooperative.

6: first language of child was not English.

7: formal assessment not offered at place of follow-up assessment.

8: other.

Guide for use: only one outcome to be used.

Clinical assessment of cognitive development

Definition: Assessment of cognitive development by a health care professional at two to three years corrected age for infants whose cognitive development was not assessed by a formal developmental test.

Coding:

0: unknown.

1: normal cognitive development or mild cognitive delay.

2: moderate cognitive delay.

3: severe cognitive delay.

4: cognitive delay but severity of delay unknown.

5: cognitive development not clinically assessed.

Clinical assessment of language development

Definition: Assessment of language development by a health care professional at two to three years corrected age for infants whose language development was not assessed by a formal developmental test.

Coding:

0: unknown.

1: normal language development or mild cognitive delay.

2: moderate language delay.

3: severe language delay.

4: language delay but severity of delay unknown.

5: language development not clinically assessed.

Clinical assessment of motor development

Definition: Assessment of motor development by a health care professional at two to three years corrected age for infants whose motor development was not assessed by a formal developmental test.

Coding:

0: unknown.

1: normal motor development or mild cognitive delay.

2: moderate motor delay.

3: severe motor delay.

4: motor delay but severity of delay unknown.

5: motor development not clinically assessed.

Other disability

Definition: Other disabilities.

Coding:

99: unknown.

0: no other disabilities.

-1: yes, other disabilities.

Description of other disabilities

Definition: Description of other disabilities. Include ICD-10 code if known.

Coding: Free text field representing description of other disabilities and ICD-10 codes if known.

Glossary

Antepartum fetal death: fetal death occurring before the onset of labour.

Apgar score: numerical score used to indicate the baby's condition at 1 minute and 5 minutes after birth. Between 0 and 2 points are given for each of five characteristics: heart rate, breathing, colour, muscle tone and reflex irritability, and the total score is between 0 and 10.

Baby's length of stay: number of days between date of birth and date of separation from the hospital of birth (calculated by subtracting the date of birth from the date of separation).

Bayley Scales of Infant and Toddler Development: assesses the motor (fine and gross), language (receptive and expressive), and cognitive development of infants and toddlers.

Birth status: status of the baby immediately after birth.

Birthweight: the first weight of the baby (stillborn or liveborn) obtained after birth (usually measured to the nearest 5 grams and obtained within one hour of birth).

Caesarean section: operative birth by surgical incision through the abdominal wall and uterus.

Cerebral palsy: a developmental disability that results from damage to or dysfunction of the developing brain.

Clinical assessment of development: professional opinion of a healthcare professional regarding the presence and severity of developmental delays for specific domains (cognitive, language and motor development), made in the absence of formal developmental testing.

Corrected age: the age a preterm baby would be if they had been born on their due date.

Early neonatal death: death of a liveborn baby within seven days of birth.

Extremely low birthweight: birthweight of less than 1,000 grams.

Extremely preterm birth: birth before 28 weeks of gestation.

Fetal death (stillbirth): death prior to the complete expulsion or extraction from its mother of a product of conception of 20 or more completed weeks of gestation or of 400 grams or more birthweight. The death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles.

Forceps: assisted birth using a metallic obstetric instrument.

Formal developmental assessment: includes neurological examination by a developmental paediatrician or physiotherapist, vision by an ophthalmologist or optometrist, hearing by an audiologist, and a developmental test using the Bayley Scales of Infant Development, Griffiths Mental Developmental Scales or another developmental test performed by a psychologist, developmental paediatrician, physiotherapist, or other qualified person.

Gestational age: the duration of pregnancy in completed weeks calculated from the date of the first day of a woman's last menstrual period and her baby's date of birth, or via ultrasound, or derived from clinical assessment during pregnancy or from examination of the baby after birth.

Griffiths Mental Development Scales: assesses the mental development of young children across five subscales; locomotor, personal-social, language, eye and hand co-ordination, performance and practical reasoning.

Gross Motor Function Classification System (GMFCS): classifies the movement ability of children with cerebral palsy.

Hyaline membrane disease: a disorder of the respiratory system.

Instrumental delivery: vaginal delivery using forceps or vacuum extraction.

Intrapartum fetal death: fetal death occurring during labour.

Intrauterine growth restriction: a fetus whose estimated weight is below the 10th percentile for its gestational age.

Late neonatal death: death of a liveborn baby after seven completed days and before 28 completed days.

Live birth: the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered liveborn (WHO definition).

Low birthweight: birthweight of less than 2,500 grams.

Maternal age: mother's age in completed years at the birth of her baby.

Mode of separation: status at separation of patient (discharge/transfer/death) and place to which patient is released (where applicable).

Neonatal care levels: Level I care is for normal healthy term babies, some of whom may need short-term observation during the first few hours of life.

Level II refers to a nursery that generally has babies born at 32–36 weeks gestation weighing around 1,500 to 2,500 grams at birth. It includes care for babies who require intravenous therapy or antibiotics, and/or those who are convalescing after intensive care, and/or those who need their heart rate or breathing monitored, and/or those who need short-term oxygen therapy.

Level III or intensive care refers to the care of newborn infants who require more specialised care and treatment. It includes most babies born at less than 32 weeks gestation or less than 1,500 grams birthweight, and others who may require such interventions as intravenous feeding, and/or surgery, and/or cardiorespiratory monitoring for management of apnoea or seizures, and/or require assisted ventilation, and/or supplemental oxygen over 40% or long-term oxygen.

Neonatal death: death of a liveborn baby within 28 days of birth.

Neonatal morbidity: any condition or disease of the baby diagnosed after birth and before separation from care.

Perinatal death: a fetal or neonatal death of at least 20 weeks gestation or at least 400 grams birthweight.

Plurality: the number of births resulting from a pregnancy.

Post menstrual age is calculated by taking the gestational age plus postnatal age – e.g. when a baby born at 25 weeks gestation is 15 weeks old, they are 40 weeks PMA (also known as term equivalent age).

Post neonatal death: death of a liveborn baby after 28 days and within one year of birth.

Post term birth: birth at 42 or more weeks of gestation.

Presentation at birth: presenting part of the fetus at birth.

Preterm birth: birth before 37 weeks of gestation.

Resuscitation of baby: active measures taken shortly after birth to assist the baby's ventilation and heartbeat, or to treat depressed respiratory effort and to correct metabolic disturbances.

Retinopathy of prematurity (ROP): a disorder of the developing eye.

Sex ratio: number of male liveborn babies per 100 female liveborn babies.

Spontaneous vaginal: birth without intervention in which the baby's head is the presenting part.

Stillbirth: see Fetal death (stillbirth).

Teenage mother: mother aged less than 20 years at the birth of her baby.

Vacuum extraction: assisted birth using a suction cap applied to the baby's head.

Vaginal breech: vaginal birth in which the baby's buttocks is the presenting part.

Very low birthweight: birthweight of less than 1,500 grams.

Very preterm birth: birth before 32 weeks of gestation.

Wechsler Preschool and Primary Scale of Intelligence: assesses the cognitive development of young children across five subscales; verbal comprehension, visual spatial, fluid reasoning, working memory, and processing speed.

References

Australian Bureau of Statistics 2024. *Births, Australia, 2023*. Canberra: ABS.

Chow SSW, Creighton P, Holberton JM, Chambers GM, Lui K 2024. *Report of the Australian and New Zealand Neonatal Network 2022*. Sydney: ANZNN < www.anznn.net >.

The Committee for the Classification of Retinopathy of Prematurity 1984. An international classification of retinopathy of prematurity. *Archives of Opthalmology* 102(8):1130-1134.

Conde-Agudelo A & Romero R 2009. Antenatal magnesium sulfate for the prevention of cerebral palsy in preterm infants less than 34 weeks' gestation: a systematic review and metaanalysis. *American Journal of Obstetrics & Gynecology* 200(6):595–609.

Crowther CA, Hiller JE, Doyle LW, Haslam RR for the Australasian Collaborative Trial of Magnesium Sulphate (ACTO $MgSO_4$) Collaborative Group 2003. Effect of magnesium sulphate given for neuroprotection before preterm birth: a randomised controlled trial. *JAMA: The Journal of the American Medical Association* 290(20):2669–2676.

Papile LA, Burstein J, Burstein R & Hoffler H 1978. Incidence and evolution of subependymal and intraventricular hemorrhage: a study of infants with birth weights less than 1500gm. *Journal of Paediatrics* 92(4):529–534.

Rouse DJ 2009. Magnesium sulfate for the prevention of cerebral palsy. *American Journal of Obstetrics & Gynecology*. 200(6):610–612.

Statistics New Zealand 2024. *Births and deaths: year ended December 2023*. Wellington: Statistics New Zealand < www.stats.govt.nz >.

WHO Multicentre Growth Reference Study Group. *WHO Child Growth Standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: Methods and development*. Geneva: World Health Organization, 2006.

List of Tables

List of Figures