

# 2008 & 2009

REPORT OF THE  
**AUSTRALIAN AND  
NEW ZEALAND  
NEONATAL NETWORK**



**UNSW**  
THE UNIVERSITY OF NEW SOUTH WALES

**ANZNN**



# 2008 & 2009

---

REPORT OF THE  
**AUSTRALIAN AND  
NEW ZEALAND  
NEONATAL NETWORK**



**UNSW**  
THE UNIVERSITY OF NEW SOUTH WALES

**ANZNN**

© Australian and New Zealand Neonatal Network 2012

This work is copyright. Apart from any use as permitted under the Copyright Act 1968, no part may be reproduced without prior written permission from the Australian and New Zealand Neonatal Network (ANZNN). Requests and enquiries concerning reproduction and rights should be directed to the Coordinator, Australian and New Zealand Neonatal Network at the Perinatal & Reproductive Epidemiology Research Unit, Level 2, McNevin Dickson Building, Gate 6, Avoca Street, Randwick Hospitals Campus, Randwick NSW 2031.

This publication is part of the Australian and New Zealand Neonatal Network annual reports series. A complete list of the ANZNN's publications is available from the Network's website <[www.preru.unsw.edu.au/ANZNN](http://www.preru.unsw.edu.au/ANZNN)>.

ISBN: 978-0-9807290-2-3

Suggested citation:

ANZNN (Australian and New Zealand Neonatal Network) 2012. Report of the Australian and New Zealand Neonatal Network 2008 and 2009. Sydney: ANZNN.

Any enquiries about or comments on this publication should be directed to:

Coordinator  
Australian and New Zealand Neonatal Network  
Perinatal & Reproductive Epidemiology Research Unit  
Level 2, McNevin Dickson Building  
Gate 6, Avoca Street  
Randwick Hospitals Campus  
Randwick NSW 2031

**Phone:** +612 9382 1047

**Email:** [anznn@unsw.edu.au](mailto:anznn@unsw.edu.au)

Published by the Australian and New Zealand Neonatal Network 2012

Designed and printed by Print Post Plus (P3)

Please note that there is the potential for minor revisions of data in this report. Please check the online version at <[www.preru.unsw.edu.au/ANZNN](http://www.preru.unsw.edu.au/ANZNN)> for any amendments.

# Contents

<b>Acknowledgements.....</b>	<b>vii</b>
<b>Structure of this report .....</b>	<b>viii</b>
<b>Abbreviations.....</b>	<b>ix</b>
<b>Participating units and supporting staff .....</b>	<b>x</b>
<b>1. Organisation of the ANZNN .....</b>	<b>1</b>
History .....	1
Purpose of this report .....	1
Structure of the ANZNN .....	1
Registration criteria.....	2
Funding support .....	3
Data set variables.....	3
<b>2008 Report of the Australian and New Zealand Neonatal Network .....</b>	<b>4</b>
Babies born in Australia, 2008 .....	5
Babies born in New Zealand, 2008 .....	5
<b>2. Babies registered to level III units, 2008 .....</b>	<b>6</b>
<b>3. Mothers of level III registrants, 2008.....</b>	<b>10</b>
Maternal age .....	10
Previous antenatal history.....	10
Assisted conception.....	10
Presenting antenatal problem.....	11
Antenatal corticosteroid use .....	12
Multiple births.....	13
Method of birth.....	13
Place of birth .....	14
Transport after birth to a level III NICU .....	15
Breastfeeding at discharge .....	15
<b>4. Characteristics of level III registrants, 2008 .....</b>	<b>16</b>
Baby gender.....	16
Resuscitation in delivery suite.....	16
Apgar score at birth .....	16
Admission temperature .....	17
Indication for respiratory support.....	17
Exogenous surfactant .....	18
Type of assisted ventilation .....	19
Ventilation in babies born at less than 32 weeks gestation .....	21

Ventilation in babies born at 32 to 36 weeks gestation.....	21
Ventilation in babies born at term .....	21
Supplemental oxygen (O <sub>2</sub> ) therapy .....	21
Chronic lung disease .....	22
Pulmonary air leak.....	23
Neonatal sepsis.....	23
Retinopathy of prematurity .....	24
Intraventricular haemorrhage .....	25
Late cerebral ultrasound .....	26
Necrotising enterocolitis .....	27
Congenital anomalies.....	27
Transfer from level III NICUs to other units .....	27
Length of stay until discharge home .....	28
Survival of the ANZNN registrants.....	29
<b>5. Babies registered to level II units, 2008 .....</b>	<b>32</b>
Overview .....	32
Maternal, pregnancy and birth characteristics.....	33
Characteristics of level II babies .....	34
Eye examination .....	36
Cerebral ultrasound.....	36
Other morbidities .....	36
Level II transfers.....	36
Survival .....	36
<b>2009 Report of the Australian and New Zealand Neonatal Network.....</b>	<b>38</b>
Babies born in Australia, 2009 .....	39
Babies born in New Zealand, 2009 .....	39
<b>6. Babies registered to level III units, 2009 .....</b>	<b>40</b>
<b>7. Mothers of level III registrants, 2009.....</b>	<b>43</b>
Maternal age .....	43
Previous antenatal history.....	43
Assisted conception.....	43
Presenting antenatal problem.....	44
Antenatal corticosteroid use .....	45
Multiple births.....	46
Method of birth.....	46
Place of birth .....	47
Transport after birth to a level III NICU.....	48
Breastfeeding at discharge .....	48

<b>8. Characteristics of level III registrants, 2009 .....</b>	<b>49</b>
Baby gender.....	49
Resuscitation in delivery suite.....	49
Apgar score at birth .....	49
Admission temperature .....	50
Indication for respiratory support.....	50
Exogenous surfactant .....	51
Type of assisted ventilation .....	52
Ventilation in babies born at less than 32 weeks gestation .....	54
Ventilation in babies born at 32 to 36 weeks gestation .....	54
Ventilation in babies born at term .....	54
Supplemental oxygen (O2) therapy .....	54
Nasal high flow therapy .....	55
Chronic lung disease .....	56
Pulmonary air leak.....	56
Neonatal sepsis.....	57
Retinopathy of prematurity .....	57
Intraventricular haemorrhage .....	59
Late cerebral ultrasound .....	60
Necrotising enterocolitis .....	61
Congenital anomalies.....	61
Transfer from level III NICUs to other units .....	61
Length of stay until discharge home .....	62
Survival of the ANZNN registrants.....	63
 <b>9. Babies registered to level II units, 2009 .....</b>	 <b>66</b>
Overview .....	66
Maternal, pregnancy and birth characteristics.....	67
Characteristics of level II babies .....	68
Eye examination .....	70
Cerebral ultrasound.....	70
Other morbidities .....	70
Level II transfers.....	70
Survival .....	70
 <b>10. Neonatal surgery, 2007–2009 .....</b>	 <b>71</b>
Introduction .....	71
Gastroschisis.....	72
Five minute Apgar score.....	72
Maternal age.....	73
Assisted conception.....	73
Antenatal diagnosis .....	74

Neonatal sepsis.....	74
Survival .....	75
Necrotising enterocolitis .....	75
NEC and PDA surgery .....	76
Summary.....	76
<b>APPENDICES .....</b>	<b>77</b>
<b>Appendix 1: Trends .....</b>	<b>77</b>
<b>Appendix 2: Data tables by birthweight, 2008 &amp; 2009 .....</b>	<b>87</b>
<b>Appendix 3: Methods used in this report.....</b>	<b>104</b>
Derived data items:.....	104
<b>Appendix 4: Confidentiality guidelines.....</b>	<b>105</b>
Principles of ownership and maintenance of data.....	105
Conditions for data collection .....	105
Conditions for data security .....	106
<b>Appendix 5: Minimum Data Set variables .....</b>	<b>107</b>
<b>Glossary .....</b>	<b>119</b>
<b>References .....</b>	<b>121</b>
<b>List of Tables .....</b>	<b>122</b>
<b>List of Figures .....</b>	<b>124</b>



# Acknowledgements

This is the fourteenth report of the Australian and New Zealand Neonatal Network (ANZNN) and combines two years of data. 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'.

The number of Australian level II units continues to increase with a total of eight units contributing data for this report, with more units joining ANZNN the number will continue to rise.

We would like to acknowledge all the units involved in the provision of data for this report. ANZNN 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 Committee 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: Ross Haslam (Chairperson), Kaye Bawden, David Cartwright, Jenny Corban, Brian Darlow, Nick Evans, Kei Lui, William Tarnow-Mordi, Elizabeth Sullivan and Kenneth Tan for their commitment and guidance for all the activities of the ANZNN. We thank Robert Halliday, Karen Walker and Nadia Badawi for compiling the focus chapter on neonatal surgery.

The ANZNN especially thanks Brian Darlow who has recently stepped down from the position of Chairperson of the Management Committee. Brian has held this position for many years and has given freely of his time and expertise to both the ANZNN and its staff.

We thank Q Healthcare Pty Ltd for their ongoing support and for helping us to achieve our aims. We acknowledge our colleagues from the Perinatal & Reproductive Epidemiology Research Unit for their continued technical support and encouragement.

## Structure of this report

- Chapter 1:** This chapter presents the structure and organisation of 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 2008 and 2009.
- Chapter 2:** ‘Babies registered to level III units, 2008’ provides information and characteristics on the ANZNN registrants in 2008 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, 2008’ provides information on the mothers of level III registrants registered to ANZNN in 2008.
- Chapter 4:** ‘Characteristics of level III registrants, 2008’ provides information about the babies admitted to a level III neonatal unit during 2008.
- Chapter 5:** ‘Babies registered to level II units, 2008’ provides information about babies registered to the level II special care baby units during 2008.
- Chapter 6:** ‘Babies registered to level III units, 2009’ provides information and characteristics on the ANZNN registrants in 2009 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 7:** ‘Mothers of level III registrants, 2009’ provides information on the mothers of level III registrants registered to ANZNN in 2009.
- Chapter 8:** ‘Characteristics of level III registrants, 2009’ provides information about the babies admitted to a level III neonatal unit during 2009.
- Chapter 9:** ‘Babies registered to level II units, 2009’ provides information about babies registered to the level II special care baby units during 2009.
- Chapter 10:** ‘Neonatal surgery, 2007–2009’. This chapter focuses on selected characteristics of ANZNN registrants who have undergone major surgery in 2007–2009 during their first admission to an NICU before discharge home after birth.
- Appendices:** Appendix 1 presents 10-year trends  
Appendix 2 presents data tables by birthweight for 2008 & 2009  
Appendix 3 presents 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 Set for ANZNN.

## Abbreviations

ABS	Australian Bureau of Statistics
ANZNN	Australian and New Zealand Neonatal Network
APH	antepartum haemorrhage
CI	confidence interval
CLD	chronic lung disease
CPAP	continuous positive airways pressure
CRIB	Clinical Risk Index for Babies
ECMO	extracorporeal membrane oxygenation
g	gram
GIFT	gamete intra-fallopian transfer
HFOV	high frequency oscillatory ventilation
HFV	high frequency 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	<i>in vitro</i> fertilisation
IVH	intraventricular haemorrhage
LOS	length of stay
NEC	necrotising enterocolitis
NHFT	nasal high flow therapy
HFNC	high flow nasal cannulae
NHMRC	National Health and Medical Research Council
NICU	neonatal intensive care unit
NO	nitric oxide
O <sub>2</sub>	oxygen – normal air is 21% oxygen
PMA	post menstrual age (completed weeks)
PPROM	preterm pre-labour rupture of membranes
PRERU	Perinatal & Reproductive Epidemiology Research Unit
PVL	periventricular leukomalacia
RD	respiratory distress
RDS	respiratory distress syndrome
ROM	rupture of membranes
ROP	retinopathy of prematurity
UNSW	University of New South Wales
WHO	World Health Organization

# Participating units and supporting staff

## Level III nurseries:

### Australia

#### New South Wales

##### Children's Hospital at Westmead

*(Nursery beds: 23)*

Nadia Badawi (Director), Karen Walker,  
Caroline Karskens

##### John Hunter Hospital

*(Nursery beds: 41)*

Chris Wake (Director), Lynne Cruden

##### Liverpool Health Service

*(Nursery beds: 31)*

Robert Guaran (Director), Ian Callendar,  
Catherine Medlin, Jacqui Stack, Sara Wilson

##### Nepean Hospital

*(Nursery beds: 35)*

Lyn Downe (Director), Vijay Shingde  
(Acting Clinical Director) Mee Fong Chin

##### Royal Hospital for Women

*(Nursery beds: 44)*

Kei Lui (Director), Diane Cameron

##### Royal North Shore Hospital

*(Nursery beds: 25)*

Mary Paradisis (Director), Jennifer Bowen,  
Sara Sedgley, Martin Kluckow

##### RPA Women and Babies

*(Nursery beds: 34)*

Nick Evans (Director), Shelley Reid,  
David Osborn (Clinical Director)

##### Sydney Children's Hospital

*(Nursery beds: 4)*

Andrew Numa (Director), Janelle Young

##### Westmead Hospital

*(Nursery beds: 39)*

Mark Tracy (Director), Jane Baird

#### Australian Capital Territory

##### The Canberra Hospital

*(Nursery beds: 24)*

Zsuzsoka Kecskes (Director), Lyn Barnes

#### Victoria

##### Mercy Hospital for Women

*(Nursery beds: 58)*

Andrew Watkins (Director), Julie Keng,  
Jim Holberton

##### Monash Medical Centre

*(Nursery beds: 52)*

Andrew Ramsden (Director), Elizabeth Carse  
(Acting Director), Kenneth Tan, Kaye Bawden,  
Rose Li

##### Royal Children's Hospital

*(Nursery beds: 24)*

Rod Hunt (Director), Jo Brooks

##### Royal Women's Hospital

*(Nursery beds: 52)*

Carl Kuschel (Director), Caroline Collis, Lex Doyle  
(Professor of Neonatology), Sheryle Rogerson,  
Esther Wong

#### Tasmania

##### Royal Hobart Hospital

*(Nursery beds: 26)*

Peter Dargaville (Director), Karen Butterley

#### Queensland

##### Mater Mothers' Hospital

*(Nursery beds: 79)*

David Knight (Director), Peter Gray,  
Chrissy Harbridge

##### Royal Brisbane and Women's Hospital

*(Nursery beds: 71)*

David Cartwright (Director), Paul Colditz  
(Professor of Perinatal Medicine), Tim Donovan

##### The Townsville Hospital

*(Nursery beds: 32)*

Guan Koh (Director), Gary Alcock, Jenny Binney,  
Cherie Boniface

## South Australia

### Flinders Medical Centre

(Nursery beds: 35)

Peter Marshall (Director), Rebecca Davis

### Women's and Children's Hospital

(Nursery beds: 49)

Chad Andersen (Director), Ross Haslam, Elizabeth Gent, Andy McPhee

## Western Australia

### King Edward Memorial and Princess Margaret Hospitals

(Nursery beds: 105)

Karen Simmer (Director and Professor of Neonatal Medicine), Annette Butler, Noel French, Rolland Kohan, Shripada Rao, Andy Gill, Jane Pillow, John McTigue

## Northern Territory

### Royal Darwin Hospital

(Nursery beds: 18)

Charles Kilburn (Director), Alan Ruben, Gurmeet Singh (Director), Margaret Stewart

### Newborn emergency transport services

#### NSW Newborn & Paediatric Emergency Transport Service

Andrew Berry (Director)

#### Newborn Emergency Transport Service (Victoria)

Michael Stewart (Director)

#### Western Australia Neonatal Transport Service

Steven Resnick

## New Zealand

### Christchurch Women's Hospital

(Nursery beds: 38)

Nicola Austin (Director), Brian Darlow (Professor of Paediatrics), Nina Mogridge

### Dunedin Hospital

(Nursery beds: 16)

Roland Broadbent (Director), Carole Chettleburgh, Frances McCaffrey

## Middlemore Hospital

(Nursery beds: 30)

Lindsay Mildenhall (Director), Maisie Wong

### National Women's Health (at Auckland City Hospital)

(Nursery beds: 46)

Malcolm Battin (Director), Jane Harding (Professor of Neonatology), Coila Bevan

### Waikato Hospital

(Nursery beds: 41)

David Bouchier (Director), Phil Weston, Deborah Harris, Arun Nair

### Wellington Women's Hospital

(Nursery beds: 40)

Vaughan Richardson (Director), Dawn Elder, Keith Fisher, Michael Hewson

## Level II nurseries:

## Australia

## New South Wales

### Blacktown Hospital

(Nursery beds: 24)

Maria Murray (Director), Debbie Green

### Campbelltown Hospital

(Nursery beds: 15)

Raymond Chin (Director), Maria Delpino

### Gosford District Hospital

(Nursery beds: 25)

John Erickson (Director), Kerry Field

### St George Hospital

(Nursery beds: 8)

Bob Fonseca (Director), Helen Giles

### Wollongong Hospital

(Nursery beds: 20)

Allan James (Director), Sylvia Lees

## Queensland

### Cairns Base Hospital

(Nursery beds: 22)

Ross Messer (Director), Sue McMahon

### Mackay Base Hospital

(Nursery beds: 4)

Michael Williams (Director), Kerry Topping

## **Tasmania**

### **Launceston General Hospital**

*(Nursery beds: 12)*

Chris Bailey (Director), Jennifer James,  
Robyn Morey, Frances McCarroll, Christine Coker

## **New Zealand**

### **Gisborne Hospital**

*(Nursery beds: 6)*

Heinrich Stander (Director)

### **Hawkes Bay Hospital**

*(Nursery beds: 12)*

Jenny Corban (Director), Kay Hodson,  
Jennifer Gibson

### **Lower Hutt Hospital**

*(Nursery beds: 8)*

Robyn Shaw (Director), Debbie Bashaw,  
Anne Mitchell

### **Nelson Hospital**

*(Nursery beds: 10)*

Peter McIlroy (Director)

### **North Shore Hospital**

*(Nursery beds: 12)*

Jutta van den Boom (Director), Diane Chesney

### **Palmerston North Hospital**

*(Nursery beds: 17)*

Jeff Brown (Director), Amy Hinder

### **Rotorua Hospital**

*(Nursery beds: 10)*

Stephen Bradley (Director), Jacquie Koberstein,  
Gaye France

### **Southland Hospital**

*(Nursery beds: 6)*

Paul Tomlinson (Director)

### **Taranaki Base Hospital**

*(Nursery beds: 8)*

John Doran (Director)

### **Tauranga Hospital**

*(Nursery beds: 10)*

Hugh Lees (Director), Heather McAlley

### **Timaru Hospital**

*(Nursery beds: 3)*

Philip Morrison (Director), Bid Esler, Mark Liddy

## **Wairau Hospital**

*(Nursery beds: 4)*

David Bond (Director)

## **Wanganui Hospital**

*(Nursery beds: 4)*

Tony de Sylva (Director), Prema Subramaniam

## **Whakatane Hospital**

*(Nursery beds: 5)*

Chris Moyes (Director), Margret Norris

## **Whangarei Area Hospital**

*(Nursery beds: 8)*

Janine Whale (Director), Lynne Clarke

## **Waitakere Hospital**

*(Nursery beds: 12)*

Jutta van den Boom (Director), Janis Stockman

## **ANZNN Program and Secretariat**

Perinatal & Reproductive Epidemiology Research  
Unit (PRERU)

Elizabeth Sullivan (Director), Vicki Gallimore,  
Sadia Hossain, Lisa Hilder, Sharon Chow

# 1. Organisation of the ANZNN

## History

A prospective audit commenced in 1994 with all level III units in Australia and New Zealand contributing data on babies from 1 January 1995. Level II units in New Zealand joined in 1998, followed by one level II unit in Tasmania, Australia in 1999. Level II units within Australia continue to join with a total of eight units contributing data in 2008 and 2009.

## Purpose of this report

The purpose of the *Report of the Australian and New Zealand Neonatal Network* is 'to improve the care of high-risk newborn infants and their families in Australia and New Zealand through collaborative audit and research'.

This is achieved through:

- providing 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
- monitoring the clinical indicators for perinatal care and improving clinical practice while maintaining national standards of evidence-based care
- monitoring the use of new technologies, e.g. high flow/oxygen air usage by patient type and outcome
- consistency in national data collections.

## Structure of the ANZNN

The ANZNN is located in the Perinatal & Reproductive Epidemiology Research Unit (PRERU) within the University of New South Wales (UNSW). The arrangement is outlined in the memorandum of understanding (MOU) between ANZNN and UNSW.

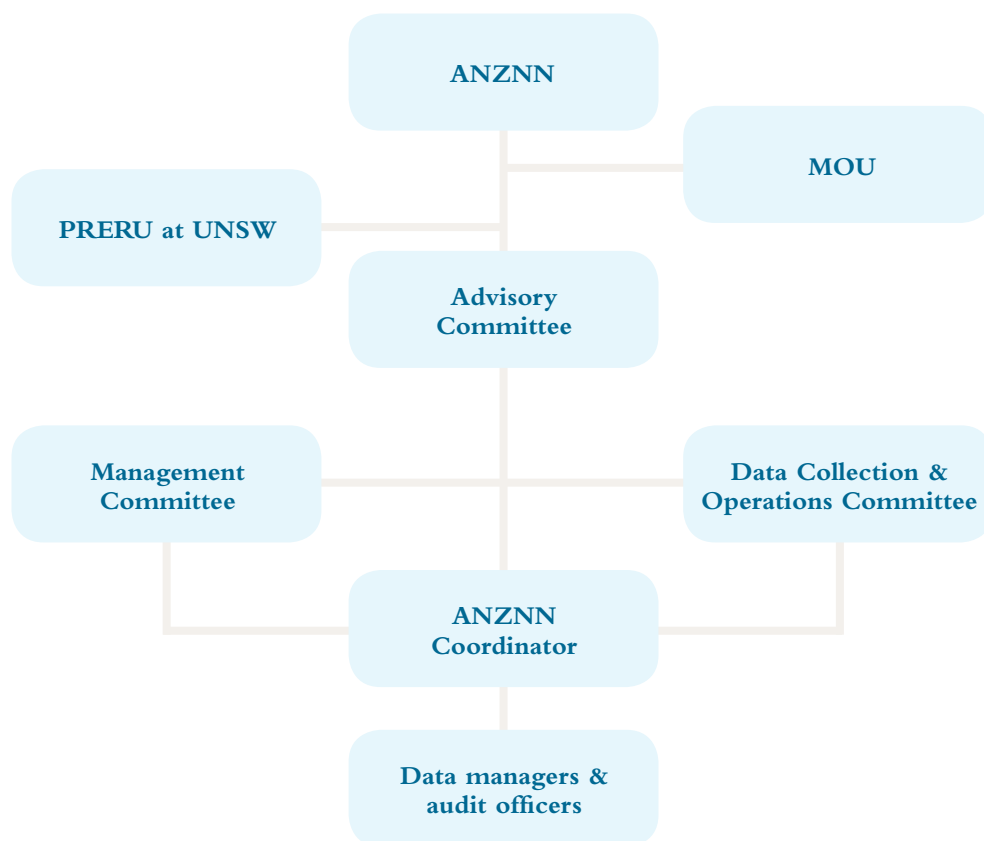
The governance structure of the ANZNN (refer to Figure 1) consists of the Advisory Committee, the Data Collection and Operations Committee and the Management Committee. The Advisory Committee is the governing body of ANZNN and includes the directors (or their nominee) of each participating unit, the academic neonatologists and neonatal nurses in the region. The Director of PRERU, who is the data custodian for ANZNN, is also a member of the Advisory Committee. The purpose of the Advisory Committee is to monitor the progress of 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.

The Data Collection and Operations Committee coordinates the operations of the ANZNN data collection, monitors the workload and progress of the annual report and reports to both the Management Committee and Advisory Committee.

The Management Committee is an elected committee that has representation from directors, data managers and nurses from across the network and is concerned with the general functioning of the network, finance and decision-making.

The data managers and audit officers are responsible for the collection and submission of data for ANZNN. The ANZNN coordinator is the point of contact for ANZNN and liaises with ANZNN committees, PRERU, data managers and audit officers.

**FIGURE 1: Schematic flow chart of ANZNN**



## Registration criteria

Babies who meet one or more of the following criteria are eligible for registration with the audit:

- born at less than 32 completed 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 airways pressure (CPAP) 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.

Babies who were discharged home and readmitted to a neonatal intensive care unit (NICU) during their neonatal period were not eligible for registration in the ANZNN audit. 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.



## Funding support

Currently the major share of funding is from annual contributions received from level III units. The contribution was a voluntary and unanimous decision made by the unit directors. In return individual units receive a feedback report that enables them to benchmark their unit against the combined ANZNN data set. Q Healthcare makes an annual contribution and ANZNN thanks them for their generosity and support.

## Data set variables

The variables used for the 2008 and 2009 audit are listed in Appendix 5 and are also available on the website <[www.preru.unsw.edu.au/ANZNN](http://www.preru.unsw.edu.au/ANZNN)>.

# 2008

---

REPORT OF THE  
**AUSTRALIAN AND  
NEW ZEALAND  
NEONATAL NETWORK**

## Babies born in Australia, 2008

There were 6,787 babies registered to ANZNN from 22 level III NICUs in Australia, representing 2.3% of notified live births in 2008 (Laws, Li & Sullivan 2010). Of these registrants, 75.0% were born in a hospital with tertiary care facilities. There were 2,967 babies born before 32 weeks gestation representing 43.7% of Australian registrants.

Maternal ethnicity was provided for more than 91.3% of mothers: 83.2% of the mothers of these babies identified as Caucasian and 7.7% as Asian. One in twenty mothers (5.5%) identified as Aboriginal or Torres Strait Islander compared to 3.8% of all births in Australia in 2008 (Laws, Li & Sullivan 2010).

Among Australian NICU admissions registered to ANZNN, 1,603 were from multiple births representing 23.6% of ANZNN admissions in Australia in 2008.

Male babies were over-represented among NICU admissions – 57.0% of the Australian ANZNN registrants, compared with 51.4% among live births in Australia (Laws, Li & Sullivan 2010).

Assisted ventilation was provided for 6,296 babies (2.1% of live births) and continuous positive airways pressure (CPAP) was the only form of respiratory assistance for 2,753 babies.

## Babies born in New Zealand, 2008

There were 1,841 babies who met ANZNN registration criteria from six level III NICUs in New Zealand representing 2.9% of the 64,343 live births registered in New Zealand in 2008 (Statistics New Zealand 2008). Of these registrants, 89.2% were born in a hospital with tertiary care facilities. There were 699 babies born before 32 weeks gestation representing 38.0% of New Zealand registrants.

The ethnicity of the mother was reported for 97.9% of the New Zealand registrants. The percentage of Caucasian mothers in the ANZNN cohort was 54.2%. A higher proportion of mothers identified themselves as Maori (20.9%) compared to 11.5% of mothers identified as Pacific Islander and 10.1% as Asian.

Among New Zealand NICU admissions registered to ANZNN, 338 were from multiple births representing 18.4% of ANZNN admissions in New Zealand in 2008.

Male babies were also over-represented among NICU admissions in New Zealand – 58.6% of the New Zealand registrants compared to 51.4% of total live births in New Zealand (Statistics New Zealand 2008).

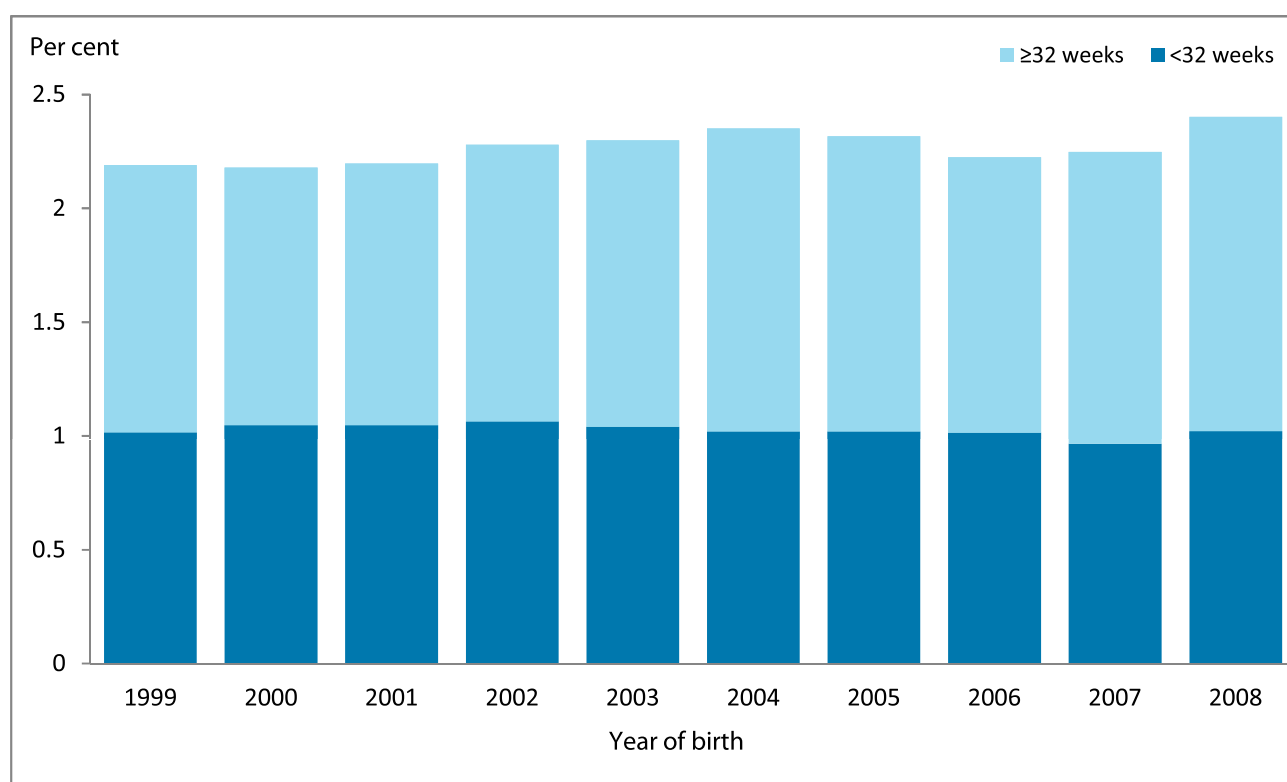
Assisted ventilation was given to 1,725 babies representing 2.7% of all live births with 1,108 babies receiving CPAP as the only form of respiratory assistance (1.7% of all live births).

## 2. Babies registered to level III units, 2008

This section includes data on the ANZNN registrants from each of the 28 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 admitted to an NICU in Australia and New Zealand in 2008, 8,628 fulfilled the registration criteria for inclusion in the ANZNN audit. The population represents 2.4% of the 359,080 live births in the two countries in 2008 (Laws, Li & Sullivan 2010; Statistics New Zealand 2008) (Figure 2) illustrating a slight increase of 626 registrants (2.2% of all live births) from 2007.

**FIGURE 2: Babies registered to ANZNN audit of level III units each year as a percentage of liveborn babies in Australia and New Zealand 1999-2008**

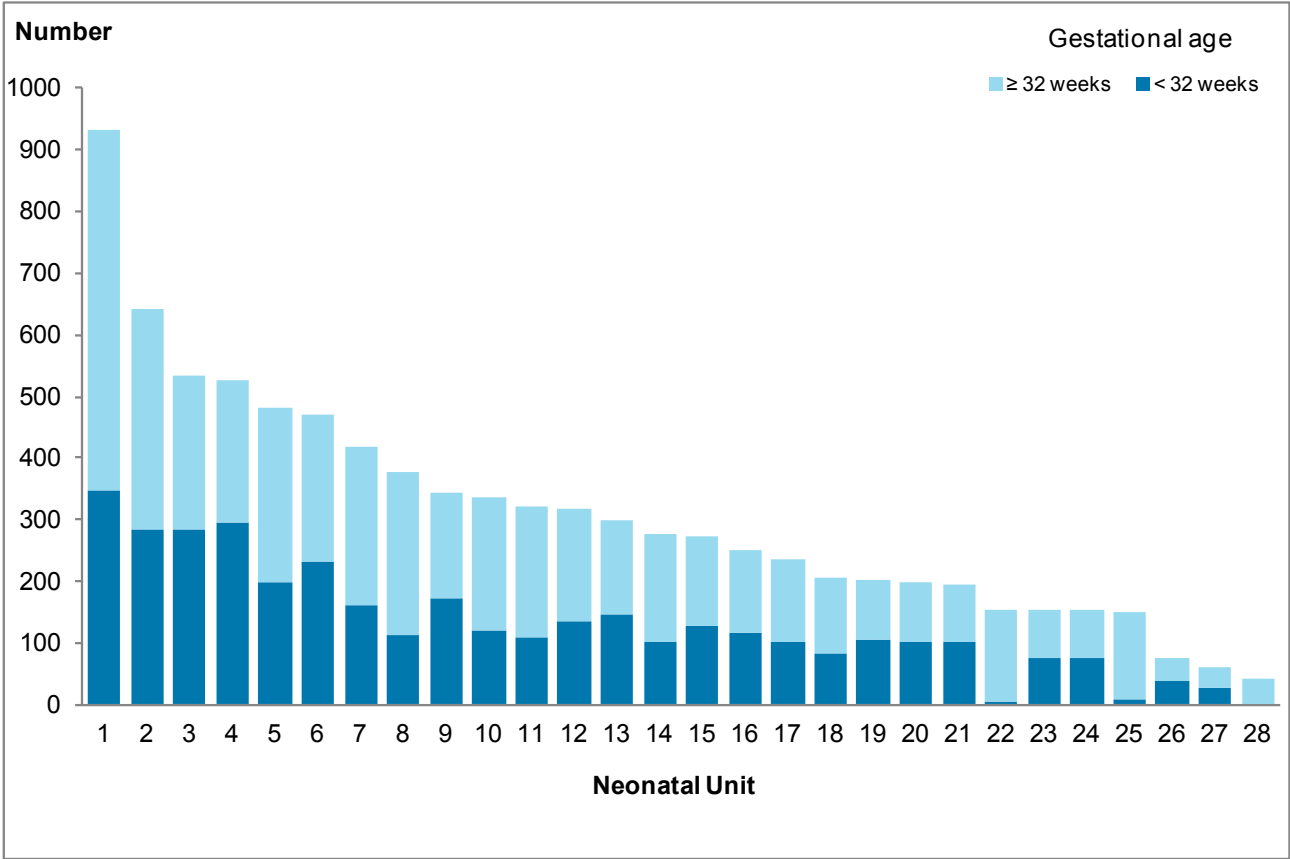


There were 3,666 (42.5%) babies born before 32 weeks gestation and 4,959 babies born at 32 weeks or more (57.5%). Of the registrants born before 32 weeks gestation 90.6% received assisted ventilation. The major indication for assisted ventilation in this age group was hyaline membrane disease.

The largest level III NICU in Australia and New Zealand registered just under 700 babies in 2008, the smallest less than 50 (Figure 3). The median number of babies registered to an ANZNN unit was 262.

The gestational age group at birth and birthweight for babies qualifying for inclusion in the ANZNN 2008 level III audit is set out in Tables 1 and 2 respectively. The 10-year trend (2000–2009) in gestational age at birth is presented in Figure 28 in Appendix 1.

FIGURE 3: Number of level III registrants born at each neonatal intensive care unit, 2008



**TABLE 1: Level III registrants born at each completed week of gestation, 2008**

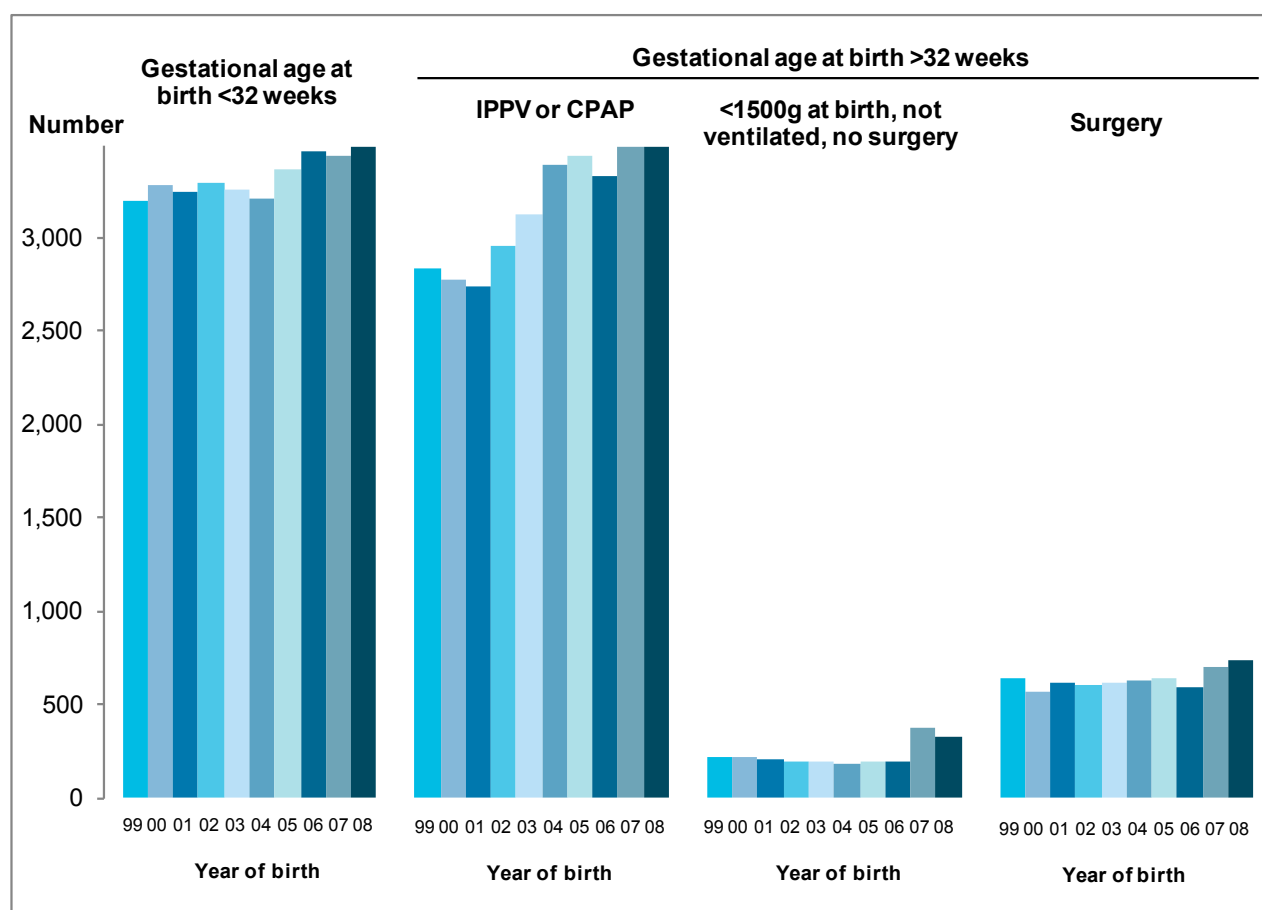
<b>Gestational age (completed weeks)</b>	<b>Number of babies</b>	<b>Percent</b>	<b>Cumulative percent</b>
<24	48	0.6	0.6
24	171	2.0	2.5
25	260	3.0	5.6
26	323	3.7	9.3
27	383	4.4	13.7
28	467	5.4	19.1
29	553	6.4	25.6
30	661	7.7	33.2
31	800	9.3	42.5
<b>All babies &lt;32 weeks</b>	<b>3,666</b>	<b>42.5</b>	
32	727	8.4	50.9
33	572	6.6	57.5
34	600	7.0	64.5
35	464	5.4	69.9
36	379	4.4	74.3
37	434	5.0	79.3
38	533	6.2	85.5
39	430	5.0	90.5
40	476	5.5	96.0
41	303	3.5	99.5
42	39	0.5	99.9
43	2	0.0	100.0
<b>Total</b>	<b>8,628</b>	<b>100.0</b>	

***Note:** Not stated data are excluded from per cent calculations.  
Gestational age was not provided for three babies.*

**TABLE 2: Level III registrants in each birthweight group, 2008**

Birth weight (grams)	Number of babies	Percent	Cumulative percent
<500	33	0.4	0.4
500–599	88	1.0	1.4
600–699	159	1.8	3.2
700–799	282	3.3	6.5
800–899	271	3.1	9.7
900–999	295	3.4	13.1
1000–1099	350	4.1	17.1
1100–1199	345	4.0	21.1
1200–1299	364	4.2	25.3
1300–1399	417	4.8	30.2
1400–1499	420	4.9	35.0
<b>All babies &lt;1500g birthweight</b>	<b>3,024</b>	<b>35.0</b>	
1500–1999	1,647	19.1	54.1
2000–2499	1,091	12.6	66.8
2500–2999	971	11.3	78.0
3000–3499	969	11.2	89.3
3500–3999	602	7.0	96.2
≥4000	324	3.8	100.0
<b>Total</b>	<b>8,628</b>	<b>100.0</b>	

**FIGURE 4: Level III registrants by registration criteria, 1999–2008**



## 3. Mothers of level III registrants, 2008

### Maternal age

While there are many determinants of perinatal outcome, an important one is maternal age. In 2008, the age of mothers of neonates registered as high-risk ranged from less than 15 years to just over 50 years. The highest proportion of registrant mothers was aged 30–34 years (28.3%) followed by mothers aged 25–29 years (25.8%). Together they accounted for more than half of the mothers (54.1%) of ANZNN registrants in 2008 (Table 3). In 2008, the proportion of teenage mothers decreased slightly (0.3%) from 2007, while mothers in the 35–39 age group increased by 0.7%, from 19.1% in 2007 to 19.8%.

Half of the babies born to teenage mothers (50.5%) were born at less than 32 weeks completed gestation, while only 40.7% 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 group, 2008**

Maternal age (years)	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
	Number								
Less than 20	4	41	57	51	90	60	59	119	481
20–24	6	69	119	161	207	175	204	364	1,305
25–29	8	118	189	298	370	295	352	561	2,191
30–34	13	105	186	264	412	395	434	598	2,407
35–39	15	74	126	191	293	303	287	399	1,688
40 and over	1	21	27	47	83	60	79	111	429
Not stated	1	3	2	8	6	11	28	65	124
Total	48	431	706	1,020	1,461	1,299	1,443	2,217	8,628
Per cent									
Less than 20	8.5	9.6	8.1	5.0	6.2	4.7	4.2	5.5	5.7
20–24	12.8	16.1	16.9	15.9	14.2	13.6	14.4	16.9	15.3
25–29	17.0	27.6	26.8	29.4	25.4	22.9	24.9	26.1	25.8
30–34	27.7	24.5	26.4	26.1	28.3	30.7	30.7	27.8	28.3
35–39	31.9	17.3	17.9	18.9	20.1	23.5	20.3	18.5	19.8
40 and over	2.1	4.9	3.8	4.6	5.7	4.7	5.6	5.2	5.0
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.  
Gestational age was not provided for three babies.

### Previous antenatal history

In 2008, a previous preterm delivery was reported by 1,038 mothers (12.0%) of babies registered to ANZNN while 319 mothers (3.7%) reported a previous perinatal loss.

### Assisted conception

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

There were 664 (7.7%) pregnancies resulting from assisted conception in the ANZNN 2008 cohort with most (81.5%) the result of IVF treatment. Of the pregnancies resulting from assisted conception, 41.4% of the mothers were more than 34 years of age at the time of giving birth.



## 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 97.9% of 2008 ANZNN registrants. More than one-quarter of mothers (26.0%) presented with preterm labour while pre-labour rupture of membranes was the second highest (15.2%) presenting antenatal problem (Table 4). Overall 84.7% of mothers of registrants had a pregnancy complication recorded.

The maternal antenatal complications for registrants born at 37–43 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 (39.5% and 30.6% respectively) followed by pre-labour rupture of membranes (23% and 16.2% respectively).

Among women who gave birth at term, just over half (52.5%) were recorded as having no maternal presenting antenatal problem.

**TABLE 4: Mother's presenting antenatal problem for level III registrants by gestational age group, 2008**

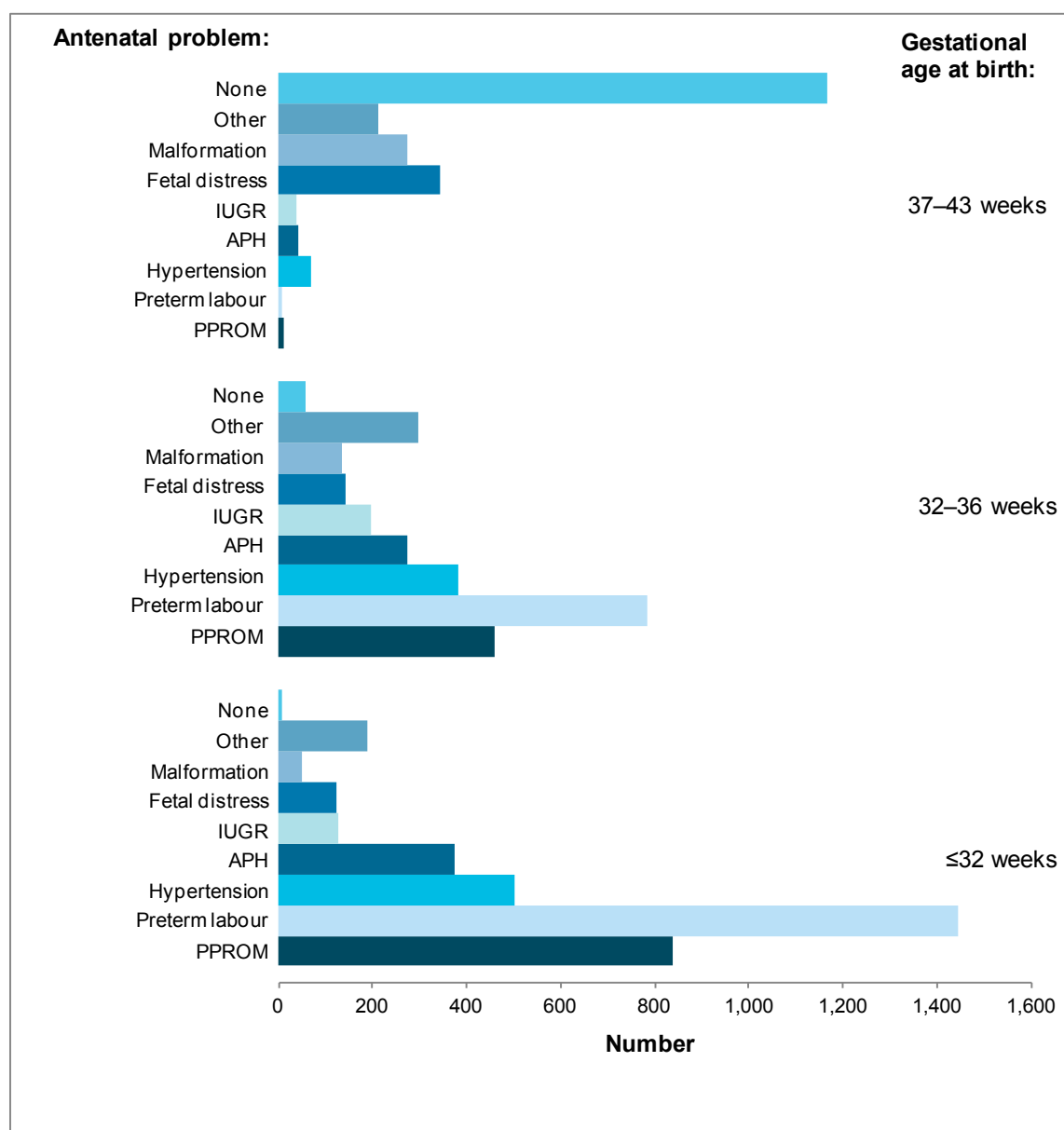
Presenting antenatal problem	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
	Number								
No antenatal problems	0	1	0	0	5	9	49	1,166	1,230
Pre-labour rupture of membranes (PROM)	15	94	180	209	342	224	234	12	1,310
Preterm labour	25	228	290	396	505	343	441	9(a)	2,237
Hypertension in pregnancy	2	29	75	147	248	236	146	69	952
Antepartum haemorrhage (APH)	6	55	67	113	133	132	140	43	689
Intrauterine growth restriction (IUGR)	0	3	25	41	56	104	91	39	359
Fetal distress	0	4	28	36	55	62	82	342	609
Other problem	0	12	23	60	94	142	154	212	697
Congenital anomalies	0	2	15	13	21	40	93	274	458
Not stated	0	3	3	5	2	7	13	51	84
<b>Total</b>	<b>48</b>	<b>431</b>	<b>706</b>	<b>1,020</b>	<b>1,461</b>	<b>1,299</b>	<b>1,443</b>	<b>2,217</b>	<b>8,628</b>
	Per cent								
No antenatal problems	0.0	0.2	0.0	0.0	0.3	0.7	3.4	53.8	14.4
Pre-labour rupture of membranes (PROM)	31.3	22.0	25.6	20.6	23.4	17.3	16.4	0.6	15.3
Preterm labour	52.1	53.3	41.3	39.0	34.6	26.5	30.8	0.4	26.2
Hypertension in pregnancy	4.2	6.8	10.7	14.5	17.0	18.3	10.2	3.2	11.1
Antepartum haemorrhage (APH)	12.5	12.9	9.5	11.1	9.1	10.2	9.8	2.0	8.1
Intrauterine growth restriction (IUGR)	0.0	0.7	3.6	4.0	3.8	8.0	6.4	1.8	4.2
Fetal distress	0.0	0.9	4.0	3.5	3.8	4.8	5.7	15.8	7.1
Other problem	0.0	2.8	3.3	5.9	6.4	11.0	10.8	9.8	8.2
Congenital anomalies	0.0	0.5	2.1	1.3	1.4	3.1	6.5	12.7	5.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

(a) These mothers presented with preterm labour, then went on to deliver at term.

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

Gestational age was not provided for three babies.

**FIGURE 5: Presenting antenatal problem for mothers of level III registrants by gestational age group, 2008**



*Note:* Gestational age was not provided for three babies.

## 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 (Crowley 1995).

Table 5 presents antenatal corticosteroids use for mothers of ANZNN registrants in each gestational age group. In 2008, 88.3% of mothers of ANZNN registrants born before 34 completed weeks of gestation received one or more doses of antenatal corticosteroids leaving 11.7% of mothers of registrants in this group who did not receive any antenatal corticosteroids. Of the mothers who received antenatal corticosteroids, 15.9% received them more than seven days prior to giving birth.

For mothers of ANZNN registrants born before 32 completed weeks of gestation, 89.7% received one or more doses of antenatal corticosteroids and 10.3% of mothers of registrants in this group did not receive 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 (2000–2009) for maternal corticosteroids is represented by Figure 29 in Appendix 1.

**TABLE 5: Antenatal corticosteroid use for mothers of level III registrants by gestational age group, 2008**

	Gestational age group								
Antenatal corticosteroids	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
None	9	46	70	109	138	200	870	1,850	3,292
Incomplete course	17	141	197	282	403	348	99	7	1,494
Course completed	21	203	339	464	692	533	210	17	2,479
Completed >7 days prior to birth	0	34	88	154	213	197	161	27	874
Not stated	1	7	12	11	15	21	103	316	486
<b>Total</b>	<b>48</b>	<b>431</b>	<b>706</b>	<b>1,020</b>	<b>1,461</b>	<b>1,299</b>	<b>1,443</b>	<b>2,217</b>	<b>8,628</b>
Per cent									
None	19.1	10.8	10.1	10.8	9.5	15.6	64.9	97.3	40.4
Incomplete course	36.2	33.3	28.4	27.9	27.9	27.2	7.4	0.4	18.3
Course completed	44.7	47.9	48.8	46.0	47.9	41.7	15.7	0.9	30.4
Completed >7 days prior to birth	0.0	8.0	12.7	15.3	14.7	15.4	12.0	1.4	10.7
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

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

Gestational age was not provided for three babies.

## Multiple births

Multiple birth 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 2008, 22.6% of ANZNN registrants were reported as being from a multiple pregnancy with the greatest percentage of multiple births being twins (20.5%). Of the 2008 ANZNN registrants from multiple births, 58.7% were born before 32 weeks gestation and 94.3% were born before 37 weeks gestation (Table 6). The 10-year trend (2000–2009) for multiple births is represented by Figure 30 in Appendix 1.

**TABLE 6: Plurality of level III registrants by gestational age group, 2008**

Plurality	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
Number									
Singletons	32	294	503	703	986	878	1,169	2,105	6,670
Twins	14	123	174	288	431	371	258	109	1,768
Triplets and higher orders	2	13	27	29	44	49	16	3	183
Not stated	0	1	2	0	0	1	0	0	4
Total	48	431	706	1,020	1,461	1,299	1,443	2,217	8,628
Per cent									
Singletons	66.7	68.4	71.4	68.9	67.5	67.6	81.0	94.9	77.3
Twins	29.2	28.6	24.7	28.2	29.5	28.6	17.9	4.9	20.5
Triplets and higher orders	4.2	3.0	3.8	2.8	3.0	3.8	1.1	0.1	2.1
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.

Gestational age was not provided for three babies.

## 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 more than half of the 2008 registrants (58.5%) the method of birth was caesarean section with 62.2% of caesarean sections occurring before the onset of labour. Just over one-third of registrants (36.6%) were non-instrumental vaginal births (Table 7). The rate of birth by caesarean section has gradually increased from 49.8%, since the first data collection in 1995, to 59.1% in 2007. The 2008 data show an increase of 3.1% from 2007.

The most common method of birth for registrants born before 24 weeks was vaginal birth (77.1%) with less than five per cent (4.8%) requiring assistance with instruments (Table 7). The 10-year trend (2000–2009) for method of birth is represented by Figure 31 in Appendix 1.

**TABLE 7: Method of birth for level III registrants by gestational age group, 2008**

	Gestational age group								
Method of birth	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
Vaginal	37	214	268	344	486	326	511	940	3,126
Vaginal instrumental birth	0	9	8	19	41	34	76	223	410
Caesarean section in labour	8	114	171	232	339	255	285	486	1,890
Caesarean section no labour	3	92	257	420	590	679	555	515	3,111
Not stated	0	2	2	5	5	5	16	53	88
Total	48	431	706	1,020	1,461	1,299	1,443	2,217	8,628
Per cent									
Vaginal	77.1	49.9	38.1	33.9	33.4	25.2	35.8	43.4	36.6
Vaginal instrumental birth	0.0	2.1	1.1	1.9	2.8	2.6	5.3	10.3	4.8
Caesarean section in labour	16.7	26.6	24.3	22.9	23.3	19.7	20.0	22.5	22.1
Caesarean section no labour	6.3	21.4	36.5	41.4	40.5	52.5	38.9	23.8	36.4
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.  
Gestational age was not provided for three babies.

## 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 2008, 78.1% of all babies and 87.6% of babies less than 32 weeks gestation at birth were born in a tertiary centre equipped with an NICU; 21.3% of all ANZNN registrants were born in a non-tertiary hospital; while 0.6% of registrants were not born in a hospital (Table 8).

**TABLE 8: Level of hospital of birth for level III registrants by gestational age group, 2008**

	Gestational age group								
Level of birth hospital	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
Tertiary hospital	43	371	608	869	1,309	1,119	1,025	1,377	6,721
Non-tertiary hospital	5	55	92	136	148	177	409	815	1,837
Not born in a hospital <sup>(a)</sup>	0	2	3	10	2	2	8	21	48
Not stated	0	3	3	5	2	1	1	4	19
<b>Total</b>	<b>48</b>	<b>431</b>	<b>706</b>	<b>1,020</b>	<b>1,461</b>	<b>1,299</b>	<b>1,443</b>	<b>2,217</b>	<b>8,628</b>
Per cent									
Tertiary hospital	89.6	86.7	86.5	85.6	89.7	86.2	71.1	62.2	78.1
Non-tertiary hospital	10.4	12.9	13.1	13.4	10.1	13.6	28.4	36.8	21.3
Not born in a hospital <sup>(a)</sup>	0.0	0.5	0.4	1.0	0.1	0.2	0.6	0.9	0.6
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*(a) These babies were either born before arrival to hospital or born at home.*  
*Note:* Not stated data are excluded from per cent calculations.  
Gestational age was not provided for three babies.

## 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; if a term baby born in a non-tertiary centre has an unexpected need for NICU care; or the baby requires specialised care in a children's hospital.

In 2008, 25.5% of ANZNN registrants were transferred to an NICU after birth. Of these the greatest percentage (76.4%) were transported by a specialist team with 20.0% transported by a non-specialist team (Table 9). The 10-year trend (2000–2009) for mode of transport to level III unit is represented by Figure 33 in Appendix 1.

**TABLE 9: Mode of transport to level III NICU after birth for level III registrants by gestational age, 2008**

	Gestational age group								
Mode of Transport	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
Not transported	41	360	589	841	1,277	1,089	965	1,229	6,391
Specialist retrieval team	5	52	81	124	130	151	393	738	1,674
Non-specialist team	1	11	29	29	38	43	68	219	438
Other	1	3	3	12	11	13	15	20	78
Not stated	0	5	4	14	5	3	2	11	44
Total	48	431	706	1,020	1,461	1,299	1,443	2,217	8,628
Per cent									
Not transported	85.4	84.5	83.9	83.6	87.7	84.0	67.0	55.7	74.5
Specialist transport team	10.4	12.2	11.5	12.3	8.9	11.7	27.3	33.5	19.5
Non-specialist team	2.1	2.6	4.1	2.9	2.6	3.3	4.7	9.9	5.1
Other	2.1	0.7	0.4	1.2	0.8	1.0	1.0	0.9	0.9
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.  
Gestational age was not provided for three babies.

## Breastfeeding at discharge

Data on breastfeeding at discharge were available for 4,497 babies (55.6% of the babies who survived to go home). Among registrants who provided data on breastfeeding, 72.7% were breastfed at discharge.

The rate of breastfeeding among surviving very preterm babies at discharge was 70.6% compared to 74.4% for surviving preterm and term babies. Care should be taken with interpretation of this data as data were not available for breastfeeding status on discharge for almost half (44.4%) of surviving ANZNN registrants.

## 4. Characteristics of level III registrants, 2008

### Baby gender

Male births exceeded female births in both Australia and New Zealand and accounted for 51.4% of combined live births in both countries in 2008 (Laws, Li & Sullivan 2010; Statistics New Zealand 2008). The percentage was higher among ANZNN registrants with male births representing 57.3%. Gender was not available for eight babies. For births at less than 32 weeks gestation, 53.5% were male; of births at term 62.5% were male.

### Resuscitation in delivery suite

The types of resuscitation given to babies immediately after birth range from the least severe, suction to the most severe, external cardiac massage and ventilator support. For the purpose of this audit ANZNN only collected data on babies on whom endotracheal intubation was performed; 24.2% of registrants were intubated in the delivery suite to establish independent respiration and heart rate. For babies born before 32 weeks the percentage was 39.6% and for babies born at term the percentage was 16.8%.

### 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 requires specialised resuscitation.

An Apgar score of less than 4 at one minute of age was recorded for 17.3% of ANZNN registrants, with 3.6% of registrants recording an Apgar score of less than 4 at five minutes of age. Among the babies who had low Apgar scores at one minute, 49.1% of babies were born at less than 32 weeks and 30.2% were born at term (Table 10).

**TABLE 10: Apgar scores at birth for level III registrants by gestational age group, 2008**

	Gestational age group								
Apgar score	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
Apgar at 1 minute									
Apgar less than 4	24	179	195	177	156	127	182	450	1,490
Apgar between 4 and 7	21	222	405	538	668	572	527	773	3,726
Apgar greater than 8	3	29	105	303	637	600	734	994	3,405
Not stated	0	1	1	2	0	0	0	0	4
Total	48	431	706	1,020	1,461	1,299	1,443	2,217	8,628
Number									
Apgar at 5 minutes									
Apgar less than 4	10	44	38	25	18	14	33	129	311
Apgar between 4 and 7	25	233	275	296	266	241	282	609	2,227
Apgar greater than 8	13	153	390	697	1,177	1,044	1,128	1,478	6,080
Not stated	0	1	3	2	0	0	0	1	7
Total	48	431	706	1,020	1,461	1,299	1,443	2,217	8,628

*Note: Gestational age was not provided for three babies.*

## Admission temperature

The temperature at admission to the NICU, or temperature nearest to admission to the registration unit, was reported for all ANZNN registrants in 2008. 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 is used to calculate the Clinical Risk Index for Babies (CRIB) II score. 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 36.4° C; the median temperature increased slightly with increasing gestational age at birth. The lowest median temperature recorded was 35.7° C by the youngest babies, i.e. those born at less than 24 weeks gestation (Table 11).

**TABLE 11: Median admission temperature and interquartile ranges for level III registrants by gestational age group, 2008**

Gestational age group	Number of babies	Temperature	
		Median	Interquartile range
<24	48	35.7	34.3–36.6
24–25	431	36.1	35.4–36.6
26–27	706	36.4	35.8–36.8
28–29	1,020	36.4	36.0–36.8
30–31	1,461	36.4	36.0–36.8
32–33	1,299	36.4	36.0–36.8
34–36	1,443	36.5	36.0–36.9
37–43	2,217	36.6	35.8–37.0
<b>Total</b>	<b>8,628</b>	<b>36.4</b>	<b>35.9–36.8</b>

*Note: Gestational age was not provided for three babies.*

## Indication for respiratory support

In 2008, only 6.2% of all ANZNN registrants did not receive any form of respiratory support. For the remaining registrants, hyaline membrane disease (HMD) remained the most common indication for respiratory support at 46.7%. Non-specific respiratory distress accounted for 24.5% of babies, congenital anomaly for 3.9%, while encephalopathy and meconium aspiration each accounted for 2.6% (Table 12).

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 (30.4%) was the most common indication followed by surgery (12.7%), congenital anomaly (10.6%) and meconium aspiration (10.1%) (Table 12). The 10-year trend (2000–2009) for mode of assisted ventilation is represented by Figure 34 in Appendix 1.

**TABLE 12: Indication for respiratory support for level III registrants by gestational age, 2008**

Indication for respiratory support	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
	Number								
No respiratory support	1	0	1	19	231	122	59	94	527
Non-specific respiratory distress	4	8	35	97	305	446	520	654	2,069
Hyaline membrane disease	38	374	584	802	798	608	537	213	3,954
Meconium aspiration syndrome	0	0	0	0	0	0	3	218	221
Pneumonia	0	2	0	2	1	0	14	46	65
Persistent pulmonary hypertension	0	2	5	5	4	1	18	94	129
Apnoea	1	34	67	69	67	41	36	42	357
Congenital anomaly	0	1	2	6	11	17	62	227	326
Other	2	5	4	5	4	24	38	110	192
Peri-surgery	0	0	1	3	9	15	93	273	394
Newborn encephalopathy	0	0	4	1	4	6	31	177	223
Not stated	2	5	3	11	27	19	32	69	168
<b>Total</b>	<b>48</b>	<b>431</b>	<b>706</b>	<b>1,020</b>	<b>1,461</b>	<b>1,299</b>	<b>1,443</b>	<b>2,217</b>	<b>8,628</b>
	Per cent								
No respiratory support	2.2	0.0	0.1	1.9	15.8	9.4	4.1	4.2	6.2
Non-specific respiratory distress	8.7	1.9	5.0	9.6	21.3	34.8	36.9	30.4	24.5
Hyaline membrane disease	82.6	87.8	83.1	79.5	55.6	47.5	38.1	9.9	46.7
Meconium aspiration syndrome	0.0	0.0	0.0	0.0	0.0	0.0	0.2	10.1	2.6
Pneumonia	0.0	0.5	0.0	0.2	0.1	0.0	1.0	2.1	0.8
Persistent pulmonary hypertension	0.0	0.5	0.7	0.5	0.3	0.1	1.3	4.4	1.5
Apnoea	2.2	8.0	9.5	6.8	4.7	3.2	2.6	2.0	4.2
Congenital anomaly	0.0	0.2	0.3	0.6	0.8	1.3	4.4	10.6	3.9
Other	4.3	1.2	0.6	0.5	0.3	1.9	2.7	5.1	2.3
Peri-surgery	0.0	0.0	0.1	0.3	0.6	1.2	6.6	12.7	4.7
Newborn encephalopathy	0.0	0.0	0.6	0.1	0.3	0.5	2.2	8.2	2.6
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Note:** Not stated data are excluded from per cent calculations.  
Gestational age was not provided for three babies.

## 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. There is some evidence that a bolus dose of exogenous surfactant given to babies with meconium aspiration syndrome can reduce ventilation requirements.

In 2008, one-third of ANZNN registrants (32.6%) were administered exogenous surfactant (Table 13).

There were 2,432 babies who received IPPV for HMD in 2008. Exogenous surfactant was given to 2,196 of these babies (90.3%). There were 236 babies diagnosed with HMD who were not given exogenous surfactant.



**TABLE 13: Exogenous surfactant use for level III registrants by gestational age group, 2008**

Exogenous surfactant	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
	Number								
None	4	28	134	421	1,020	1,010	1,203	1,975	5,795
Curosurf	34	333	445	411	261	181	165	140	1,970
Survanta	8	66	116	177	175	101	68	92	803
Surv+Curo	0	0	4	6	1	3	3	4	21
Exosurf	0	0	1	0	1	0	2	0	4
Any combination	0	1	2	0	0	0	0	0	3
Not stated	2	3	4	5	3	4	2	6	29
<b>Total</b>	<b>48</b>	<b>431</b>	<b>706</b>	<b>1,020</b>	<b>1,461</b>	<b>1,299</b>	<b>1,443</b>	<b>2,217</b>	<b>8,628</b>
Per cent									
None	8.7	6.5	19.1	41.5	70.0	78.0	83.5	89.3	67.4
Curosurf	73.9	77.8	63.4	40.5	17.9	14.0	11.5	6.3	22.9
Survanta	17.4	15.4	16.5	17.4	12.0	7.8	4.7	4.2	9.3
Surv+Curo	0.0	0.0	0.6	0.6	0.1	0.2	0.2	0.2	0.2
Exosurf	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.0
Any combination	0.0	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*Note:* Not stated data are excluded from per cent calculations.  
Gestational age was not provided for three babies.

## 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 2008, 93.0% required assisted ventilation for four or more hours.

The two major forms of assisted ventilation used are intermittent positive pressure ventilation (IPPV) and continuous positive airways pressure (CPAP). IPPV is assisted ventilation given via an endotracheal tube, while CPAP can be administered via an endotracheal tube or via nasopharyngeal prongs (nasal CPAP). For the purposes of this audit CPAP is recorded via any route. The 10-year trend (2000–2009) for assisted ventilation is represented in Figures 35 and 36 in Appendix 1.

In 2008, IPPV was given for a total of 580,759 hours to ANZNN registrants and CPAP was given for 1,603,898 hours. The total number of hours of ventilation equates to each baby receiving 10.6 days of assisted ventilation. The median number of days of assisted ventilation is inversely related to the gestational age at birth (Table 14).

The most common form of ventilation given to ANZNN registrants in 2008 remains CPAP with 44.7% of registrants receiving CPAP only, 13.6% receiving IPPV only and 34.6% receiving both CPAP and IPPV.

In addition to IPPV and CPAP babies may have received oxygen (O<sub>2</sub>), high frequency oscillatory ventilation (HFOV), nitric oxide (NO) or extracorporeal membrane oxygenation (ECMO). HFOV without IPPV is very rarely given; therefore the rates of HFOV and NO are given as a percentage of the babies who received IPPV. The use of HFOV had been relatively stable at 12–14% since 1999, with the exception of 2007 (11.2%). In 2008, 12.8% of registrants who received IPPV also received HFOV. The use of HFOV among individual units varied between 1.8% and 14.0% with the highest percentage of babies receiving HFOV born at less than 24 weeks (53.3%) followed by babies born at 24–25 weeks gestation (38.4%). The 10-year trend (2000–2009) for HFOV is represented in Figure 37 in Appendix 1.

**TABLE 14: Duration of assisted ventilation and oxygen use by level III registrants by gestational age group, 2008**

Median & Interquartile range (IQR)	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
IPPV (hours)									
Median	528	269	64	25	20.5	25.5	39	51	43
IQR	22–971	65–598	19–255	12–79	11–49	12–71	18–82	21–100.5	16–119
CPAP (hours)									
Median	1,203	1,056	799	240	51	30	24	17	47
IQR	938–1,365	631–1,385	399–1,095	72–556	18–116	12–72	11–59	7–41	15–173
Oxygen (days)									
Median	85	69	47	13	2	2	2	3	3
IQR	12–122	25–107	22–79	2–39	1–5	1–4	1–5	1–7	1–19

*Note: IQR = Interquartile range*

The percentage of ANZNN registrants who received nitric oxide (NO) was 4.7%. The use of NO continues to have a U-shaped distribution with the highest percentage of babies to receive NO born at less than 24 weeks gestation (24.4%) (Table 15). The 10-year trend (2000–2009) for NO is represented in Figure 38 in Appendix 1.

**TABLE 15: Assisted ventilation for level III registrants by gestational age group, 2008**

	Gestational age group								
Ventilation type	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
CPAP given	25	345	649	950	1,147	1,095	1,175	1,462	6,848
IPPV given	45	409	591	611	494	372	494	1,144	4,160
Oxygen given	35	376	565	659	640	610	756	1,284	4,925
HFOV given	24	157	115	59	24	12	33	107	531
NO given	11	40	53	35	16	14	34	200	403
ECMO given	0	0	0	0	0	0	2	8	10
Total in each age group	48	431	706	1,020	1,461	1,299	1,443	2,217	8,628
Per cent									
CPAP given	52.1	80.0	91.9	93.1	78.5	84.3	81.4	65.9	79.4
IPPV given	93.8	94.9	83.7	59.9	33.8	28.6	34.2	51.6	48.2
Oxygen given	72.9	87.2	80.0	64.6	43.8	47.0	52.4	57.9	57.1
Per cent of babies given IPPV									
HFOV given	53.3	38.4	19.5	9.7	4.9	3.2	6.7	9.4	12.8
NO given	24.4	9.8	9.0	5.7	3.2	3.8	6.9	17.5	9.7
ECMO given	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	0.2

*Note: Groups are not mutually exclusive.*

*Percentage of babies given HFOV and NO are given as a percentage of babies given IPPV.*

*Gestational age was not provided for three babies.*

## 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 3,666 babies born before 32 weeks gestation, 91.6% were given assisted ventilation in the form of IPPV or CPAP. For registrants in this age group CPAP was the only form of ventilation for 32.9% and IPPV was the only form of ventilation for 6.6% of registrants. Both IPPV and CPAP were given to 52.0% of registrants.

The total duration of IPPV for these very preterm babies was 398,576 hours (16,607 days), and the duration of CPAP was 1,405,164 hours (58,549 days).

Of the babies born before 32 weeks gestational age and given IPPV in 2008, 17.6% were given high frequency ventilation while 7.2% of these babies were given NO (Table 15).

Among 2008 ANZNN registrants born at less than 32 weeks gestation 35.8% of registrants received supplemental oxygen at 28 days of age, with 16.9% of them discharged on home oxygen (Table 16).

## Ventilation in babies born at 32 to 36 weeks gestation

Among the babies born at 32–36 weeks gestation, 92.8% received assisted ventilation. Non-specific respiratory distress was the main reason for ventilation. Total duration of CPAP use by registrants in this gestational age group was 126,046 hours (5,252 days) and IPPV use was 71,434 hours (2,976 days).

Of the babies born at 32–36 weeks gestation and given IPPV in 2008, 5.2% were given high frequency ventilation while 5.5% of these babies were given NO. Supplementary oxygen was given to 5.5% of registrants (Table 15).

## Ventilation in babies born at term

The main indication for respiratory support in term babies was non-specific respiratory distress (24.5%). This group required 110,749 hours of IPPV (4,615 days) and 72,688 hours (3,029 days) of CPAP.

Of the babies born at term and given IPPV in 2008, 9.4% were given high frequency ventilation while 17.5% of these babies were given NO. There were five babies born at term who received extracorporeal membrane oxygenation (ECMO) (Table 15).

## Supplemental oxygen (O<sub>2</sub>) therapy

Supplemental oxygen can be 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 oxygen administration as part of their specialised care. The duration of supplemental oxygen use may vary 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 constitutes the use of supplemental oxygen on that day. The continued use of oxygen at 28 days of age is a predictor of postneonatal mortality and the need for continued oxygen therapy after discharge.

Among 2008 ANZNN registrants, 19.2% received supplemental oxygen on day 28, a lower percentage than in 2007 (20.1%), and 17.5% of registrants given oxygen on day 28 were discharged on home oxygen (Table 16).

**TABLE 16: Supplemental oxygen therapy for level III registrants by gestational age group, 2008**

	Gestational age group								
Oxygen therapy	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
No oxygen on day 28	1	41	216	715	1,361	1,241	1,344	2,009	6,928
Oxygen on day 28	47	378	482	298	96	56	94	192	1,643
▪ survived to discharge home	20	264	408	256	73	31	47	64	1,163
▪ died before discharge	27	114	74	42	23	25	47	128	480
Not stated	0	12	8	7	4	2	5	16	54
Total in each age group	48	431	706	1,020	1,461	1,299	1,443	2,217	8,628
Number									
Babies given home oxygen	7	67	56	31	12	5	7	18	203
Per cent									
No oxygen on day 28	2.1	9.8	30.9	70.6	93.4	95.7	93.5	91.3	80.8
Oxygen on day 28	97.9	90.2	69.1	29.4	6.6	4.3	6.5	8.7	19.2
▪ survived to discharge home	42.6	69.8	84.6	85.9	76.0	55.4	50.0	33.3	70.8
▪ died before discharge	57.4	30.2	15.4	14.1	24.0	44.6	50.0	66.7	29.2
Per cent									
Babies given home oxygen	35.0	25.4	13.7	12.1	16.4	16.1	14.9	28.1	17.5

**Note:** Not stated data are excluded from per cent calculations.  
Gestational age was not provided for three babies.

## Chronic lung disease

Chronic lung disease (CLD) is diagnosed in babies born at less than 32 weeks gestation, who receive any form of respiratory support (supplemental oxygen and/or assisted ventilation) for their initial respiratory disease and continue to require respiratory support 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 7.2% of babies in 2008 were reported to have had respiratory support at 36 weeks PMA, indicating the presence of CLD. The prevalence of chronic lung disease continues to be highest in babies born less than 27 weeks gestation. The highest percentage of chronic lung disease was in those babies born before 24 weeks gestation (45.8%) (Table 17). Not all the babies born at earlier gestations survived to 36 weeks PMA. CLD by gestational age is represented by Figure 39 in Appendix 1.

**TABLE 17: Chronic lung disease for level III registrants by gestational age group, 2008**

Chronic lung disease (CLD)	Gestational age										Total
	<24	24	25	26	27	28	29	30	31	≥32	
	Number										
No CLD	26	105	142	199	275	391	489	636	779	4,959	8,001
CLD	22	66	118	124	108	76	64	25	21	0	624
▪ CLD & survived	18	62	116	120	105	75	61	24	20	0	601
▪ CLD and died	4	4	2	4	3	1	3	1	1	0	23
Total	48	171	260	323	383	467	553	661	800	7,959	8,628
Per cent											
No CLD	54.2	61.4	54.6	61.6	71.8	83.7	88.4	96.2	97.4	62.3	92.7
CLD	45.8	38.6	45.4	38.4	28.2	16.3	11.6	3.8	2.6	0.0	7.2
▪ CLD & survived	81.8	93.9	98.3	96.8	97.2	98.7	95.3	96.0	95.2	0.0	96.3
▪ CLD and died	18.2	6.1	1.7	3.2	2.8	1.3	4.7	4.0	4.8	0.0	3.7

**Note:** Survival is assessed to discharge from hospital.  
Gestational age was not provided for three babies.

## 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 18).

**TABLE 18: Pulmonary air leak for level III registrants by gestational age group, 2008**

	Gestational age group								
Air leak	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
Air leak	7	32	28	42	37	40	58	164	408
No air leak	41	395	675	974	1,422	1,257	1,381	2,050	8,195
Not stated	0	4	3	4	2	2	4	3	22
Total	48	431	706	1,020	1,461	1,299	1,443	2,217	8,628
Per cent									
Air leak	14.6	7.5	4.0	4.1	2.5	3.1	4.0	7.4	4.7
No air leak	85.4	92.5	96.0	95.9	97.5	96.9	96.0	92.6	95.2
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.  
Gestational age was not provided for three babies.*

## 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 8.5% of ANZNN registrants in 2008. Of these babies, 48.8% were born at less than 28 weeks gestation, 74.8% were born at less than 32 weeks gestation and 99.2% of registrants survived up to 2 days of life (Table 19). The 6-year trends (2004–2009) for early and late sepsis are represented by Figures 43 and 44 respectively in Appendix 1.

**TABLE 19: Neonatal sepsis for level III registrants by gestational age group, 2008**

	Gestational age group								
Sepsis	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
No sepsis	28	264	533	904	1,386	1,259	1,387	2,127	7,888
Sepsis	20	167	173	116	75	40	56	90	737
▪ <48 hrs	2	8	14	9	8	9	17	28	95
▪ ≥48 hrs	18	155	155	106	65	31	38	61	629
▪ both <48 and ≥48 hrs	0	4	4	1	2	0	1	1	13
Babies alive on day 2	36	416	699	1,010	1,455	1,297	1,440	2,209	8,562
Babies who did not survive to day 2	12	15	7	10	6	2	3	9	64
Total in each age group	48	431	706	1,020	1,461	1,299	1,443	2,217	8,628
Per cent									
No sepsis <sup>(a)</sup>	58.3	61.3	75.5	88.6	94.9	96.9	96.1	95.9	91.4
Sepsis <sup>(a)</sup>	41.7	38.7	24.5	11.4	5.1	3.1	3.9	4.1	8.5
▪ <48 hrs <sup>(a)</sup>	4.2	1.9	2.0	0.9	0.5	0.7	1.2	1.3	1.1
▪ ≥48 hrs <sup>(b)</sup>	50.0	37.3	22.2	10.5	4.5	2.4	2.6	2.8	7.3
▪ both <48 and ≥48 hrs <sup>(a)</sup>	0.0	1.0	0.6	0.1	0.1	0.0	0.1	0.0	0.2

*(a) Denominator is all registrants.*

*(b) Denominator is registrants alive at 48 hours.*

*Note: Denominator for these calculations are all ANZNN registrants.  
Gestational age was not provided for three babies.*

## 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 2008 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 2008 registrants, 33.4% were eligible for ROP examination and of these eligible registrants, 78.6% were examined and had the results of their eye examination recorded.

Of those ANZNN registrants who were eligible for an eye examination, 34 died before their ROP status could be determined. Of those examined, 6.2% had stage 3 or 4 eye disease and of these babies 72.1% received treatment (Table 20). The 5-year trend (2005–2009) for stages 3 and 4 ROP and treatment are represented by Figure 41 in Appendix 1.

**TABLE 20: Retinopathy of prematurity for level III registrants by gestational age, 2008**

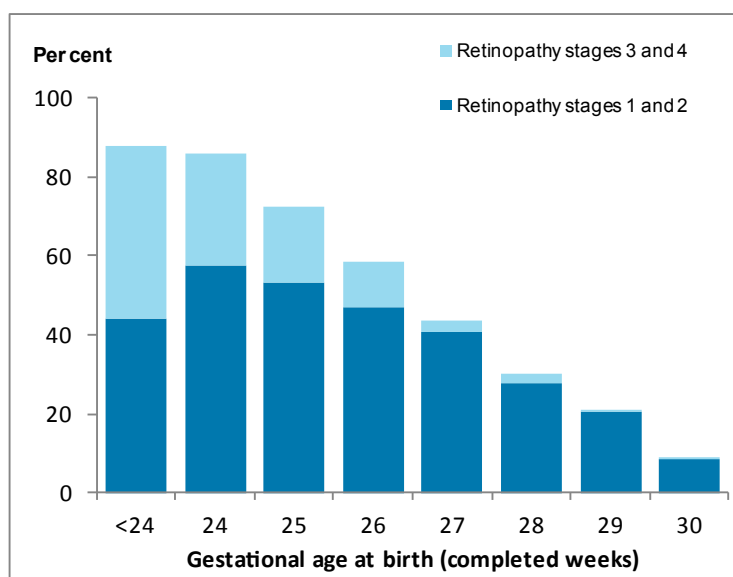
Retinopathy of prematurity (ROP)	Gestational age									Total
	<24	24	25	26	27	28	29	30	>30	
Number										
No ROP	3	14	58	111	194	287	377	378	0	1,422
▪ Stage 1 ROP	7	17	41	53	87	66	68	17	11	367
▪ Stage 2 ROP	4	41	70	74	53	48	29	18	3	340
▪ Stage 3 ROP	10	26	39	31	10	8	4	1	3	132
▪ Stage 4 ROP	1	3	1	0	1	1	0	1	0	8
Not examined	10	59	40	47	34	50	69	242	65	616
Not stated	1	2	4	3	0	2	1	0	0	13
<b>Total</b>	<b>36</b>	<b>162</b>	<b>253</b>	<b>319</b>	<b>379</b>	<b>462</b>	<b>548</b>	<b>657</b>	<b>82</b>	<b>2,898</b>
Number										
Treatment for ROP <sup>(a)</sup>	7	24	28	18	9	3	3	1	1	101
Per cent										
No ROP	12.0	13.9	27.8	41.3	56.2	70.0	78.9	91.1	0.0	62.7
▪ Stage 1 ROP	28.0	16.8	19.6	19.7	25.2	16.1	14.2	4.1	64.7	16.2
▪ Stage 2 ROP	16.0	40.6	33.5	27.5	15.4	11.7	6.1	4.3	17.6	15.0
▪ Stage 3 ROP	40.0	25.7	18.7	11.5	2.9	2.0	0.8	0.2	17.6	5.8
▪ Stage 4 ROP	4.0	3.0	0.5	0.0	0.3	0.2	0.0	0.2	0.0	0.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
Per cent										
Treatment for ROP	63.6	82.8	70.0	58.1	81.8	33.3	75.0	50.0	33.3	72.1

(a) Percentages for babies with retinopathy of prematurity who received treatment have been calculated using as the denominator the total number in each age group who had stages 3 and 4 ROP.

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

Gestational age was not provided for three babies.

**FIGURE 6: Retinopathy of prematurity for level III registrants by gestational age in 2008**



*Note: Gestational age was not provided for three babies.*

## Intraventricular haemorrhage

An initial head 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 3,666 babies born at less than 32 weeks gestation eligible for a cerebral ultrasound, 3,616 survived to day 3 and 91.8% had an examination recorded. A normal report was recorded for 79.9% of these 2008 ANZNN registrants.

There were 159 babies reported to have grade 3 or 4 IVH representing 4.4% of the babies born before 32 weeks gestation. The highest percentage of babies who had severe IVH (grade 4) were born before 29 weeks gestational age, with the majority (64.4%) of the babies born between 24 and 26 weeks gestation. The 10-year trend (2000–2009) for registrants with grades 3 and 4 IVH who survived to day 3 is represented in Figure 42 in Appendix 1.

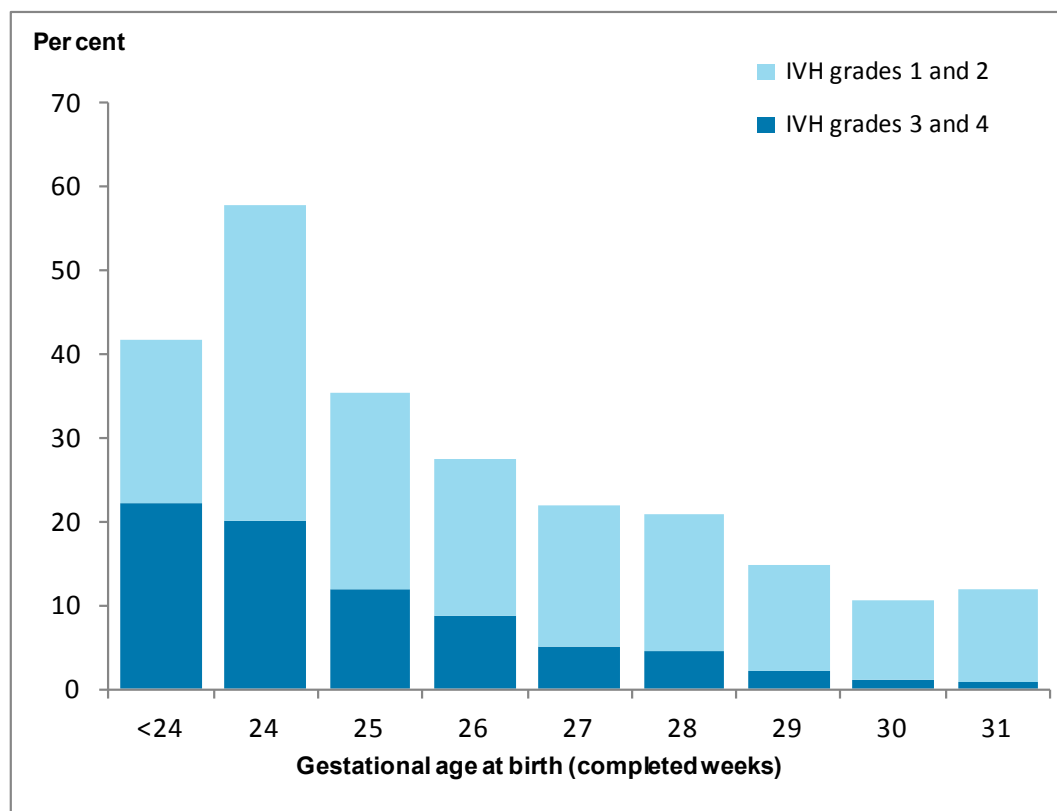
**TABLE 21: Intraventricular haemorrhage for level III registrants born before 32 weeks and survived to day 3 by gestational age, 2008**

Intraventricular haemorrhage	Gestational age									Total
	<24	24	25	26	27	28	29	30	31	
Number										
No IVH	21	67	156	226	290	355	452	518	566	2,651
▪ Grade 1 IVH	3	38	34	42	45	55	55	51	64	387
▪ Grade 2 IVH	4	22	22	17	17	18	11	4	7	122
▪ Grade 3 IVH	3	11	6	6	11	6	10	3	2	58
▪ Grade 4 IVH	5	21	23	21	8	14	2	4	3	101
Not examined	0	3	12	7	8	13	18	78	155	294
Not stated	0	1	0	1	0	1	0	0	0	3
<b>Total</b>	<b>36</b>	<b>163</b>	<b>253</b>	<b>320</b>	<b>379</b>	<b>462</b>	<b>548</b>	<b>658</b>	<b>797</b>	<b>3,616</b>
Per cent										
None	58.3	42.1	64.7	72.4	78.2	79.2	85.3	89.3	88.2	79.9
▪ Grade 1 IVH	8.3	23.9	14.1	13.5	12.1	12.3	10.4	8.8	10.0	11.7
▪ Grade 2 IVH	11.1	13.8	9.1	5.4	4.6	4.0	2.1	0.7	1.1	3.7
▪ Grade 3 IVH	8.3	6.9	2.5	1.9	3.0	1.3	1.9	0.5	0.3	1.7
▪ Grade 4 IVH	13.9	13.2	9.5	6.7	2.2	3.1	0.4	0.7	0.5	3.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

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

*Gestational age was not provided for three babies.*

**FIGURE 7: Intraventricular haemorrhage in level III registrants born at less than 32 weeks gestation and survived to day 3, by gestational age, 2008**



*Note: Gestational age was not provided for three babies.*

## 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 3,666 babies born at less than 32 weeks gestation eligible for a cerebral ultrasound, 3,616 survived until day 3 and late ultrasound results were available for 2,745 of these babies. A normal report of no cysts was recorded for 97.4% of these registrants, 0.8% reported porencephalic cysts, 1.7% reported periventricular leukomalacia (PVL) and only one report of encephaloclastic porencephaly. Hydrocephalus was reported for 1.1% of these registrants in 2008 (Table 22).

**TABLE 22: Late cerebral ultrasound results for level III registrants born before 32 weeks by gestational age, 2008**

	Gestational age									
Cerebral ultrasound results	<24	24	25	26	27	28	29	30	31	Total
Number										
No cysts	30	116	195	269	309	387	447	452	470	2,675
Porencephalic cysts	0	1	6	2	5	4	3	1	1	23
Periventricular leukomalacia	0	0	4	8	11	4	7	8	4	46
Encephaloclastic porencephaly	0	0	0	0	0	0	0	0	1	1
Not stated	18	54	55	44	58	72	96	200	324	921
<b>Total</b>	<b>48</b>	<b>171</b>	<b>260</b>	<b>323</b>	<b>383</b>	<b>467</b>	<b>553</b>	<b>661</b>	<b>800</b>	<b>3,666</b>
Hydrocephalus	0	1	7	3	4	5	5	1	4	30
Per cent										
No cysts	100.0	99.1	95.1	96.4	95.1	98.0	97.8	98.0	98.7	97.4
Porencephalic cysts	0.0	0.9	2.9	0.7	1.5	1.0	0.7	0.2	0.2	0.8
Periventricular leukomalacia	0.0	0.0	2.0	2.9	3.4	1.0	1.5	1.7	0.8	1.7
Encephaloclastic porencephaly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
Hydrocephalus	0.0	0.9	3.4	1.1	1.2	1.3	1.1	0.2	0.8	1.1

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

*Gestational age was not provided for three 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 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 2008 the percentage of babies with confirmed NEC was 2.2%. Of these babies, 61.5% were born before 28 weeks gestation with 49.2% of them undergoing surgery, and 38.5% were born after 27 weeks gestation; surgery was required for 51.4% of them. In total 58 registrants died from NEC. The number of registrants with confirmed NEC is more than in 2007 (Table 23).

**TABLE 23: Necrotising enterocolitis in level III registrants by year of birth, 1999–2008**

Necrotising enterocolitis	Year of birth									
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Number										
NEC at <28 weeks	56	68	78	75	78	85	85	95	80	118
▪ No NEC at <28 weeks	989	1,028	952	1,042	943	941	951	944	1,005	1,052
▪ Not stated	3	1	1	0	2	0	0	20	24	15
NEC at ≥28 weeks	55	57	57	65	77	63	50	72	50	74
▪ No NEC at ≥28 weeks	5,776	5,682	5,718	5,861	6,091	6,316	6,560	6,428	6,773	7,339
▪ Not stated	7	4	5	2	4	2	0	32	70	27
<b>Total</b>	<b>6,886</b>	<b>6,840</b>	<b>6,811</b>	<b>7,045</b>	<b>7,195</b>	<b>7,407</b>	<b>7,646</b>	<b>7,591</b>	<b>8,002</b>	<b>8,628</b>
Per cent										
NEC <28 weeks	5.4	6.2	7.6	6.7	7.6	8.3	8.2	9.1	7.4	10.1
NEC ≥28 weeks	0.9	1.0	1.0	1.1	1.2	1.0	0.8	1.1	0.7	1.0

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

## Congenital anomalies

In 2008, 1,310 ANZNN registrants (15.2%) had one or more congenital anomalies. For registrants who had a congenital anomaly, 19.5% were born before 32 weeks gestation, 26.6% were born between 32 and 36 weeks gestation and more than half of registrants (53.9%) were born at term.

Almost half of ANZNN registrants (44.8%) with congenital anomalies were diagnosed during the antenatal period with 8.5% of congenital anomalies recorded as fatal. A higher percentage of babies with congenital anomalies were male (57.3%).

## Transfer from level III NICUs to other units

Once intensive care is no longer required babies are often 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 2008, more than one-third of ANZNN registrants (38.2%) were transferred from a level III unit to a level II unit before discharge home. Half of the registrants (51.3%) transferred from level III to level II units were born at less than 32 weeks gestation compared to 12.7% born at term.

Some level III registrants required transfer to a specialist children's hospital and in 2008 these accounted for 3.5% of transfers from level III units. Overall 56.1% of level III registrants were not transferred after registration (Table 24).

**TABLE 24: Transfer after registration of level III registrants by level of destination hospital and gestational age group, 2008**

Transfer status	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
	Number								
Not transferred	41	294	378	469	577	580	868	1,631	4,838
Level III hospital	1	14	32	39	40	24	17	28	195
Level II hospital	4	97	270	490	827	669	517	419	3,293
Children's hospital	1	26	26	22	17	26	41	139	298
Not stated	1	0	0	0	0	0	0	0	1
Total	48	431	706	1,020	1,461	1,299	1,443	2,217	8,628
	Per cent								
Not transferred	87.2	68.2	53.5	46.0	39.5	44.6	60.2	73.6	56.1
Level III hospital	2.1	3.2	4.5	3.8	2.7	1.8	1.2	1.3	2.3
Level II hospital	8.5	22.5	38.2	48.0	56.6	51.5	35.8	18.9	38.2
Children's hospital	2.1	6.0	3.7	2.2	1.2	2.0	2.8	6.3	3.5
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.

Gestational age was not provided for three babies.

## Length of stay until discharge home

Factors that influence a baby's length of stay (LOS) in hospital are 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 ANZNN the LOS includes all the time the baby spends in hospital from the first day of their first admission up until and including the day of their discharge home. The LOS has added together the time spent in all 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 93.8% of ANZNN registrants in 2008. The median length of stay was 31 days with an interquartile range of 13–55 days (Table 25). LOS 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 approximately 216,962 days in hospital, babies born between 32 and 36 weeks spent 70,100 days and babies born at term spent 33,463 days in hospital.

**TABLE 25: Median length of stay for level III registrants who survived until discharge home by gestational age, 2008**

Gestational age (completed weeks)	Number of babies	Median LOS (in days)	Interquartile range (in days)
<24	21	125	108–162
24	99	120	105–138
25	206	109	94–122
26	270	94	82–111
27	354	79	69–92
28	437	69	60–81
29	534	58	50–69
30	647	47	40–55
31	787	37	32–45
32	714	32	26–39
33	558	25	19–33
34	585	20	14–27
35	451	15	10–22
36	355	12	8–21
37	402	11	7–22
38	504	10	7–21
39	392	12	6–22
40	447	8	5–17
41	289	9	5–16
42	37	8	5–16
43	2	4.5	3–6
<b>Total</b>	<b>8,091</b>	<b>31</b>	<b>13–55</b>

*Note:* Gestational age was not provided for three babies.

## Survival of the ANZNN registrants

In 2008, 93.8% of ANZNN registrants survived to go home. These data include babies who were transferred to level I or level II 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 26 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 2008, there were 537 neonatal deaths, of which 254 occurred in the early neonatal period that is within seven days of birth (Table 26). Mortality was highest among babies born before 26 weeks gestation with a survival rate at discharge increasing week on week from 43.8% for babies born before 24 weeks to 92.4% for babies born at 27 weeks (Table 26 and Figure 8). A similar pattern of increasing survival with increasing birthweight is seen in Figure 9.

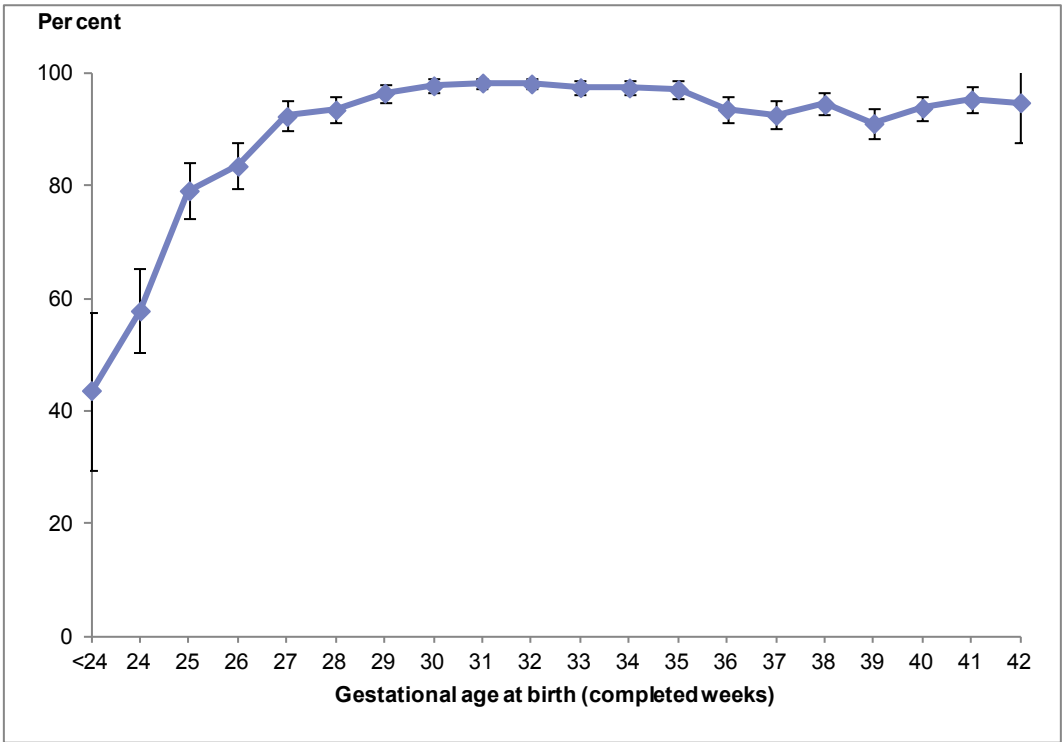
Lethal congenital anomaly was the cause of death for 1.3% of registrants, with most occurring in babies born between 36–39 weeks gestation (Table 26).

**TABLE 26: Survival to discharge home for level III registrants by gestational age at birth, 2008**

<b>Gestational age (completed weeks)</b>	<b>Number of babies</b>	<b>Lethal congenital anomalies</b>	<b>Babies alive on day 7</b>	<b>Babies alive on day 28</b>	<b>Survived to go home</b>	<b>Per cent survival at discharge home</b>
<24	48	0	33	30	21	43.8
24	171	0	138	114	99	57.9
25	260	0	232	222	206	79.2
26	323	4	304	288	270	83.6
27	383	2	373	365	354	92.4
28	467	2	450	441	437	93.6
29	553	7	542	538	534	96.6
30	661	6	656	650	647	97.9
31	800	6	793	789	787	98.4
32	727	5	721	717	714	98.2
33	572	6	569	563	558	97.6
34	600	7	592	590	585	97.5
35	464	3	457	455	451	97.2
36	379	12	366	361	355	93.7
37	434	15	421	412	402	92.6
38	533	10	522	515	504	94.6
39	430	13	412	402	392	91.2
40	476	8	458	451	447	93.9
41	303	5	295	290	289	95.4
42	39	0	38	37	37	94.9
43	2	0	2	2	2	100.0
<b>Total</b>	<b>8,628</b>	<b>111</b>	<b>8,374</b>	<b>8,232</b>	<b>8,091</b>	<b>93.8</b>

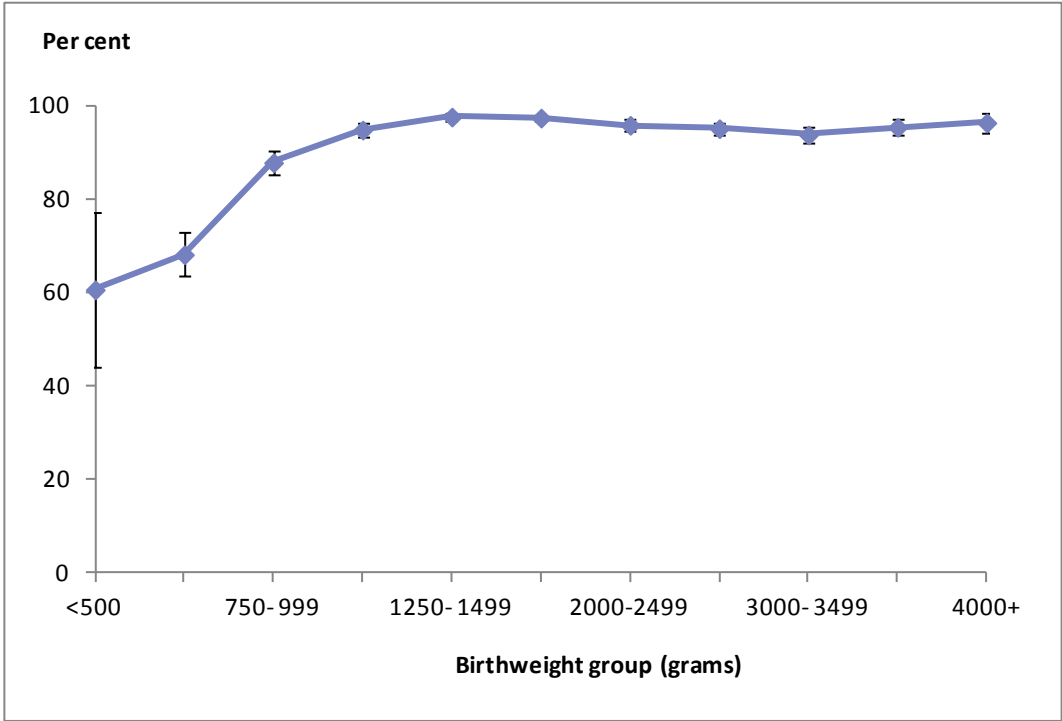
*Note: Gestational age was not provided for three babies.*

FIGURE 8: Survival of level III registrants to discharge home (with 95% CI) by gestational age, 2008



*Note: Gestational age was not provided for three babies.*

FIGURE 9: Survival of level III registrants to discharge home (with 95% CI) by birthweight group, 2008



## 5. Babies registered to level II units, 2008

### Overview

Nurseries with facilities to manage mild or moderately ill babies are known as 'level II units' or 'special care baby units'. Individual nurseries 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 nurseries, or if they were transferred to a level III NICU after 28 days, or they were transferred to a level II nursery 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 eight in Australia that are members of the ANZNN. Altogether, 22 level II units contributed data for this 2008 report.

In 2008, 704 babies fulfilled the ANZNN criteria for registration to a level II unit. Of those babies, 15.3% were born at less than 32 weeks gestation and 13.9% weighed less than 1,500 grams at birth (Tables 27 and 28). The highest number of babies registered to a level II unit in 2008 was 84.

**TABLE 27: Level II registrants born at each completed week of gestation, 2008**

Gestational age group	Number of babies	Percent	Cumulative percent
<26	9	1.3	1.3
26–27	7	1.0	2.3
28–29	17	2.4	4.7
30–31	75	10.7	15.3
<b>Babies &lt;32 weeks gestation</b>	<b>108</b>	<b>15.3</b>	
32–33	151	21.5	36.8
34–36	205	29.2	66.0
37–43	239	34.0	100.0
<b>Total</b>	<b>704</b>	<b>100.0</b>	

*Note:* Gestational age groups below 26 weeks have been combined to maintain confidentiality of small numbers. Gestational age was not provided for one baby.

**TABLE 28: Level II registrants by birthweight group, 2008**

Birthweight group (grams)	Number of babies	Percent	Cumulative percent
<1,000	13	1.8	1.8
1,000–1,099	9	1.3	3.1
1,100–1,199	9	1.3	4.4
1,200–1,299	11	1.6	6.0
1,300–1,399	23	3.3	9.2
1,400–1,499	33	4.7	13.9
<b>All babies &lt;1500g birthweight</b>	<b>98</b>	<b>13.9</b>	
1,500–1,999	129	18.3	32.2
2,000–2,499	144	20.5	52.7
2,500–2,999	113	16.1	68.8
3,000–3,499	92	13.1	81.8
3,500–3,999	82	11.6	93.5
≥4,000	46	6.5	100.0
<b>Total</b>	<b>704</b>	<b>100.0</b>	

*Note:* Birthweight groups below 1,000g have been combined to maintain confidentiality of small numbers.

More than half of the level II registrants, 387 babies (64.2%), were born to Caucasian mothers, 69.5% of which were born preterm. The number of registrants born to Maori mothers was 128 (21.2%), and 79 (61.7%) were born preterm. There were 13 babies (2.2%) born to Pacific Islander mothers.

There were 424 male (60.2%) and 263 female (37.4%) registrants in the audit. No gender was recorded for 17 registrants (2.4%). 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, 23.2% did not present with any maternal complications. Among babies born before 37 weeks, more than half of the mothers had presented with preterm labour (Table 29).

**TABLE 29: Mothers of level II registrants presenting antenatal problem by gestational age group, 2008**

Presenting antenatal problem	Gestational age group							Total
	<26	26–27	28–29	30–31	32–33	34–36	37–43	
	Number							
No antenatal problems	0	0	0	0	n.p.	n.p.	147	153
Pre-labour rupture of membranes	n.p.	0	n.p.	9	15	31	0	59
Preterm labour	n.p.	n.p.	5	37	56	75	n.p.	179
Hypertension in pregnancy	n.p.	0	n.p.	11	16	21	8	59
Antepartum haemorrhage	0	n.p.	n.p.	8	27	16	5	59
Intrauterine growth restriction	0	0	0	n.p.	8	9	n.p.	21
Fetal distress	0	0	0	n.p.	n.p.	12	42	66
Other problem	0	0	n.p.	n.p.	11	21	23	58
Congenital anomalies	0	0	0	0	n.p.	n.p.	n.p.	4
Not stated	4	4	5	4	5	13	10	45
Total	9	7	17	75	151	205	239	704
Per cent								
No antenatal problems	0.0	0.0	0.0	0.0	n.p.	n.p.	64.2	23.2
Pre-labour rupture of membranes	n.p.	0.0	n.p.	12.7	10.3	16.1	0.0	9.0
Preterm labour	n.p.	n.p.	41.7	52.1	38.4	39.1	n.p.	27.2
Hypertension in pregnancy	n.p.	0.0	n.p.	15.5	11.0	10.9	3.5	9.0
Antepartum haemorrhage	0.0	n.p.	n.p.	11.3	18.5	8.3	2.2	9.0
Intrauterine growth restriction	0.0	0.0	0.0	n.p.	5.5	4.7	n.p.	3.2
Fetal distress	0.0	0.0	0.0	n.p.	n.p.	6.3	18.3	10.0
Other problem	0.0	0.0	n.p.	n.p.	7.5	10.9	10.0	8.8
Congenital anomalies	0.0	0.0	0.0	0.0	n.p.	n.p.	n.p.	0.6
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.

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

Gestational age was not provided for one baby.

Previous preterm births were reported by 71 (10.1%) of the mothers of level II registrants and 23 mothers (3.3%) had had a previous perinatal death(s).

Most mothers (80.6%) of level II registrants had booked into a level II hospital for delivery. Of the level II registrants born before 34 weeks gestation, 192 were born at a level II hospital and 77.1% of these mothers were given antenatal corticosteroids within seven days of the birth (Table 30).

**TABLE 30: Antenatal corticosteroid use by mothers of level II registrants by gestational age group, 2008**

Antenatal corticosteroids	Gestational age group							Total
	<26	26–27	28–29	30–31	32–33	34–36	37–43	
	Number							
None	n.p.	0	n.p.	9	54	147	226	443
Incomplete course	n.p.	n.p.	n.p.	31	31	13	0	79
Complete course	0	n.p.	9	28	44	19	n.p.	102
Completed >7 days	0	n.p.	n.p.	n.p.	15	9	n.p.	29
Not stated	5	3	2	6	7	17	10	50
<b>Total</b>	<b>9</b>	<b>7</b>	<b>17</b>	<b>75</b>	<b>151</b>	<b>205</b>	<b>239</b>	<b>704</b>
Per cent								
None	n.p.	0.0	n.p.	13.0	37.5	78.2	98.7	67.7
Incomplete course	n.p.	n.p.	n.p.	44.9	21.5	6.9	0.0	12.1
Complete course	0.0	n.p.	60.0	40.6	30.6	10.1	n.p.	15.6
Completed >7 days	0.0	n.p.	n.p.	n.p.	10.4	4.8	n.p.	4.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

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

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

Gestational age was not provided for one baby.

Caesarean section was the most common method of birth for 54.5% of level II registrants, with more than half of these occurring before the onset of labour, followed by vaginal delivery (45.3%) (Table 31).

**TABLE 31: Method of delivery for level II registrants by gestational age group, 2008**

Method of delivery	Gestational age group							Total
	<26	26–27	28–29	30–31	32–33	34–36	37–43	
Number								
Vaginal <sup>(a)</sup>	n.p.	n.p.	8	26	45	84	140	306
Caesarean <sup>(b)</sup>	n.p.	n.p.	7	46	104	116	90	368
Not stated	4	4	2	3	2	5	9	29
Total	9	7	17	75	151	205	239	704
Per cent								
Vaginal	n.p.	n.p.	53.3	36.1	30.2	42.0	60.9	45.3
Caesarean	n.p.	n.p.	46.7	63.9	69.8	58.0	39.1	54.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*(a)* Vaginal and assisted 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

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

Gestational age was not provided for one baby.

## Characteristics of level II babies

Among the 704 babies registered to level II units, 102 were from multiple births (14.5%). There were 424 male births and 17 babies whose gender was not recorded.

A low Apgar score of less than 4 at one minute of age was recorded for 11.8% of babies and 36.1% of them required endotracheal intubation in the labour ward to assist in their adaptation to extrauterine life.



Non-specific respiratory distress (43.5%) was the major reason for assisted ventilation for level II registrants, followed by hyaline membrane disease (31.2%) (Table 32).

For level II registrants, the median duration of assisted ventilation by IPPV was 18 hours and 21 hours by CPAP. The median duration of oxygen was 2 days (Table 33).

**TABLE 32: Indication for respiratory support for level II registrants by gestational age group, 2008**

Indication for respiratory support	Gestational age group							Total
	<26	26–27	28–29	30–31	32–33	34–36	37–43	
	Number							
No support	n.p.	0	n.p.	17	18	7	6	52
Non-specific distress	n.p.	n.p.	n.p.	n.p.	49	105	121	296
Hyaline membrane disease	n.p.	n.p.	11	37	71	62	22	212
Meconium aspiration syndrome	0	0	0	0	0	n.p.	n.p.	38
Pneumonia	0	0	0	0	0	9	17	26
Persistent pulmonary hypertension	0	0	0	0	n.p.	0	n.p.	8
Apnoea	0	n.p.	0	0	n.p.	n.p.	5	13
Congenital anomaly	0	0	0	0	n.p.	n.p.	6	9
Other	0	0	0	n.p.	n.p.	n.p.	8	16
Peri-surgery	0	0	0	0	0	0	0	0
Newborn encephalopathy	0	0	0	0	n.p.	0	n.p.	9
Not stated	0	1	1	5	3	10	4	24
<b>Total</b>	<b>9</b>	<b>7</b>	<b>17</b>	<b>75</b>	<b>151</b>	<b>205</b>	<b>239</b>	<b>704</b>
Per cent								
No support	n.p.	0.0	n.p.	24.3	12.2	3.6	2.6	7.6
Non-specific distress	n.p.	n.p.	n.p.	n.p.	33.1	53.8	51.5	43.5
Hyaline membrane disease	n.p.	n.p.	68.8	52.9	48.0	31.8	9.4	31.2
Meconium aspiration syndrome	0.0	0.0	0.0	0.0	0.0	n.p.	n.p.	5.6
Pneumonia	0.0	0.0	0.0	0.0	0.0	4.6	7.2	3.8
Persistent pulmonary hypertension	0.0	0.0	0.0	0.0	n.p.	0.0	n.p.	1.2
Apnoea	0.0	n.p.	0.0	0.0	n.p.	n.p.	2.1	1.9
Congenital anomaly	0.0	0.0	0.0	0.0	n.p.	n.p.	2.6	1.3
Other	0.0	0.0	0.0	n.p.	n.p.	n.p.	3.4	2.4
Peri-surgery	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Newborn encephalopathy	0.0	0.0	0.0	0.0	n.p.	0.0	n.p.	1.3
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

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

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

Gestational age was not provided for one baby.

**TABLE 33: Duration of assisted ventilation and oxygen use by level II registrants by gestational age group, 2008**

Median & Interquartile range (IQR)	Gestational age group						Total
	<28	28–29	30–31	32–33	34–36	37–43	
IPPV (hours)							
Median	22	23	36	37	11	12	18
IQR	4–72	17–30	29.5–55.5	1.5–62	1–94	2–35	4–60
CPAP (hours)							
Median	840	191	66	30.5	18	15	21
IQR	202–1,344	49–456	21–88	15–68	9–53	9–29	10–60
Oxygen (days)							
Median	86	2.5	3	2	3	2	2
IQR	45–93	2–29.5	1–5	1–4	1–4	1–4	1–4

*Note: IQR = Interquartile range.*

*Gestational age was not provided for one baby.*

## Eye examination

Screening for retinopathy of prematurity (ROP) was reported for 31 of the 72 eligible babies born at less than 31 weeks gestational age and/or weighing less than 1,250 grams at birth. Most were reported as normal except for three babies who had stage 1, 2 and 3 ROP, respectively.

## Cerebral ultrasound

Of the 108 babies born at less than 32 weeks, 72 (66.7%) had a cerebral ultrasound in the first week after birth. Fifty-seven of them were reported as normal, that is no intraventricular haemorrhage (IVH), 14 reported a grade 1 IVH and one reported a grade 2 IVH. Most babies who did not have an early cerebral ultrasound reported at this time were born at 30 or 31 weeks gestation. A late cerebral ultrasound was reported for 50 babies, most of whom had normal reports except for two babies with reported cysts.

## Other morbidities

Septicaemia was proven in 35 babies, including 13 before day two, that is less than 48 hours. There were one case of necrotising enterocolitis; this baby required surgery. Major congenital anomalies were reported for 31 babies, four required surgery, and three registrants died due to congenital anomalies.

## Level II transfers

In total 40 level II registrants were transferred to other units, 24 were transferred to a level I or II unit, 10 were transferred to a level III unit and the remaining 6 to a children's hospital.

## Survival

There were 679 level II registrants who survived to discharge home (96.4%). Six babies died within the first seven days of birth and a further 19 babies died before discharge home. Three babies were reported to have had lethal congenital anomalies (Table 34).

**TABLE 34: Survival to discharge home for level II registrants by gestational age group, 2008**

<b>Gestational age group</b>	<b>Number of babies</b>	<b>Lethal congenital anomalies</b>	<b>Babies alive on day 7</b>	<b>Babies alive on day 28</b>	<b>Survived to go home</b>	<b>Per cent survival at discharge home</b>
<26	9	0	7	7	5	55.6
26–27	7	0	7	7	7	100.0
28–29	17	0	17	17	15	92.9
30–31	75	0	75	75	75	88.6
32–33	151	0	151	151	150	97.3
34–36	205	2	204	204	196	98.0
37–43	239	1	237	237	231	97.9
<b>Total</b>	<b>704</b>	<b>3</b>	<b>698</b>	<b>698</b>	<b>679</b>	<b>96.4</b>

***Note:** Gestational age groups below 26 weeks have been combined to maintain confidentiality of small numbers.  
Gestational age was not provided for one baby.*

# 2009

---

REPORT OF THE  
**AUSTRALIAN AND  
NEW ZEALAND  
NEONATAL NETWORK**

## Babies born in Australia, 2009

There were 7,230 babies registered to ANZNN from 22 level III NICUs in Australia, representing 2.4% of notified live births in 2009 (Li et al. 2011). Of these registrants, 74.1% were born in a hospital with tertiary care facilities. There were 2,921 babies born before 32 weeks gestation representing 40.4% of Australian registrants.

Maternal ethnicity was provided for 67.8% mothers: 82.5% of the mothers of these babies identified as Caucasian and 8.3% as Asian. One in twenty mothers (5.0%) identified as Aboriginal or Torres Strait Islander compared to 3.8% of all births in Australia in 2009 (Li et al. 2011).

Among Australian NICU admissions registered to ANZNN, 1,728 were from multiple births representing 23.9% of ANZNN admissions in Australia in 2009.

Male babies were over-represented among NICU admissions – 57.8% of the Australian ANZNN registrants, compared with 51.4% among live births in Australia (Li et al. 2011).

Assisted ventilation was provided for 6,698 babies (2.3% of live births) and continuous positive airways pressure (CPAP) was the only form of respiratory assistance for 2,897 babies.

## Babies born in New Zealand, 2009

There were 1,756 babies who met ANZNN registration criteria from six level III NICUs in New Zealand representing 2.8% of the 62,543 live births registered in New Zealand in 2009 (Statistics New Zealand 2009). Of these registrants, 88.1% were born in a hospital with tertiary care facilities. There were 631 babies born before 32 weeks gestation representing 36.0% of New Zealand registrants.

The ethnicity of the mother was reported for 97.0% of the New Zealand registrants. The percentage of Caucasian mothers in the ANZNN cohort was 56.1%. A higher proportion of mothers identified themselves as Maori (20.5%) compared to 11.9% of mothers identified as Pacific Islander and 9.3% as Asian.

Among New Zealand NICU admissions registered to ANZNN, 324 were from multiple births representing 18.5% of ANZNN admissions in New Zealand in 2009.

Male babies were also over-represented among NICU admissions in New Zealand – 57.8% of the New Zealand registrants compared to 51.3% of total live births in New Zealand (Statistics New Zealand 2009).

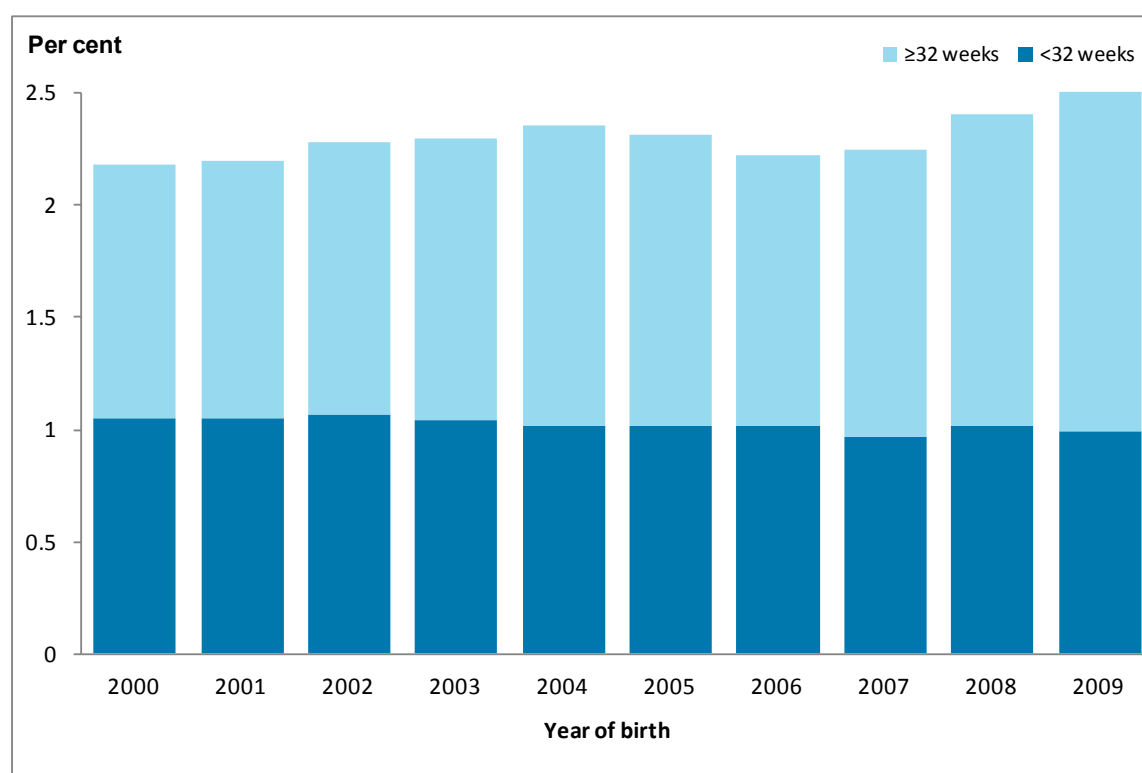
Assisted ventilation was given to 1,676 babies representing 2.7% of all live births with 1,077 babies receiving CPAP as the only form of respiratory assistance (1.7% of all live births).

## 6. Babies registered to level III units, 2009

This section includes data on the ANZNN registrants from each of the 28 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 admitted to an NICU in Australia and New Zealand in 2009, 8,986 fulfilled the registration criteria for inclusion in the ANZNN audit. The population represents 2.5% of the 359,334 live births in the two countries in 2009 (Li et al. 2011; Statistics New Zealand 2009) (Figure 10) illustrating a slight increase of 358 registrants (2.4% of all live births) from 2008.

**FIGURE 10: Babies registered to ANZNN audit of level III units each year as a percentage of liveborn babies in Australia and New Zealand 2000-2009**

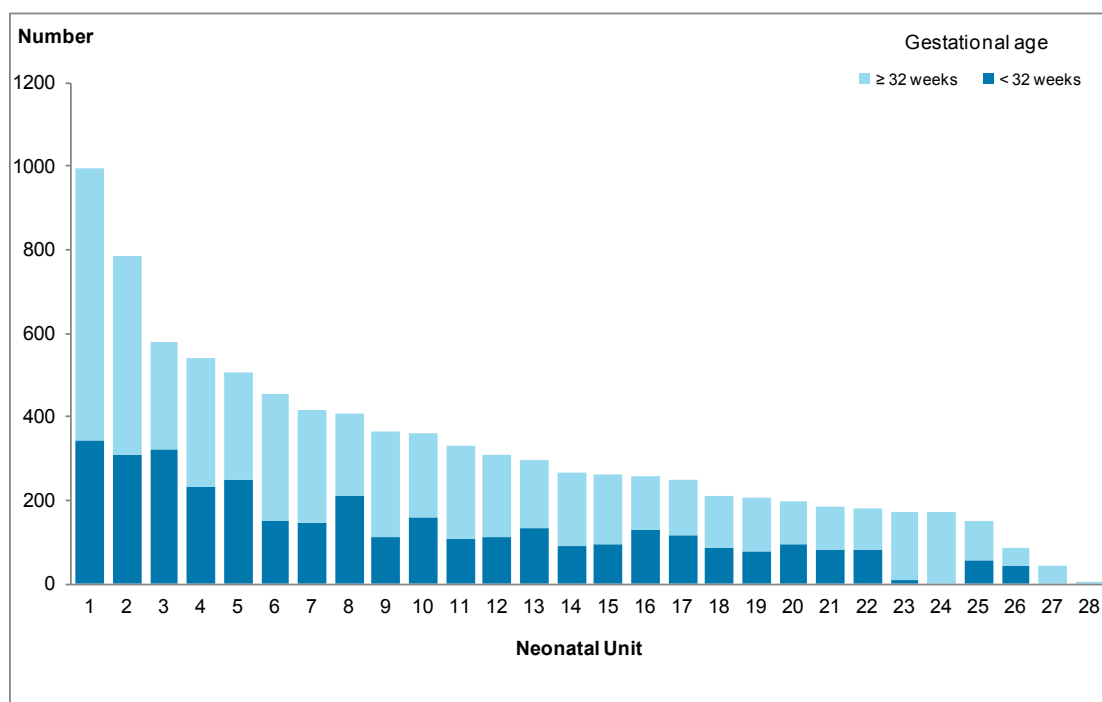


There were 3,552 (39.5%) babies born before 32 weeks gestation and 5,434 babies born at 32 weeks or more (60.5%). Of the registrants born before 32 weeks gestation 89.3% received assisted ventilation. The major indication for assisted ventilation in this age group was hyaline membrane disease.

The largest level III NICU in Australia and New Zealand registered more than 750 babies in 2009, the smallest less than 50 (Figure 11). The median number of babies registered to an ANZNN unit was 276.

The gestational age group at birth and birthweight for babies qualifying for inclusion in the ANZNN 2009 level III audit is set out in Tables 35 and 36 respectively. The 10-year trend (2000–2009) in gestational age at birth is presented in Figure 28 in Appendix 1.

**FIGURE 11: Number of level III registrants born at each neonatal intensive care unit, 2009**



**TABLE 35: Level III registrants born at each completed week of gestation, 2009**

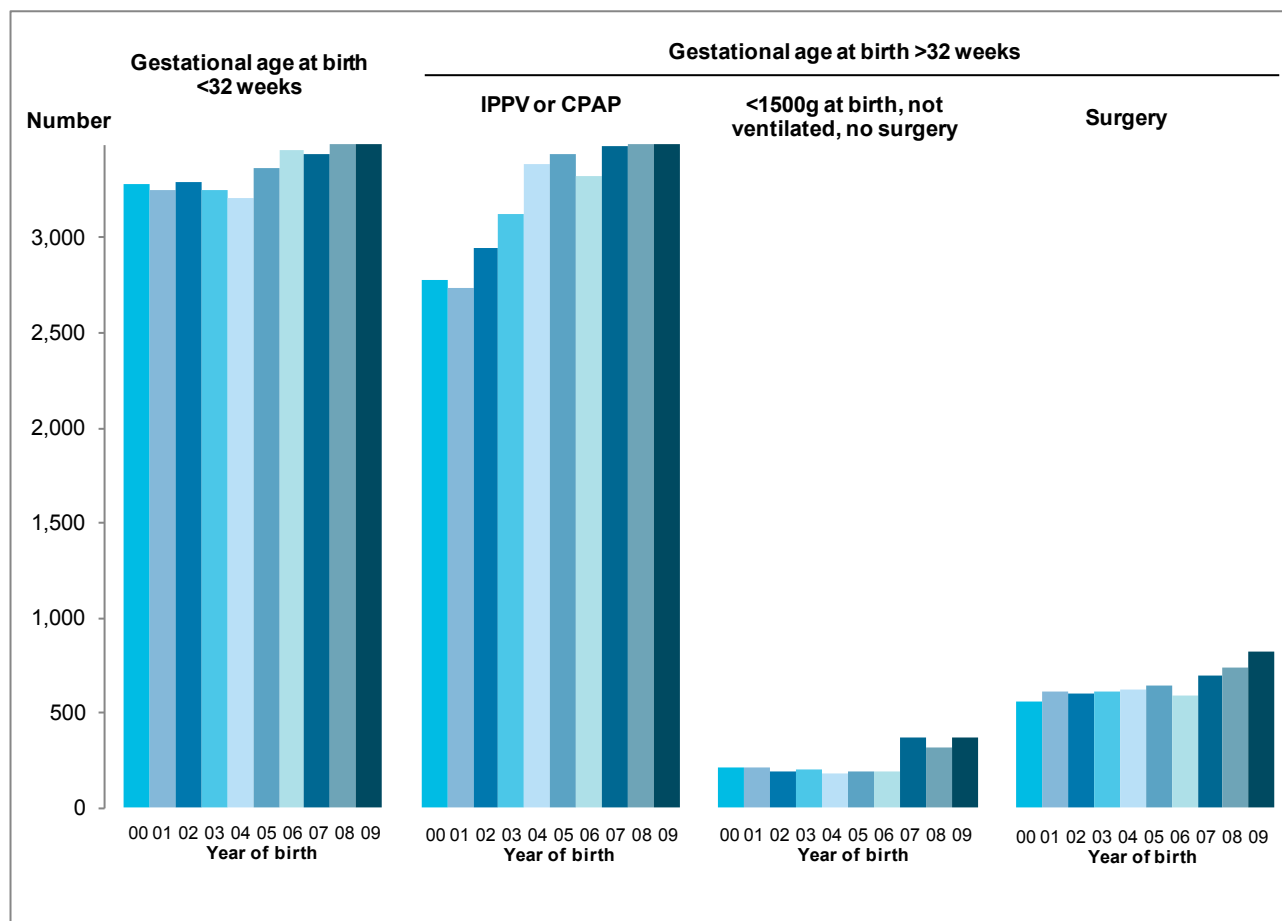
Gestational age (completed weeks)	Number of babies	Percent	Cumulative percent
<24	54	0.6	0.6
24	164	1.8	2.4
25	259	2.9	5.3
26	335	3.7	9.0
27	319	3.5	12.6
28	411	4.6	17.2
29	526	5.9	23.0
30	635	7.1	30.1
31	849	9.4	39.5
<b>All babies &lt;32 weeks</b>	<b>3,552</b>	<b>39.5</b>	
32	757	8.4	48.0
33	659	7.3	55.3
34	625	7.0	62.2
35	568	6.3	68.6
36	444	4.9	73.5
37	436	4.9	78.4
38	599	6.7	85.0
39	483	5.4	90.4
40	488	5.4	95.8
41	339	3.8	99.6
42	32	0.4	100.0
43	3	0.0	100.0
<b>Total</b>	<b>8,986</b>	<b>100.0</b>	

*Note: Gestational age was not provided for one baby.*

**TABLE 36: Level III registrants in each birthweight group, 2009**

Birth weight (grams)	Number of babies	Per cent	Cumulative percent
<500	31	0.3	0.3
500–599	85	0.9	1.3
600–699	202	2.2	3.5
700–799	239	2.7	6.2
800–899	272	3.0	9.2
900–999	305	3.4	12.6
1000–1099	275	3.1	15.7
1100–1199	322	3.6	19.3
1200–1299	378	4.2	23.5
1300–1399	410	4.6	28.0
1400–1499	481	5.4	33.4
<b>All babies &lt;1500g birthweight</b>	<b>3,000</b>	<b>33.4</b>	
1500–1999	1,651	18.4	51.8
2000–2499	1,220	13.6	65.3
2500–2999	1,069	11.9	77.2
3000–3499	1,011	11.3	88.5
3500–3999	699	7.8	96.3
≥4000	336	3.7	100.0
<b>Total</b>	<b>8,986</b>	<b>100.0</b>	

**FIGURE 12: Level III registrants by registration criteria, 2000–2009**





## 7. Mothers of level III registrants, 2009

### Maternal age

While there are many determinants of perinatal outcome, an important one is maternal age. In 2009, the age of mothers of neonates registered as high-risk ranged from less than 15 years to just over 50 years. The highest proportion of registrant mothers was aged 30–34 years (28.3%) followed by mothers aged 25–29 years (24.9%). Together they accounted for more than half of the mothers (53.2%) of ANZNN registrants in 2009 (Table 37). In 2009, the proportion of teenage mothers increased slightly (0.2%) from 2008, while mothers in the 35–39 age group increased by 0.4%, from 19.8% in 2008 to 20.2%.

Two out of five babies born to teenage mothers (42.5%) were born at less than 32 weeks completed gestation, while only 37.8% of babies born to mothers 30–34 years were less than 32 weeks gestation at birth (Table 37).

**TABLE 37: Age group of mothers of level III registrants by gestational age group, 2009**

Maternal age (years)	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
	Number								
Less than 20	10	29	43	55	84	72	103	124	520
20–24	10	69	103	143	203	213	228	378	1,347
25–29	15	104	162	225	396	319	399	584	2,204
30–34	16	108	163	264	400	433	455	674	2,513
35–39	3	82	142	187	316	279	343	443	1,795
40 and over	0	29	40	54	75	87	81	121	487
Not stated	0	2	1	9	10	13	28	56	119
Total	54	423	654	937	1,484	1,416	1,637	2,380	8,986
Per cent									
Less than 20	18.5	6.9	6.6	5.9	5.7	5.1	6.4	5.3	5.9
20–24	18.5	16.4	15.8	15.4	13.8	15.2	14.2	16.3	15.2
25–29	27.8	24.7	24.8	24.2	26.9	22.7	24.8	25.1	24.9
30–34	29.6	25.7	25.0	28.4	27.1	30.9	28.3	29.0	28.3
35–39	5.6	19.5	21.7	20.2	21.4	19.9	21.3	19.1	20.2
40 and over	0.0	6.9	6.1	5.8	5.1	6.2	5.0	5.2	5.5
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.  
Gestational age was not provided for one baby.

### Previous antenatal history

In 2009, a previous preterm delivery was reported by 1,121 mothers (12.5%) of babies registered to ANZNN while 359 mothers (4.0%) reported a previous perinatal loss.

### Assisted conception

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

There were 730 (8.1%) pregnancies resulting from assisted conception in the ANZNN 2009 cohort with most (84.2%) the result of IVF treatment. Of the pregnancies resulting from assisted conception, 52.6% of the mothers were more than 34 years of age at the time of giving birth, which is more than 10% higher than in 2008 (41.4%).

## 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 99.1% of 2009 ANZNN registrants. Almost one-quarter of mothers (24.6%) presented with preterm labour while pre-labour rupture of membranes was the second highest (15.1%) presenting antenatal problem (Table 38). Overall 85.3% mothers of registrants had a pregnancy complication recorded.

The maternal antenatal complications for registrants born at 37–43 weeks, 32–36 weeks and less than 32 weeks gestational age are set out in Figure 13. 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 (36.8% and 29.4% respectively) followed by pre-labour rupture of membranes (23.7% and 15.9% respectively).

Among women who gave birth at term, almost half (49.9%) were recorded as having no maternal presenting antenatal problem.

**TABLE 38: Mother's presenting antenatal problem for level III registrants by gestational age group, 2009**

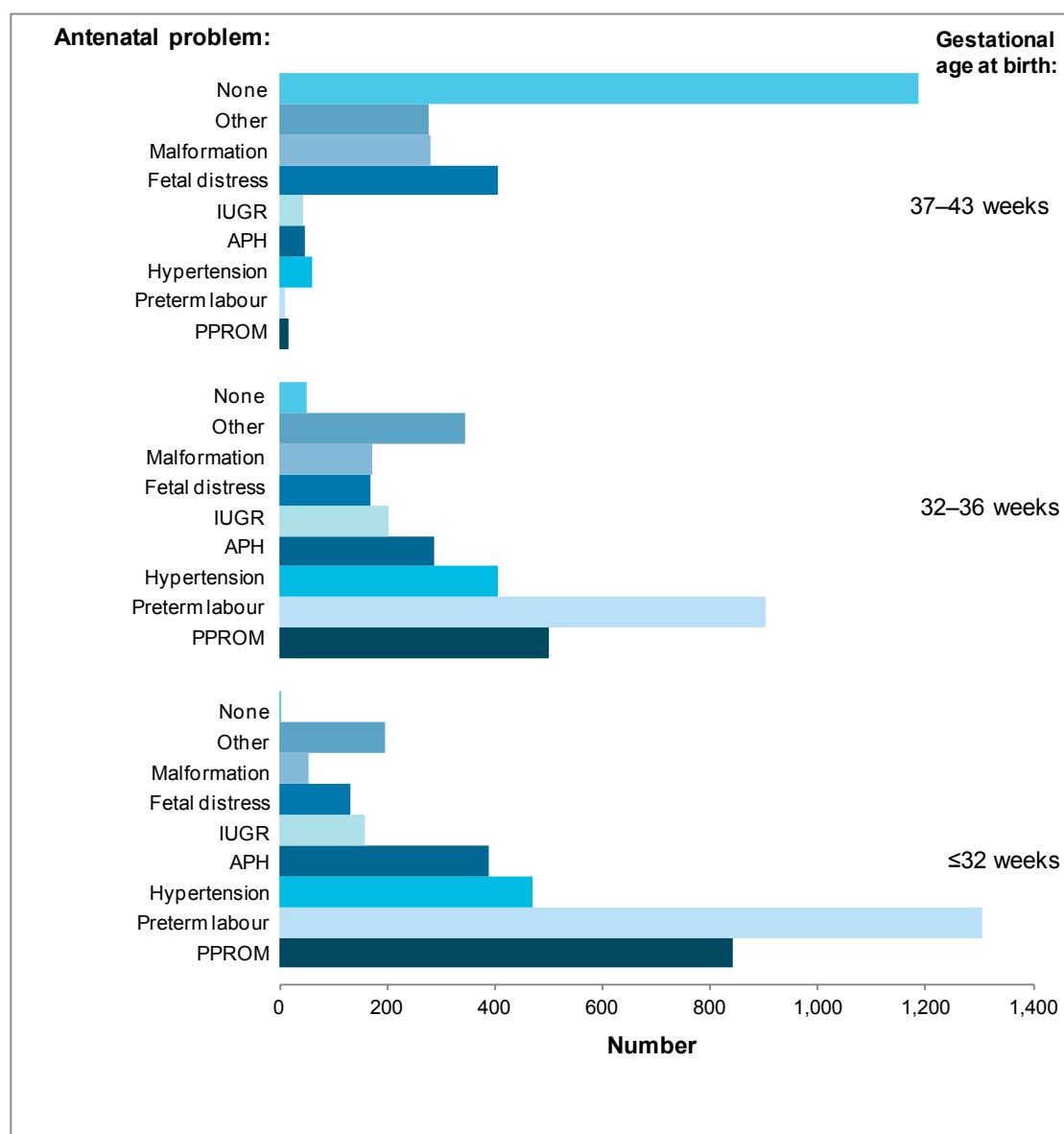
Presenting antenatal problem	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
	Number								
No antenatal problems	0	0	0	1	0	7	42	1,188	1,238
Pre-labour rupture of membranes (PROM)	12	112	157	222	339	241	260	15	1,358
Preterm labour	37	201	249	316	503	420	481	8 <sup>(a)</sup>	2,215
Hypertension in pregnancy	1	28	79	140	220	239	168	62	937
Antepartum haemorrhage (APH)	3	45	88	104	150	154	132	48	724
Intrauterine growth restriction (IUGR)	0	6	22	41	88	94	108	45	404
Fetal distress	0	3	27	43	60	63	105	407	708
Other problem	1	21	24	55	94	149	196	278	818
Congenital anomalies	0	6	6	14	28	44	127	281	506
Not stated	0	1	2	1	2	5	18	48	77
<b>Total</b>	<b>54</b>	<b>423</b>	<b>654</b>	<b>937</b>	<b>1,484</b>	<b>1,416</b>	<b>1,637</b>	<b>2,380</b>	<b>8,986</b>
Per cent									
No antenatal problems	0.0	0.0	0.0	0.1	0.0	0.5	2.6	50.9	13.9
Pre-labour rupture of membranes (PROM)	22.2	26.5	24.1	23.7	22.9	17.1	16.1	0.6	15.2
Preterm labour	68.5	47.6	38.2	33.8	33.9	29.8	29.7	0.3	24.9
Hypertension in pregnancy	1.9	6.6	12.1	15.0	14.8	16.9	10.4	2.7	10.5
Antepartum haemorrhage (APH)	5.6	10.7	13.5	11.1	10.1	10.9	8.2	2.1	8.1
Intrauterine growth restriction (IUGR)	0.0	1.4	3.4	4.4	5.9	6.7	6.7	1.9	4.5
Fetal distress	0.0	0.7	4.1	4.6	4.0	4.5	6.5	17.5	7.9
Other problem	1.9	5.0	3.7	5.9	6.3	10.6	12.1	11.9	9.2
Congenital anomalies	0.0	1.4	0.9	1.5	1.9	3.1	7.8	12.0	5.7
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*(a) These mothers presented with preterm labour, then went on to deliver at term.*

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

Gestational age was not provided for one baby.

**FIGURE 13: Presenting antenatal problem for mothers of level III registrants by gestational age group, 2009**



*Note:* Gestational age was not provided for one baby.

## 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 (Crowley 1995).

Table 39 presents antenatal corticosteroids use for mothers of ANZNN registrants in each gestational age group. In 2009, 87.7% of mothers of ANZNN registrants born before 34 completed weeks of gestation received one or more doses of antenatal corticosteroids leaving 12.3% of mothers of registrants in this group who did not receive any antenatal corticosteroids. Of the mothers who received antenatal corticosteroids, 16.9% received them more than seven days prior to giving birth.

For mothers of ANZNN registrants born before 32 completed weeks of gestation, 90.4% received one or more doses of antenatal corticosteroids and 9.6% of mothers of registrants in this group did not receive any antenatal corticosteroids. Of the mothers who received antenatal corticosteroids, 15.2% received them more than seven days prior to giving birth (Table 39). The 10-year trend (2000–2009) for maternal corticosteroids is represented by Figure 29 in Appendix 1.

**TABLE 39: Antenatal corticosteroid use for mothers of level III registrants by gestational age group, 2009**

	Gestational age group								
Antenatal corticosteroids	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
None	8	31	59	82	158	265	958	1,951	3,512
Incomplete course	25	140	184	250	395	358	119	6	1,477
Course completed	20	197	316	468	693	519	253	20	2,486
Completed >7 days prior to birth	1	50	91	127	213	244	202	31	959
Not stated	0	5	4	10	25	30	105	372	551
Total	54	423	654	937	1,484	1,416	1,637	2,380	8,986
Per cent									
None	14.8	7.4	9.1	8.8	10.8	19.1	62.5	97.2	41.6
Incomplete course	46.3	33.5	28.3	27.0	27.1	25.8	7.8	0.3	17.5
Course completed	37.0	47.1	48.6	50.5	47.5	37.4	16.5	1.0	29.5
Completed >7 days prior to birth	1.9	12.0	14.0	13.7	14.6	17.6	13.2	1.5	11.4
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.

Gestational age was not provided for one baby.

## Multiple births

Multiple birth 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 2009, 22.8% of ANZNN registrants were reported as being from a multiple pregnancy with the greatest percentage of multiple births being twins (20.4%). Of the 2009 ANZNN registrants from multiple births, 54.0% were born before 32 weeks gestation and 94.5% were born before 37 weeks gestation (Table 40). The 10-year trend (2000–2009) for multiple births is represented by Figure 30 in Appendix 1.

**TABLE 40: Plurality of level III registrants by gestational age group, 2009**

Plurality	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
Number									
Singletons	36	287	486	661	972	946	1,274	2,269	6,931
Twins	17	112	159	241	457	393	346	110	1,835
Triplets and higher orders	1	24	9	35	55	76	17	1	218
Not stated	0	0	0	0	0	1	0	0	1
Total	54	423	654	937	1,484	1,416	1,637	2,380	8,986
Per cent									
Singletons	66.7	67.8	74.3	70.5	65.5	66.9	77.8	95.3	77.1
Twins	31.5	26.5	24.3	25.7	30.8	27.8	21.1	4.6	20.4
Triplets and higher orders	1.9	5.7	1.4	3.7	3.7	5.4	1.0	0.0	2.4
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.

Gestational age was not provided for one baby.

## 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 more than half of the 2009 registrants (59.2%) the method of birth was caesarean section with 60.3% of caesarean sections occurring before the onset of labour.

Just over one-third of registrants (36.0%) were non-instrumental vaginal births (Table 41). The rate of birth by caesarean section has gradually increased from 49.8%, since the first data collection in 1995, to 60.4% in 2007. The 2009 data show an increase of 0.7% from 2008.

The most common method of birth for registrants born before 24 weeks was vaginal birth (79.6%) with none requiring assistance with instruments (Table 41). The 10-year trend (2000–2009) for method of birth is represented by Figure 31 in Appendix 1.

**TABLE 41: Method of birth for level III registrants by gestational age group, 2009**

	Gestational age group								
Method of birth	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
Vaginal	43	218	261	270	499	395	529	996	3,211
Vaginal instrumental birth	0	4	8	26	41	46	69	226	420
Caesarean section in labour	6	127	164	246	322	302	357	569	2,093
Caesarean section no labour	5	73	221	392	618	670	669	536	3,184
Not stated	0	1	0	3	4	3	13	53	77
Total	54	423	654	937	1,484	1,416	1,637	2,380	8,986
Per cent									
Vaginal	79.6	51.7	39.9	28.9	33.7	28.0	32.6	42.8	36.0
Vaginal instrumental birth	0.0	0.9	1.2	2.8	2.8	3.3	4.2	9.7	4.7
Caesarean section in labour	11.1	30.1	25.1	26.3	21.8	21.4	22.0	24.5	23.5
Caesarean section no labour	9.3	17.3	33.8	42.0	41.8	47.4	41.2	23.0	35.7
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.  
Gestational age was not provided for one baby.

## 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 2009, 77.0% of all babies and 87.3% of babies less than 32 weeks gestation at birth were born in a tertiary centre equipped with an NICU; 21.9% of all ANZNN registrants were born in a non-tertiary hospital; while 1.1% of registrants were not born in a hospital (Table 42). This is an increase of 0.5% from 2008.

**TABLE 42: Level of hospital of birth for level III registrants by gestational age group, 2009**

	Gestational age group								
Level of birth hospital	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
Tertiary hospital	46	375	566	818	1,294	1,185	1,161	1,462	6,907
Non-tertiary hospital	7	45	77	109	178	212	457	880	1,965
Not born in a hospital <sup>(a)</sup>	1	2	9	10	11	17	16	35	101
Not stated	0	1	2	0	1	2	3	3	12
<b>Total</b>	<b>54</b>	<b>423</b>	<b>654</b>	<b>937</b>	<b>1,484</b>	<b>1,416</b>	<b>1,637</b>	<b>2,380</b>	<b>8,986</b>
Per cent									
Tertiary hospital	85.2	88.9	86.8	87.3	87.3	83.8	71.1	61.5	77.0
Non-tertiary hospital	13.0	10.7	11.8	11.6	12.0	15.0	28.0	37.0	21.9
Not born in a hospital <sup>(a)</sup>	1.9	0.5	1.4	1.1	0.7	1.2	1.0	1.5	1.1
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*(a) These babies were either born before arrival to hospital or born at home.*

*Note:* Not stated data are excluded from per cent calculations.  
Gestational age was not provided for one baby.

## 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; if a term baby born in a non-tertiary centre has an unexpected need for NICU care; or the baby requires specialised care in a children's hospital.

In 2009, 26.0% of ANZNN registrants were transferred to an NICU after birth. Of these the greatest percentage (79.6%) were transported by a specialist team with 17.0% transported by a non-specialist team (Table 43). The 10-year trend (2000–2009) for mode of transport to level III unit is represented by Figure 33 in Appendix 1.

**TABLE 43: Mode of transport to level III NICU after birth for level III registrants by gestational age, 2009**

	Gestational age group								
Mode of Transport	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
Not transported	46	360	559	807	1,276	1,178	1,106	1,304	6,636
Specialist retrieval team	6	45	75	94	149	203	457	829	1,858
Non-specialist team	1	8	13	28	42	24	58	224	398
Other	1	8	6	6	15	10	11	22	79
Not stated	0	2	1	2	2	1	5	1	14
Total	54	423	654	937	1,484	1,416	1,637	2,380	8,986
Per cent									
Not transported	85.2	85.5	85.6	86.3	86.1	83.3	67.8	54.8	74.0
Specialist transport team	11.1	10.7	11.5	10.1	10.1	14.3	28.0	34.8	20.7
Non-specialist team	1.9	1.9	2.0	3.0	2.8	1.7	3.6	9.4	4.4
Other	1.9	1.9	0.9	0.6	1.0	0.7	0.7	0.9	0.9
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.

Gestational age was not provided for one baby.

## Breastfeeding at discharge

Data on breastfeeding at discharge were available for 1,653 babies (19.5% of the babies who survived to go home). Among registrants who provided data on breastfeeding, 73.9% were breastfed at discharge.

The rate of breastfeeding among surviving very preterm babies at discharge was 69.4% compared to 77.3% for surviving preterm and term babies. Care should be taken with interpretation of this data as data were not available for breastfeeding status on discharge for just over four fifths (80.5%) of surviving ANZNN registrants.

## 8. Characteristics of level III registrants, 2009

### Baby gender

Male births exceeded female births in both Australia and New Zealand and accounted for 51.4% of combined live births in both countries in 2009 (Li et al. 2011; Statistics New Zealand 2009). The percentage was higher among ANZNN registrants with male births representing 57.9%. Gender was not available for 11 babies. For births at less than 32 weeks gestation, 54.2% were male; of births at term 61.6% were male.

### Resuscitation in delivery suite

The types of resuscitation given to babies immediately after birth range from the least severe, suction to the most severe, external cardiac massage and ventilator support. For the purpose of this audit ANZNN only collected data on babies on whom endotracheal intubation was performed; 24.9% of registrants were intubated in the delivery suite to establish independent respiration and heart rate. For babies born before 32 weeks the percentage was 41.7% and for babies born at term the percentage was 17.9%.

### 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 requires specialised resuscitation.

An Apgar score of less than 4 at one minute of age was recorded for 17.7% of ANZNN registrants, with 4.0% of registrants recording an Apgar score of less than 4 at five minutes of age. Among the babies who had low Apgar scores at one minute, 44.9% of babies were born at less than 32 weeks and 31.8% were born at term (Table 44).

**TABLE 44: Apgar scores at birth for level III registrants by gestational age group, 2009**

	Gestational age group								
Apgar score	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
Apgar at 1 minute									
Apgar less than 4	32	167	178	174	165	161	210	506	1,593
Apgar between 4 and 7	19	222	386	474	717	651	608	799	3,876
Apgar greater than 8	3	34	90	289	601	604	819	1,073	3,513
Not stated	0	0	0	0	1	0	0	2	3
Total	54	423	654	937	1,484	1,416	1,637	2,380	8,986
Number									
Apgar at 5 minutes									
Apgar less than 4	8	35	34	26	24	24	46	162	359
Apgar between 4 and 7	30	225	284	263	306	300	327	655	2,390
Apgar greater than 8	16	163	336	647	1,154	1,092	1,264	1,562	6,234
Not stated	0	0	0	1	0	0	0	1	2
Total	54	423	654	937	1,484	1,416	1,637	2,380	8,986

*Note: Gestational age was not provided for one baby.*

## Admission temperature

The temperature at admission to the NICU, or temperature nearest to admission to the registration unit, was reported for all ANZNN registrants in 2009. 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 is used to calculate the Clinical Risk Index for Babies (CRIB) II score. 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 36.4° C; the median temperature increased slightly with increasing gestational age at birth. The lowest median temperature recorded was 35.7° C by the youngest babies, i.e. those born at less than 24 weeks gestation (Table 45).

**TABLE 45: Median admission temperature and interquartile ranges for level III registrants by gestational age group, 2009**

Gestational age group	Number of babies	Temperature	
		Median	Interquartile range
<24	54	35.7	34.8–36.4
24–25	423	36.1	35.4–36.7
26–27	654	36.4	35.8–36.8
28–29	937	36.4	35.9–36.8
30–31	1,484	36.4	36.0–36.8
32–33	1,416	36.3	35.7–36.7
34–36	1,637	36.4	35.6–36.9
37–43	2,380	36.5	34.5–37.0
<b>Total</b>	<b>8,986</b>	<b>36.4</b>	<b>35.7–36.8</b>

*Note: Gestational age was not provided for one baby.*

## Indication for respiratory support

In 2009, only 5.9% of all ANZNN registrants did not receive any form of respiratory support. For the remaining registrants, hyaline membrane disease (HMD) remained the most common indication for respiratory support at 49.0%. Non-specific respiratory distress accounted for 24.0% of babies, congenital anomaly for 4.7% of babies, while encephalopathy and meconium aspiration each accounted for approximately 3.0% (Table 46).

For babies born before 37 weeks gestation, HMD (62.5%) remained the most common indication for respiratory support. For babies born at term, non-specific respiratory distress (28.9%) was the most common indication followed by surgery (12.2%), congenital anomaly (11.4%) and HMD (11.3%) (Table 46). The 10-year trend (2000–2009) for mode of assisted ventilation is represented by Figure 34 in Appendix 1.



**TABLE 46: Indication for respiratory support for level III registrants by gestational age, 2009**

Indication for respiratory support	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
	Number								
No respiratory support	0	0	1	11	201	113	85	109	520
Non-specific respiratory distress	1	15	25	104	321	435	553	672	2,126
Hyaline membrane disease	53	393	611	779	857	745	635	264	4,337
Meconium aspiration syndrome	0	0	0	0	0	1	7	245	253
Pneumonia	0	0	0	3	3	6	14	66	92
Persistent pulmonary hypertension	0	1	1	2	4	2	11	75	96
Apnoea	0	1	4	19	38	36	22	27	147
Congenital anomaly	0	7	6	6	17	20	93	265	414
Other	0	2	0	3	10	11	39	140	205
Peri-surgery	0	0	1	0	5	19	95	285	405
Newborn encephalopathy	0	0	3	2	8	8	46	181	248
Not stated	0	4	2	8	20	20	37	51	142
<b>Total</b>	<b>54</b>	<b>423</b>	<b>654</b>	<b>937</b>	<b>1,484</b>	<b>1,416</b>	<b>1,637</b>	<b>2,380</b>	<b>8,986</b>
Per cent									
No respiratory support	0.0	0.0	0.2	1.2	13.5	8.0	5.2	4.6	5.9
Non-specific respiratory distress	1.9	3.6	3.8	11.2	21.9	31.2	34.6	28.9	24.0
Hyaline membrane disease	98.1	93.8	93.7	83.9	58.5	53.4	39.7	11.3	49.0
Meconium aspiration syndrome	0.0	0.0	0.0	0.0	0.0	0.1	0.4	10.5	2.9
Pneumonia	0.0	0.0	0.0	0.3	0.2	0.4	0.9	2.8	1.0
Persistent pulmonary hypertension	0.0	0.2	0.2	0.2	0.3	0.1	0.7	3.2	1.1
Apnoea	0.0	0.2	0.6	2.0	2.6	2.6	1.4	1.2	1.7
Congenital anomaly	0.0	1.7	0.9	0.6	1.2	1.4	5.8	11.4	4.7
Other	0.0	0.5	0.0	0.3	0.7	0.8	2.4	6.0	2.3
Peri-surgery	0.0	0.0	0.2	0.0	0.3	1.4	5.9	12.2	4.6
Newborn encephalopathy	0.0	0.0	0.5	0.2	0.5	0.6	2.9	7.8	2.8
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*Note:* Not stated data are excluded from per cent calculations.  
Gestational age was not provided for one baby.

## 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. There is some evidence that a bolus dose of exogenous surfactant given to babies with meconium aspiration syndrome can reduce ventilation requirements.

In 2009, one-third of ANZNN registrants (33.5%) were administered exogenous surfactant (Table 47).

There were 2,738 babies who received IPPV for HMD in 2009. Exogenous surfactant was given to 2,520 of these babies (92.0%). There were 218 babies diagnosed with HMD who were not given exogenous surfactant.

**TABLE 47: Exogenous surfactant use for level III registrants by gestational age group, 2009**

Exogenous surfactant	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
	Number								
None	1	21	109	370	1,037	1,062	1,291	2,083	5,974
Curosurf	42	321	434	431	306	244	219	189	2,186
Survanta	10	74	106	134	135	107	119	104	789
Surv+Curo	0	2	2	0	4	1	5	2	16
Exosurf	0	1	1	0	0	0	1	0	3
Any combination	1	1	1	1	1	2	0	1	8
Not stated	0	3	1	1	1	0	2	1	9
<b>Total</b>	<b>54</b>	<b>423</b>	<b>654</b>	<b>937</b>	<b>1,484</b>	<b>1,416</b>	<b>1,637</b>	<b>2,380</b>	<b>8,986</b>
Per cent									
None	1.9	5.0	16.7	39.5	69.9	75.0	79.0	87.6	66.5
Curosurf	77.8	76.4	66.5	46.0	20.6	17.2	13.4	7.9	24.4
Survanta	18.5	17.6	16.2	14.3	9.1	7.6	7.3	4.4	8.8
Surv+Curo	0.0	0.5	0.3	0.0	0.3	0.1	0.3	0.1	0.2
Exosurf	0.0	0.2	0.2	0.0	0.0	0.0	0.1	0.0	0.0
Any combination	1.9	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.1
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*Note:* Not stated data are excluded from per cent calculations.  
 Gestational age was not provided for one baby.

## 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 2009, 93.2% required assisted ventilation for four or more hours.

The two major forms of assisted ventilation used are intermittent positive pressure ventilation (IPPV) and continuous positive airways pressure (CPAP). IPPV is assisted ventilation given via an endotracheal tube, while CPAP can be administered via an endotracheal tube or via nasopharyngeal prongs (nasal CPAP). For the purposes of this audit CPAP is recorded via any route. The 10-year trend (2000–2009) for assisted ventilation is represented in Figures 35 and 36 in Appendix 1.

In 2009, IPPV was given for a total of 571,246 hours to ANZNN registrants and CPAP was given for 1,574,383 hours. The total number of hours of ventilation equates to each baby receiving 9.9 days of assisted ventilation. The median number of days of assisted ventilation is inversely related to the gestational age at birth (Table 48).

The most common form of ventilation given to ANZNN registrants in 2009 remains CPAP with 44.2% of registrants receiving CPAP only, 14.7% receiving IPPV only and 34.3% receiving both CPAP and IPPV.

In addition to IPPV and CPAP babies may have received oxygen (O<sub>2</sub>), high frequency oscillatory ventilation (HFOV), nitric oxide (NO) or extracorporeal membrane oxygenation (ECMO). HFOV without IPPV is very rarely given; therefore the rates of HFOV and NO are given as a percentage of the babies who received IPPV. The use of HFOV had been relatively stable at 12–14% since 1999, with the exception of 2007 (11.2%). In 2009, 14.2% of 2009 ANZNN registrants who received IPPV also received HFOV. The use of HFOV among individual units varied between 0.4% and 18.0% with the highest percentage of babies receiving HFOV born at less than 24 weeks (58.5%) followed by babies born at 24–25 weeks gestation (38.6%). The 10-year trend (2000–2009) for HFOV is represented in Figure 37 in Appendix 1.

TABLE 48: Duration of assisted ventilation and oxygen use by level III registrants by gestational age group, 2009

Median & Interquartile range (IQR)	Gestational age group							
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43
IPPV (hours)								
Median	453	261.5	64	27.5	22	22	43	48
IQR	104–777	67–599	21–207	14–73	11–54	12–59	19–91	22–98
CPAP (hours)								
Median	1,075	1,089.5	827	234	45	26	23	17
IQR	268–1,372	743–1,368	493–1,133	80–598	17–116	12–70	10–54	8–41
Oxygen (days)								
Median	51	70	48	12	3	3	3	3
IQR	5–112	29–104	21–76	3–45	2–8	1–5	2–6	2–8

*Note: IQR = Interquartile range*

*Gestational age was not provided for one baby.*

The percentage of ANZNN registrants who received nitric oxide (NO) was 4.3%. The use of NO continues to have a U-shaped distribution with the highest percentage of babies to receive NO born at term (16.4%) (Table 49). The 10-year trend (2000–2009) for NO is represented in Figure 38 in Appendix 1.

TABLE 49: Assisted ventilation for level III registrants by gestational age group, 2009

Ventilation type	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
	Number								
CPAP	35	338	607	886	1,202	1,184	1,271	1,529	7,052
IPPV	53	414	565	574	492	419	621	1,260	4,398
Oxygen given	47	383	520	621	660	595	853	1,382	5,061
HFOV	31	160	104	55	41	27	58	150	626
NO	6	36	32	25	14	18	52	207	390
ECMO	0	0	0	0	0	1	2	14	17
Total in each age group	54	423	654	937	1,484	1,416	1,637	2,380	8,986
Per cent									
CPAP	64.8	79.9	92.8	94.6	81.0	83.6	77.6	64.2	78.5
IPPV	98.1	97.9	86.4	61.3	33.2	29.6	37.9	52.9	48.9
Oxygen given	87.0	90.5	79.5	66.3	44.5	42.0	52.1	58.1	56.3
Per cent of babies given IPPV									
HFOV	58.5	38.6	18.4	9.6	8.3	6.4	9.3	11.9	14.2
NO	11.3	8.7	5.7	4.4	2.8	4.3	8.4	16.4	8.9
ECMO	0.0	0.0	0.0	0.0	0.0	0.2	0.3	1.1	0.4

*Note: Groups are not mutually exclusive. Percentage of babies given HFOV and NO are given as a percentage of babies given IPPV.*

*Gestational age was not provided for one baby.*

## 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 3,552 babies born before 32 weeks gestation, 94.6% were given assisted ventilation in the form of IPPV or CPAP. For registrants in this age group CPAP was the only form of ventilation for 34.0% and IPPV was the only form of ventilation for 6.8% of registrants. Both IPPV and CPAP were given to 53.7% of registrants.

The total duration of IPPV for these very preterm babies was 361,602 hours (15,067 days), and the duration of CPAP was 1,374,858 hours (57,286 days).

Of the babies born before 32 weeks gestational age and given IPPV in 2009, 18.6% were given high frequency ventilation while 5.4% of these babies were given NO (Table 49).

Among 2009 ANZNN registrants born at less than 32 weeks gestation 36.4% of registrants received supplemental oxygen at 28 days of age, with 17.7% of them discharged on home oxygen (Table 50).

## Ventilation in babies born at 32 to 36 weeks gestation

Among the babies born at 32–36 weeks gestation, 83.3% received assisted ventilation. Hyaline membrane disease was the main reason for ventilation. Total duration of CPAP use by registrants in this gestational age group was 132,101 hours (5,504 days) and IPPV use was 84,562 hours (3,523 days).

Of the babies born at 32–36 weeks gestation and given IPPV in 2009, 8.2% were given high frequency ventilation while 6.7% of these babies were given NO. Supplementary oxygen was given to 6.3% of registrants (Table 49).

## Ventilation in babies born at term

The main indication for respiratory support in term babies was non-specific respiratory distress (30.3%). This group required 125,082 hours of IPPV (5,212 days) and 67,424 hours (2,809 days) of CPAP.

Of the babies born at term and given IPPV in 2009, 11.9% were given high frequency ventilation while 16.4% of these babies were given NO. There were 14 babies born at term who received extracorporeal membrane oxygenation (ECMO) (Table 49).

## Supplemental oxygen (O2) therapy

Supplemental oxygen can be 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 oxygen administration as part of their specialised care. The duration of supplemental oxygen use may vary 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 constitutes the use of supplemental oxygen on that day. The continued use of oxygen at 28 days of age is a predictor of postneonatal mortality and the need for continued oxygen therapy after discharge.

Among 2009 ANZNN registrants, 19.0% received supplemental oxygen on day 28, a lower percentage than in 2008 (20.1%), and 18.5% of registrants given oxygen on day 28 were discharged on home oxygen (Table 50).

**TABLE 50: Supplemental oxygen therapy for level III registrants by gestational age group, 2009**

	Gestational age group								
Oxygen therapy	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
No oxygen on day 28	28	310	586	899	1,448	1,378	1,572	2,238	8,459
Oxygen on day 28	53	394	443	282	122	74	119	216	1,704
▪ survived to discharge home	27	281	375	244	86	36	54	75	1,178
▪ died before discharge	26	113	68	38	36	38	65	141	526
Not stated	0	0	0	0	0	0	0	1	1
Total in each age group	54	423	654	937	1,484	1,416	1,637	2,380	8,986
Number									
Babies given home oxygen	9	70	56	32	12	6	9	24	218
Per cent									
No oxygen on day 28	51.9	73.3	89.6	95.9	97.6	97.3	96.0	94.1	94.1
Oxygen on day 28	98.1	93.1	67.7	30.1	8.2	5.2	7.3	9.1	19.0
survived to discharge home	50.9	71.3	84.7	86.5	70.5	48.6	45.4	34.7	69.1
died before discharge	49.1	28.7	15.3	13.5	29.5	51.4	54.6	65.3	30.9
Per cent									
Babies given home oxygen	33.3	24.9	14.9	13.1	14.0	16.7	16.7	32.0	18.5

*Note:* Not stated data are excluded from per cent calculations.  
Gestational age was not provided for one baby.

## Nasal high flow therapy

Nasal high flow therapy (NHFT) as a form of non invasive respiratory support for premature babies, is an emerging trend within neonatal units. Humidified blended air and oxygen mix is administered through a high flow device via high flow nasal cannulae (HFNC). NHFT may deliver a positive end-expiratory pressure and for this reason can be preferred to nasal CPAP for use in premature infants (Wilkinson et al. 2011).

In 2009 nasal high flow therapy was reported for 724 babies (8.1%) of all level III registrants (Table 51). The minimum flow recorded was 2 litres/min and the maximum 10 litres/min. Of the babies receiving NHFT 74% received a minimum rate of 2–4 litres/min while 76% received a maximum rate of 6–8 litres/min.

Care should be taken in interpretation of these data as this is the first year of collection for ANZNN and NHFT is an emerging trend amongst member units.

**TABLE 51: Nasal high flow respiratory support for level III registrants by gestational age group, 2009**

Nasal high flow	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
Number									
High flow	9	86	137	130	123	81	70	88	724
No high flow	45	337	517	807	1,361	1,335	1,567	2,292	8,261
Total	54	423	654	937	1,484	1,416	1,637	2,380	8,986
Per cent									
High flow	16.7	20.3	20.9	13.9	8.3	5.7	4.3	3.7	8.1
No high flow	83.3	79.7	79.1	86.1	91.7	94.3	95.7	96.3	91.9
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*Note:* Gestational age was not provided for one baby.

## Chronic lung disease

Chronic lung disease (CLD) is diagnosed in babies born at less than 32 weeks gestation, who receive any form of respiratory support (supplemental oxygen and/or assisted ventilation) for their initial respiratory disease and continue to require respiratory support 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 7.1% of babies in 2009 were reported to have had respiratory support at 36 weeks PMA, indicating the presence of CLD. The highest percentage of chronic lung disease was in the 24–25 weeks gestation group with almost half (45.6%) reported as having CLD (Table 52). Not all the babies born at earlier gestations survived to 36 weeks PMA. CLD by gestational age is represented by Figure 40 in Appendix 1.

**TABLE 52: Chronic lung disease for level III registrants by gestational age group, 2009**

Chronic lung disease (CLD)	Gestational age										Total
	<24	24	25	26	27	28	29	30	31	≥32	
Number											
No CLD	33	83	147	205	239	318	464	604	825	5,433	8,352
CLD	21	81	112	130	80	93	62	31	24	0	634
▪ CLD & survived	18	80	110	127	78	89	60	30	23	0	615
▪ CLD and died	3	1	2	3	2	4	2	1	1	0	19
Total	54	164	259	335	319	411	526	635	849	5,433	8,986
Per cent											
No CLD	61.1	50.6	56.8	61.2	74.9	77.4	88.2	95.1	97.2	100.0	92.9
CLD	38.9	49.4	43.2	38.8	25.1	22.6	11.8	4.9	2.8	0.0	7.1
▪ CLD & survived	85.7	98.8	98.2	97.7	97.5	95.7	96.8	96.8	95.8	0.0	97.0
▪ CLD and died	14.3	1.2	1.8	2.3	2.5	4.3	3.2	3.2	4.2	0.0	3.0

*Note: Survival is assessed to discharge from hospital.  
Gestational age was not provided for one baby.*

## 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 53).

**TABLE 53: Pulmonary air leak for level III registrants by gestational age group, 2009**

	Gestational age group								
Air leak	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
Air leak	10	44	21	41	36	40	73	190	455
No air leak	44	378	632	896	1,448	1,376	1,563	2,189	8,526
Not stated	0	1	1	0	0	0	1	1	4
Total	54	423	654	937	1,484	1,416	1,637	2,380	8,986
Per cent									
Air leak	18.5	10.4	3.2	4.4	2.4	2.8	4.5	8.0	5.1
No air leak	81.5	89.6	96.8	95.6	97.6	97.2	95.5	92.0	94.9
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*Note: Not stated data are excluded from per cent calculations.  
Gestational age was not provided for one baby.*

## 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 7.7% of ANZNN registrants in 2009. Of these babies, 49.1% were born at less than 28 weeks gestation, 73.6% were born at less than 32 weeks gestation and 98.7% of registrants survived up to 2 days of life (Table 54). The 6-year trends (2004–2009) for early and late sepsis are represented by Figures 43 and 44 respectively in Appendix 1.

**TABLE 54: Neonatal sepsis for level III registrants by gestational age group, 2009**

Sepsis	Gestational age group								Total
	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	
Number									
No sepsis	33	274	486	842	1,410	1,370	1,596	2,285	8,296
Sepsis	21	149	168	95	74	46	41	95	689
▪ <48 hrs	0	9	8	10	16	8	15	30	96
▪ ≥48 hrs	21	135	158	83	58	38	26	65	584
▪ both <48 and ≥48 hrs	0	5	2	2	0	0	0	0	9
Babies alive on day 2	47	390	644	931	1,479	1,407	1,625	2,343	8,866
Babies who did not survive to day 2	7	33	10	6	5	9	12	37	119
Total in each age group	54	423	654	937	1,484	1,416	1,637	2,380	8,986
Per cent									
No sepsis <sup>(a)</sup>	61.1	64.8	74.3	89.9	95.0	96.8	97.5	96.0	92.3
Sepsis <sup>(a)</sup>	38.9	35.2	25.7	10.1	5.0	3.2	2.5	4.0	7.7
▪ <48 hrs <sup>(a)</sup>	0.0	2.1	1.2	1.1	1.1	0.6	0.9	1.3	1.1
▪ ≥48 hrs <sup>(b)</sup>	44.7	34.6	24.5	8.9	3.9	2.7	1.6	2.8	6.6
▪ both <48 and ≥48 hrs <sup>(a)</sup>	0.0	1.2	0.3	0.2	0.0	0.0	0.0	0.0	0.1

(a) Denominator is all registrants.

(b) Denominator is registrants alive at 48 hours.

**Note:** Denominator for these calculations are all ANZNN registrants.

Not stated data are excluded from per cent calculations.

Gestational age was not provided for one baby.

## 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 2009 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 2009 registrants, 29.6% were eligible for ROP examination and of these eligible registrants, 77.6% were examined and had the results of their eye examination recorded.

Of those ANZNN registrants who were eligible for an eye examination, 52 died before their ROP status could be determined. Of those examined, 4.6% had stage 3 or 4 eye disease and of these babies 83.2% received treatment (Table 55). The 5-year trend (2005–2009) for stages 3 and 4 ROP and treatment is represented by Figure 41 in Appendix 1.

**TABLE 55: Retinopathy of prematurity for level III registrants by gestational age, 2009**

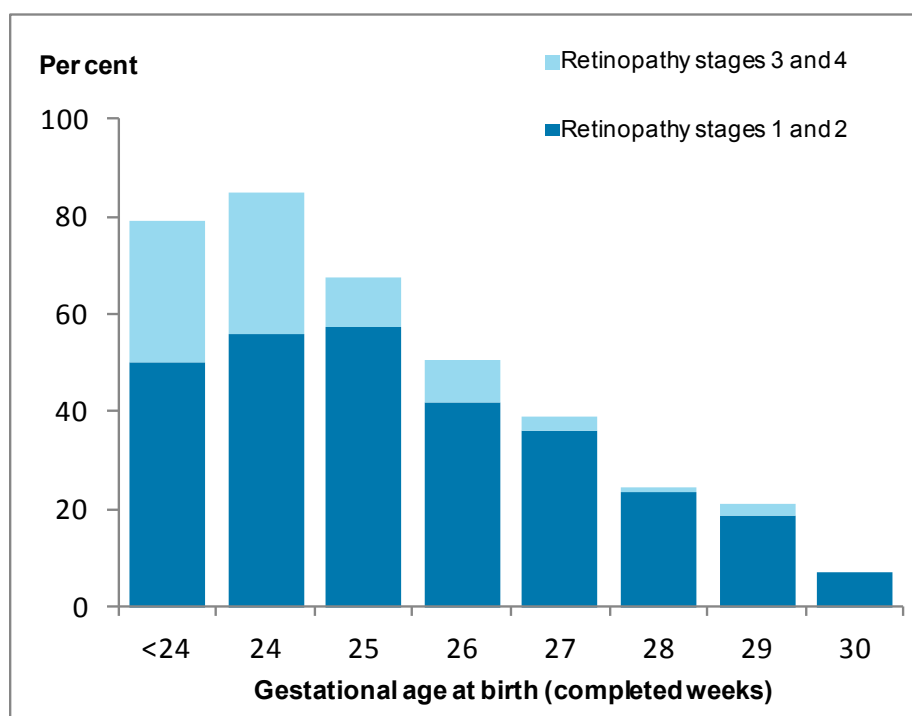
Retinopathy of prematurity (ROP)	Gestational age									Total
	<24	24	25	26	27	28	29	30	>30	
Number										
No ROP	6	19	68	134	168	265	342	367	0	1,369
▪ Stage 1 ROP	5	17	44	55	49	54	53	16	5	298
▪ Stage 2 ROP	7	39	71	56	49	29	27	13	8	299
▪ Stage 3 ROP	7	29	20	23	7	4	10	0	0	100
▪ Stage 4 ROP	1	0	0	0	0	0	0	0	0	1
Not examined	18	42	31	44	30	45	81	232	72	595
Not stated	0	1	2	12	9	9	9	5	4	51
Total	44	147	236	324	312	406	522	633	89	2,713
Number										
Treatment for ROP <sup>(a)</sup>	9	26	16	19	3	1	8	1	1	84
Per cent										
No ROP	23.1	18.3	33.5	50.0	61.5	75.3	79.2	92.7	0.0	66.2
▪ Stage 1 ROP	19.2	16.3	21.7	20.5	17.9	15.3	12.3	4.0	38.5	14.4
▪ Stage 2 ROP	26.9	37.5	35.0	20.9	17.9	8.2	6.3	3.3	61.5	14.5
▪ Stage 3 ROP	26.9	27.9	9.9	8.6	2.6	1.1	2.3	0.0	0.0	4.8
▪ Stage 4 ROP	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Per cent										
Treatment for ROP	112.5 <sup>(b)</sup>	89.7	80.0	82.6	42.9	25.0	80.0	0.0	0.0	83.2

(a) Percentages for babies with retinopathy of prematurity who received treatment have been calculated using as the denominator the total number in each age group who had stages 3 and 4 ROP.

(b) Some babies had more than one treatment for ROP.

**Note:** Not stated and not examined data are excluded from per cent calculations.  
Gestational age was not provided for one baby.

**FIGURE 14: Retinopathy of prematurity for level III registrants by gestational age in 2009**



**Note:** Gestational age was not provided for one baby.



## Intraventricular haemorrhage

An initial head 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 3,552 babies born at less than 32 weeks gestation eligible for a cerebral ultrasound, 3,462 survived to day 3 and 93.7% had an examination recorded. A normal report was recorded for 79.0% of these 2009 ANZNN registrants.

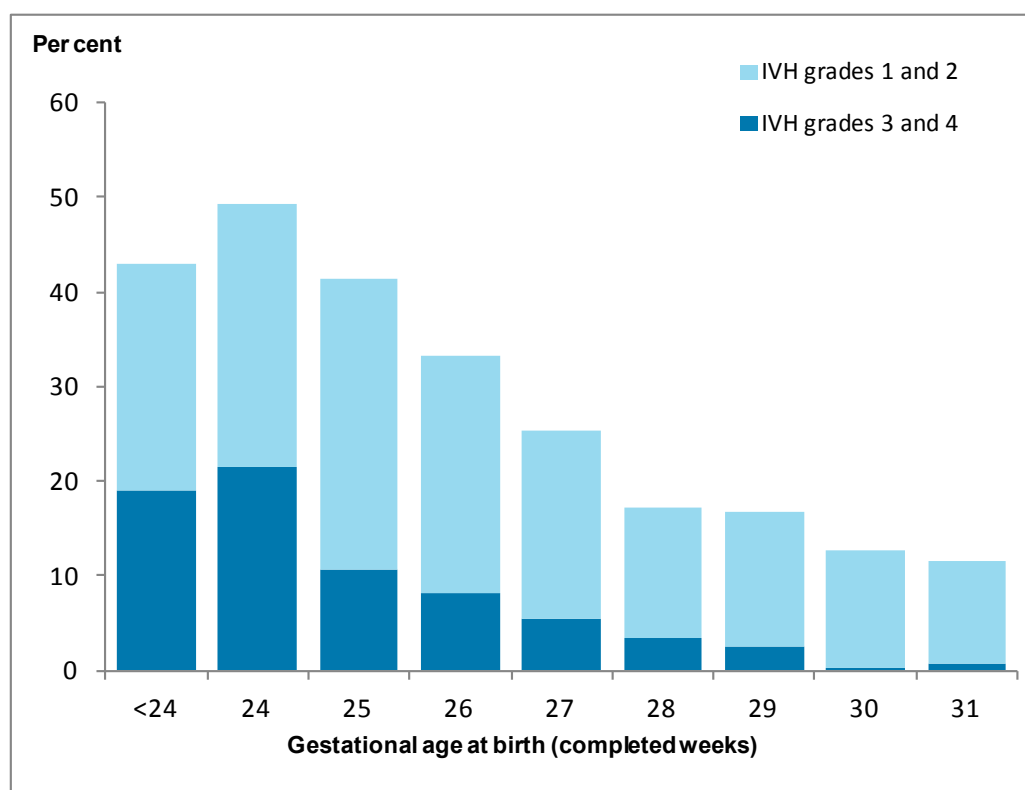
There were 142 babies reported to have grade 3 or 4 IVH representing 4.1% of the babies born before 32 weeks gestation. The highest percentage of babies who had severe IVH (grade 4) were born before 29 weeks gestational age, with the majority (65.7%) of the babies born between 24 and 26 weeks gestation. The 10-year trend (2000–2009) for registrants with grades 3 and 4 IVH who survived to day 3 is represented in Figure 42 in Appendix 1.

**TABLE 56: Intraventricular haemorrhage for level III registrants born before 32 weeks and survived to day 3 by gestational age, 2009**

Intraventricular haemorrhage	Gestational age									Total
	<24	24	25	26	27	28	29	30	31	
Number										
None	24	73	136	212	230	328	426	498	638	2,565
▪ Grade 1 IVH	6	22	43	50	33	34	58	58	65	369
▪ Grade 2 IVH	4	18	28	30	28	20	15	13	13	169
▪ Grade 3 IVH	2	5	6	4	5	5	7	2	4	40
▪ Grade 4 IVH	6	26	19	22	12	9	6	0	2	102
Not examined	1	1	2	6	3	9	10	62	121	215
Not stated	0	0	1	0	1	0	0	0	0	2
<b>Total</b>	<b>43</b>	<b>145</b>	<b>235</b>	<b>324</b>	<b>312</b>	<b>405</b>	<b>522</b>	<b>633</b>	<b>843</b>	<b>3,462</b>
Per cent										
None	57.1	50.7	58.6	66.7	74.7	82.8	83.2	87.2	88.4	79.0
▪ Grade 1 IVH	14.3	15.3	18.5	15.7	10.7	8.6	11.3	10.2	9.0	11.4
▪ Grade 2 IVH	9.5	12.5	12.1	9.4	9.1	5.1	2.9	2.3	1.8	5.2
▪ Grade 3 IVH	4.8	3.5	2.6	1.3	1.6	1.3	1.4	0.4	0.6	1.2
▪ Grade 4 IVH	14.3	18.1	8.2	6.9	3.9	2.3	1.2	0.0	0.3	3.1
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

**Note:** Not stated and not examined data are excluded from per cent calculations.  
Gestational age was not provided for one baby.

**FIGURE 15: Intraventricular haemorrhage in level III registrants born at less than 32 weeks gestation and survived to day 3, by gestational age, 2009**



*Note: Gestational age was not provided for one baby.*

## 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 3,552 babies born at less than 32 weeks gestation eligible for a cerebral ultrasound, 3,320 survived until day 3 and late ultrasound results were available for 2,600 of these babies. A normal report of no cysts was recorded for 96.9% of these registrants, 0.8% reported porencephalic cysts, 2.3% reported periventricular leukomalacia (PVL) and no baby reported encephaloclastic porencephaly. Hydrocephalus was reported for 1.3% of these registrants in 2009 (Table 57).

**TABLE 57: Late cerebral ultrasound results for level III registrants born before 32 weeks by gestational age, 2009**

	Gestational age									
Cerebral ultrasound results	<24	24	25	26	27	28	29	30	31	Total
Number										
No cysts	40	118	197	255	260	332	415	418	485	2,520
Porencephalic cysts	1	2	6	3	3	1	2	2	1	21
Periventricular leukomalacia	0	3	5	9	10	8	12	5	7	59
Encephaloclastic porencephaly	0	0	0	0	0	0	0	0	0	0
Not stated	13	41	51	68	46	70	97	210	356	952
<b>Total</b>	<b>54</b>	<b>164</b>	<b>259</b>	<b>335</b>	<b>319</b>	<b>411</b>	<b>526</b>	<b>635</b>	<b>849</b>	<b>3,552</b>
Hydrocephalus	2	6	4	7	4	2	6	2	2	35
Per cent										
No cysts	97.6	95.9	94.7	95.5	95.2	97.4	96.7	98.4	98.4	96.9
Porencephalic cysts	2.4	1.6	2.9	1.1	1.1	0.3	0.5	0.5	0.2	0.8
Periventricular leukomalacia	0.0	2.4	2.4	3.4	3.7	2.3	2.8	1.2	1.4	2.3
Encephaloclastic porencephaly	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
Hydrocephalus	4.9	4.9	1.9	2.6	1.5	0.6	1.4	0.5	0.4	1.3

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

*Gestational age was not provided for one baby.*

## 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 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 2009 the percentage of babies with confirmed NEC was 1.6%. Of these babies, 66% were born before 28 weeks gestation with 62.1% of them undergoing surgery, and 34% were born after 27 weeks gestation; surgery was required for 58.0% of them. In total 45 registrants died from NEC. The number of registrants with confirmed NEC is less than in 2008 (Table 58).

**TABLE 58: Necrotising enterocolitis in level III registrants by year of birth, 2000–2009**

Necrotising enterocolitis	Year of birth									
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Number										
NEC at <28 weeks	68	78	75	78	85	85	95	80	118	97
▪ No NEC at <28 weeks	1,028	952	1,042	943	941	951	944	1,005	1,052	1,032
▪ Not stated	1	1	0	2	0	0	20	24	15	2
NEC at ≥28 weeks	57	57	65	77	63	50	72	50	74	50
▪ No NEC at <28 weeks	5,682	5,718	5,861	6,091	6,316	6,560	6,428	6,773	7,339	7,801
▪ Not stated	4	5	2	4	2	0	32	70	27	3
<b>Total</b>	<b>6,840</b>	<b>6,811</b>	<b>7,045</b>	<b>7,195</b>	<b>7,407</b>	<b>7,646</b>	<b>7,591</b>	<b>8,002</b>	<b>8,628</b>	<b>8,986</b>
Per cent										
NEC <28 weeks	6.2	7.6	6.7	7.6	8.3	8.2	9.1	7.4	10.1	8.6
NEC ≥28 weeks	1.0	1.0	1.1	1.2	1.0	0.8	1.1	0.7	1.0	0.6

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

## Congenital anomalies

In 2009, 1,340 ANZNN registrants (15.3%) had one or more congenital anomalies. For registrants who had a congenital anomaly, 16.3% were born before 32 weeks gestation, 30.1% were born between 32 and 36 weeks gestation and more than half of registrants (53.6%) were born at term.

More than half of ANZNN registrants (52.2%) with congenital anomalies were diagnosed during the antenatal period with 9.9% of congenital anomalies recorded as fatal. A higher percentage of babies with congenital anomalies were male (58.3%).

## Transfer from level III NICUs to other units

Once intensive care is no longer required babies are often 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 2009, more than one-third of ANZNN registrants (38.8%) were transferred from a level III unit to a level II unit before discharge home. Almost half of the registrants (48.4%) transferred from level III to level II units were born at less than 32 weeks gestation compared to 13.2% born at term.

Some level III registrants required transfer to a specialist children's hospital and in 2009 these accounted for 3.9% of transfers from level III units. Overall 55.1% of level III registrants were not transferred after registration (Table 59).

**TABLE 59: Transfer after registration of level III registrants by level of destination hospital and gestational age group, 2009**

	Gestational age group								
Transfer status	<24	24–25	26–27	28–29	30–31	32–33	34–36	37–43	Total
Number									
Not transferred	36	270	323	398	584	626	968	1,743	4,948
Level 3 hospital	0	18	43	44	27	28	17	29	206
Level 2 hospital	9	103	251	477	846	741	598	459	3,484
Children's hospital	9	32	36	18	27	21	54	149	346
Not stated	0	0	1	0	0	0	0	0	1
<b>Total</b>	<b>54</b>	<b>423</b>	<b>654</b>	<b>937</b>	<b>1,484</b>	<b>1,416</b>	<b>1,637</b>	<b>2,380</b>	<b>8,986</b>
Per cent									
Not transferred	66.7	63.8	49.5	42.5	39.4	44.2	59.1	73.2	55.1
Level 3 hospital	0.0	4.3	6.6	4.7	1.8	2.0	1.0	1.2	2.3
Level 2 hospital	16.7	24.3	38.4	50.9	57.0	52.3	36.5	19.3	38.8
Children's hospital	16.7	7.6	5.5	1.9	1.8	1.5	3.3	6.3	3.9
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

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

*Gestational age was not provided for one baby.*

## Length of stay until discharge home

Factors that influence a baby's length of stay (LOS) in hospital are 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 ANZNN the LOS includes all the time the baby spends in hospital from the first day of their first admission up until and including the day of their discharge home. The LOS has added together the time spent in all 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 82.7% of ANZNN registrants in 2009. The median length of stay was 25 days with an interquartile range of 19–32 days (Table 60). LOS 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 approximately 209,127 days in hospital, babies born between 32 and 36 weeks spent 77,867 days and babies born at term spent 38,662 days in hospital.

**TABLE 60: Median length of stay for level III registrants who survived until discharge home by gestational age, 2009**

<b>Gestational age (completed weeks)</b>	<b>Number of babies</b>	<b>Median LOS (in days)</b>	<b>Interquartile range (in days)</b>
<24	28	166	156–171
24	106	126	102–150
25	204	104	92–120
26	284	94	81–112
27	302	78	68–89
28	390	68	59–82
29	509	58	49–68
30	618	47	40–56
31	830	39	32–46
32	734	33	27–41
33	644	25	19–32
34	613	19	15–26
35	542	14	9–23
36	417	12	7–21
37	409	9	6–22
38	567	11	6–20
39	452	11	5–21
40	462	9	5–18
41	314	8	5–16
42	31	5	4–11
43	3	6	6–13
<b>Total</b>	<b>8,459</b>	<b>25</b>	<b>19–32</b>

*Note: Gestational age was not provided for one baby.*

## Survival of the ANZNN registrants

In 2009, 94.1% of ANZNN registrants survived to go home. These data include babies who were transferred to level I or level II 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 27 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 2009, there were 527 neonatal deaths, of which 292 occurred in the early neonatal period that is within seven days of birth (Table 27). Mortality was highest among babies born before 26 weeks gestation with a survival rate at discharge increasing week on week from 51.9% for babies born before 24 weeks to 94.7% for babies born at 27 weeks (Table 61 and Figure 16). A similar pattern of increasing survival with increasing birthweight is seen in Figure 17.

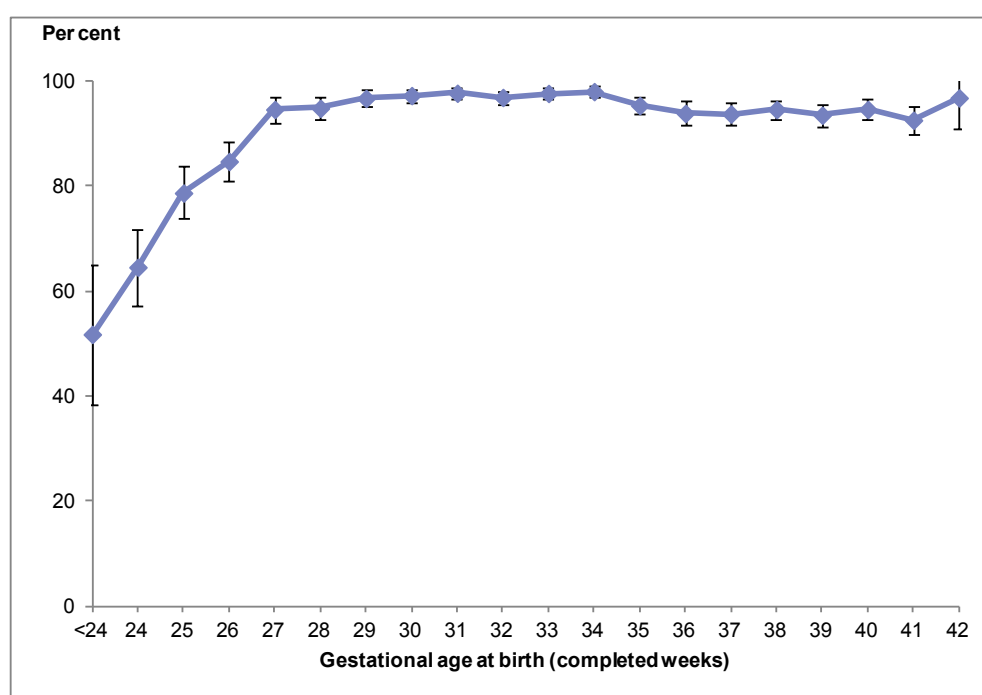
Lethal congenital anomaly was the cause of death for 1.5% of registrants, with most occurring in babies born between 35–39 weeks gestation (Table 61).

**TABLE 61: Survival to discharge home for level III registrants by gestational age at birth, 2009**

Gestational age (completed weeks)	Number of babies	Lethal congenital anomalies	Babies alive on day 7	Babies alive on day 28	Survived to go home	Per cent survival at discharge home
<24	54	0	39	36	28	51.9
24	164	1	131	116	106	64.6
25	259	3	221	215	204	78.8
26	335	2	319	303	284	84.8
27	319	2	310	305	302	94.7
28	411	2	402	396	390	94.9
29	526	3	518	513	509	96.8
30	635	10	629	623	618	97.3
31	849	5	836	831	830	97.8
32	757	14	745	740	734	97.0
33	659	4	653	646	644	97.7
34	625	6	618	615	613	98.1
35	568	17	556	548	542	95.4
36	444	15	430	421	417	93.9
37	436	12	421	415	409	93.8
38	599	12	578	576	567	94.7
39	483	13	462	457	452	93.6
40	488	6	469	464	462	94.7
41	339	6	323	315	314	92.6
42	32	0	31	31	31	96.9
43	3	0	3	3	3	100.0
<b>Total</b>	<b>8,986</b>	<b>133</b>	<b>8,694</b>	<b>8,569</b>	<b>8,459</b>	<b>94.1</b>

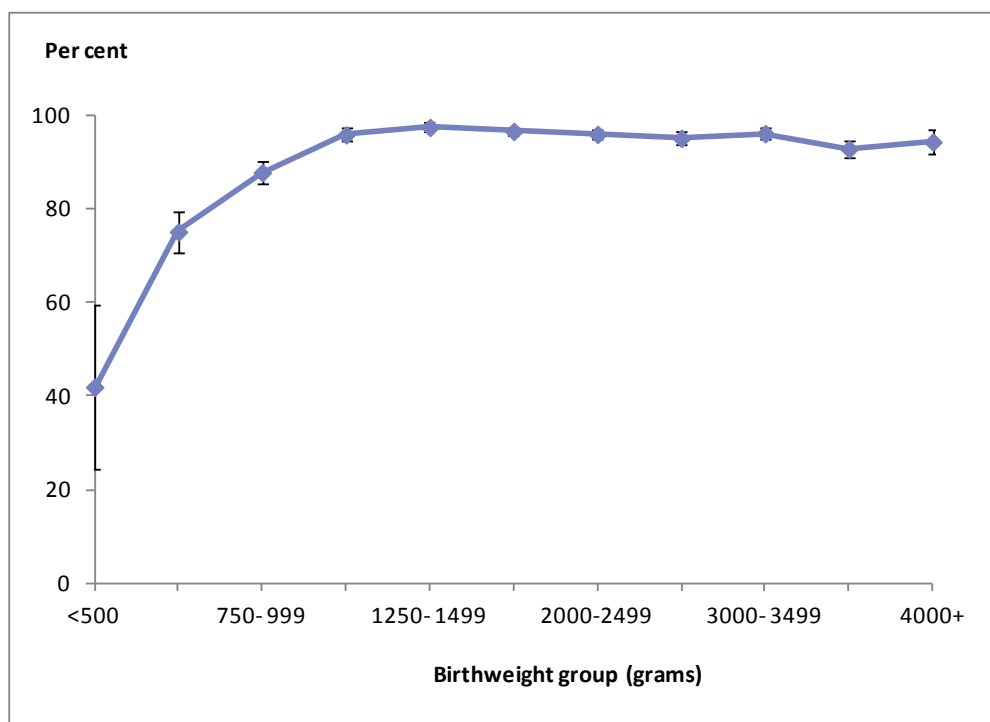
*Note: Gestational age was not provided for one baby.*

**FIGURE 16: Survival of level III registrants to discharge home (with 95% CI) by gestational age, 2009**



*Note: Gestational age was not provided for one baby.*

**FIGURE 17: Survival of level III registrants to discharge home (with 95% CI) by birthweight group, 2009**



## 9. Babies registered to level II units, 2009

### Overview

Nurseries with facilities to manage mild or moderately ill babies are known as 'level II units' or 'special care baby units'. Individual nurseries 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 nurseries, or if they were transferred to a level III NICU after 28 days, or they were transferred to a level II nursery 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 eight in Australia that are members of the ANZNN. Altogether, 22 level II units contributed data for this report.

In 2009, 658 babies fulfilled the ANZNN criteria for registration to a level II unit. Of those babies, 12.6% were born at less than 32 weeks gestation and 9.4% weighed less than 1,500 grams at birth (Tables 62 and 63). The highest number of babies registered to a level II unit in 2009 was 77.

**TABLE 62: Level II registrants born at each completed week of gestation, 2009**

Gestational age group	Number of babies	Per cent	Cumulative per cent
<28	5	0.8	0.8
28–29	19	2.9	3.6
30–31	59	9.0	12.6
<b>Babies &lt;32 weeks gestation</b>	<b>83</b>	<b>12.6</b>	
32–33	133	20.2	32.8
34–36	179	27.2	60.0
37–43	261	39.7	99.7
<b>Total</b>	<b>658</b>	<b>100.0</b>	

*Note:* Gestational age groups below 28 weeks have been combined to maintain confidentiality of small numbers. Gestational age was not provided for two babies.

**TABLE 63: Level II registrants by birthweight group, 2009**

Birthweight group (grams)	Number of babies	Per cent	Cumulative percent
<1,100	9	1.4	1.4
1,100–1,199	6	0.9	2.3
1,200–1,299	9	1.4	3.6
1,300–1,399	19	2.9	6.5
1,400–1,499	19	2.9	9.4
<b>All babies &lt;1500g birthweight</b>	<b>62</b>	<b>9.4</b>	
1,500–1,999	106	16.1	25.5
2,000–2,499	141	21.4	47.0
2,500–2,999	108	16.4	63.4
3,000–3,499	118	17.9	81.3
3,500–3,999	83	12.6	93.9
≥4,000	40	6.1	100.0
<b>Total</b>	<b>658</b>	<b>100.0</b>	

*Note:* Birthweight groups below 1,100g have been combined to maintain confidentiality of small numbers.



More than half of the level II registrants, 353 babies (61.6%), were born to Caucasian mothers, 70.8% of which were born preterm. The number of registrants born to Maori mothers was 136 (23.7%), and 107 (78.7%) were born preterm. There were 14 babies (2.4%) born to Pacific Islander mothers.

There were 412 male (62.6.0%) and 239 female (36.3%) registrants in the audit. No gender was recorded for 7 registrants (1.1%). 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, 28.3% did not present with any maternal complications. Among babies born before 37 weeks, 37.6% of mothers had presented with preterm labour (Table 64).

**TABLE 64: Mothers of level II registrants presenting antenatal problem by gestational age group, 2009**

	Gestational age group						
Presenting antenatal problem	<28	28–29	30–31	32–33	34–36	37–43	Total
Number							
No antenatal problems	0	0	0	n.p.	n.p.	162	181
Pre-labour rupture of membranes	n.p.	6	6	21	28	n.p.	66
Preterm labour	n.p.	5	32	43	64	n.p.	149
Hypertension in pregnancy	0	n.p.	6	21	18	n.p.	50
Antepartum haemorrhage	n.p.	5	9	22	16	n.p.	55
Intrauterine growth restriction	0	0	n.p.	n.p.	14	n.p.	27
Fetal distress	0	n.p.	0	10	n.p.	44	66
Other problem	0	0	n.p.	n.p.	8	22	37
Congenital anomalies	0	0	n.p.	0	n.p.	5	7
Not stated	0	1	0	4	1	12	18
Total	5	19	59	133	179	261	658
Per cent							
No antenatal problems	0.0	0.0	0.0	n.p.	n.p.	65.1	28.3
Pre-labour rupture of membranes	n.p.	33.3	10.2	16.3	15.7	n.p.	10.3
Preterm labour	n.p.	27.8	54.2	33.3	36.0	n.p.	23.3
Hypertension in pregnancy	0.0	n.p.	10.2	16.3	10.1	n.p.	7.8
Antepartum haemorrhage	n.p.	27.8	15.3	17.1	9.0	n.p.	8.6
Intrauterine growth restriction	0.0	0.0	n.p.	n.p.	7.9	1.6	4.2
Fetal distress	0.0	n.p.	n.p.	7.8	n.p.	17.7	10.3
Other problem	0.0	0.0	n.p.	n.p.	4.5	8.8	5.8
Congenital anomalies	0.0	0.0	n.p.	0.0	n.p.	2.0	1.1
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:** Not stated data are excluded from per cent calculations.

Gestational age was not provided for two babies.

Previous preterm births were reported by 74 (11.2%) of the mothers of level II registrants and 27 mothers (4.1%) had had a previous perinatal death(s).

Most mothers (74.2%) of level II registrants had booked into a level II hospital for delivery. Of the level II registrants born before 34 weeks gestation, 60.6% of the mothers were given antenatal corticosteroids within seven days of the birth (Table 65).

**TABLE 65: Antenatal corticosteroid use by mothers of level II registrants by gestational age group, 2009**

Antenatal corticosteroids	Gestational age group						Total
	<28	28–29	30–31	32–33	34–36	37–43	
Number							
None	0	n.p.	n.p.	9	11	n.p.	39
Incomplete course	n.p.	n.p.	n.p.	43	141	247	445
Complete course	n.p.	8	22	37	8	n.p.	78
Completed >7 days	n.p.	n.p.	21	37	13	n.p.	80
Not stated	0	0	1	7	6	0	14
<b>Total</b>	<b>5</b>	<b>19</b>	<b>59</b>	<b>133</b>	<b>179</b>	<b>261</b>	<b>658</b>
Per cent							
None	0.0	n.p.	n.p.	7.1	6.4	n.p.	6.1
Incomplete course	n.p.	n.p.	n.p.	34.1	81.5	94.6	69.1
Complete course	n.p.	42.1	37.9	29.4	4.6	n.p.	12.1
Completed >7 days	n.p.	n.p.	36.2	29.4	7.5	n.p.	12.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

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

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

Gestational age was not provided for two babies.

Caesarean section was the most common method of birth for 52.2% of level II registrants, followed by vaginal delivery (47.8%) with more than half of the caesarean section occurring before the onset of labour (Table 66).

**TABLE 66: Method of delivery for level II registrants by gestational age group, 2009**

Method of delivery	Gestational age group						Total
	27–28	28–29	30–31	32–33	34–36	37–43	
Number							
Vaginal <sup>(a)</sup>	n.p.	7	27	50	69	n.p.	310
Caesarean <sup>(b)</sup>	n.p.	12	32	83	104	n.p.	338
Not stated	0	0	0	0	6	4	10
<b>Total</b>	<b>5</b>	<b>19</b>	<b>59</b>	<b>133</b>	<b>179</b>	<b>261</b>	<b>658</b>
Per cent							
Vaginal	n.p.	36.8	45.8	37.6	39.9	n.p.	47.8
Caesarean	n.p.	63.2	54.2	62.4	60.1	n.p.	52.2
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*(a)* Vaginal and assisted 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

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

Gestational age was not provided for two babies.

## Characteristics of level II babies

Among the 658 babies registered to level II units, 70 were from multiple births (10.6%). There were 412 male births and 7 babies whose gender was not recorded.

A low Apgar score of less than 4 at one minute of age was recorded for 13.7% of babies and 27.8% of them required endotracheal intubation in the labour ward to assist in their adaptation to extrauterine life.

Non-specific respiratory distress (47.8%) was the major reason for assisted ventilation for level II registrants, followed by hyaline membrane disease (29.9%) (Table 67).

For level II registrants, the median duration of assisted ventilation by IPPV was 15 hours and 20 hours by CPAP. The median duration of oxygen was 2 days (Table 68).

**TABLE 67: Indication for respiratory support for level II registrants by gestational age group, 2009**

	Gestational age group						
Indication for respiratory support	<28	28–29	30–31	32–33	34–36	37–43	Total
Number							
No support	0	6	14	13	n.p.	n.p.	39
Non-specific distress	n.p.	n.p.	15	54	88	151	310
Hyaline membrane disease	n.p.	12	n.p.	58	73	19	194
Meconium aspiration syndrome	0	0	0	0	0	31	31
Pneumonia	0	0	0	n.p.	n.p.	24	31
Persistent pulmonary hypertension	0	n.p.	0	0	0	n.p.	n.p.
Apnoea	0	0	0	n.p.	n.p.	n.p.	6
Congenital anomaly	0	0	0	n.p.	n.p.	n.p.	11
Other	n.p.	0	n.p.	0	0	n.p.	9
Peri-surgery	0	0	0	0	n.p.	0	n.p.
Newborn encephalopathy	0	0	0	n.p.	0	11	n.p.
Not stated	0	0	0	2	3	5	10
<b>Total</b>	<b>5</b>	<b>19</b>	<b>59</b>	<b>133</b>	<b>179</b>	<b>261</b>	<b>658</b>
Per cent							
No support	0.0	31.6	23.7	9.9	n.p.	n.p.	6.0
Non-specific distress	n.p.	n.p.	25.4	41.2	50.0	59.0	47.8
Hyaline membrane disease	n.p.	63.2	n.p.	44.3	41.5	7.4	29.9
Meconium aspiration syndrome	0.0	0.0	0.0	0.0	0.0	12.1	4.8
Pneumonia	0.0	0.0	0.0	n.p.	n.p.	9.4	4.8
Persistent pulmonary hypertension	0.0	n.p.	0.0	0.0	0.0	n.p.	n.p.
Apnoea	0.0	0.0	0.0	n.p.	n.p.	n.p.	0.9
Congenital anomaly	0.0	0.0	0.0	n.p.	n.p.	n.p.	1.7
Other	n.p.	0.0	n.p.	0.0	0.0	n.p.	1.4
Peri-surgery	0.0	0.0	0.0	0.0	n.p.	0.0	n.p.
Newborn encephalopathy	0.0	0.0	0.0	n.p.	0.0	4.3	n.p.
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

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

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

Gestational age was not provided for two babies.

**TABLE 68: Duration of assisted ventilation and oxygen use by level II registrants by gestational age group, 2009**

Median & Interquartile range (IQR)	Gestational age group						Total
	<28	28–29	30–31	32–33	34–36	37–43	
IPPV (hours)							
Median	5.5	67	11	15	33	15.5	15
IQR	2–9	40–133	11–11	6–31	4–39	3–38	5–36
CPAP (hours)							
Median	588	234	36.5	27.5	24	13	20
IQR	377–799	55–521	23–127	12–56	11–53	7–26	9–49
Oxygen (days)							
Median	1	8	4	2.5	2	2	2
IQR	1–3	3–32	1–13	1–4	2–5	1–3	1–4

**Note:** IQR = Interquartile range.

Gestational age was not provided for two babies.

## Eye examination

Screening for retinopathy of prematurity (ROP) was reported for 33 of the 40 eligible babies born at less than 31 weeks gestational age and/or weighing less than 1,250 grams at birth. All were reported as normal except for two babies with stage 1 and one baby with stage 2 ROP.

## Cerebral ultrasound

Of the 83 babies born at less than 32 weeks, 61 (73.5%) had a cerebral ultrasound in the first week after birth. Fifty-three of them were reported as normal, that is no intraventricular haemorrhage (IVH), seven reported a grade 1 IVH and one reported a grade 2 IVH. Most babies who did not have an early cerebral ultrasound reported at this time were born at 30 or 31 weeks gestation. A late cerebral ultrasound was reported for 57 babies all of whom had normal reports.

## Other morbidities

Septicaemia was proven in 25 babies, including 18 before day two, that is less than 48 hours. There were no cases of necrotising enterocolitis. Major congenital anomalies were reported for 23 babies, four required surgery, and five registrants died due to congenital anomalies.

## Level II transfers

In total 45 level II registrants were transferred to other units, 40 were transferred to a level I or II unit and the remaining 5 were transferred to a level III unit.

## Survival

There were 638 level II registrants who survived to discharge home (97.0%). 12 babies died within the first seven days of birth and a further 8 babies died before discharge home. 5 babies were reported to have had lethal congenital anomalies (Table 69).

**TABLE 69: Survival to discharge home for level II registrants by gestational age group, 2009**

Gestational age group	Number of babies	Lethal congenital anomalies	Babies alive on day 7	Babies alive on day 28	Survived to go home	Per cent survival at discharge home
<28	5	0	n.p.	n.p.	n.p.	60.0
28–29	19	0	19	19	19	100.0
30–31	59	0	59	59	59	100.0
32–33	133	n.p.	132	132	n.p.	n.p.
34–36	179	n.p.	178	177	n.p.	n.p.
37–43	261	n.p.	n.p.	n.p.	246	94.3
<b>Total</b>	<b>658</b>	<b>5</b>	<b>646</b>	<b>645</b>	<b>638</b>	<b>97.0</b>

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

**Note:** Gestational age groups below 28 weeks have been combined to maintain confidentiality of small numbers.

Gestational age was not provided for two babies.

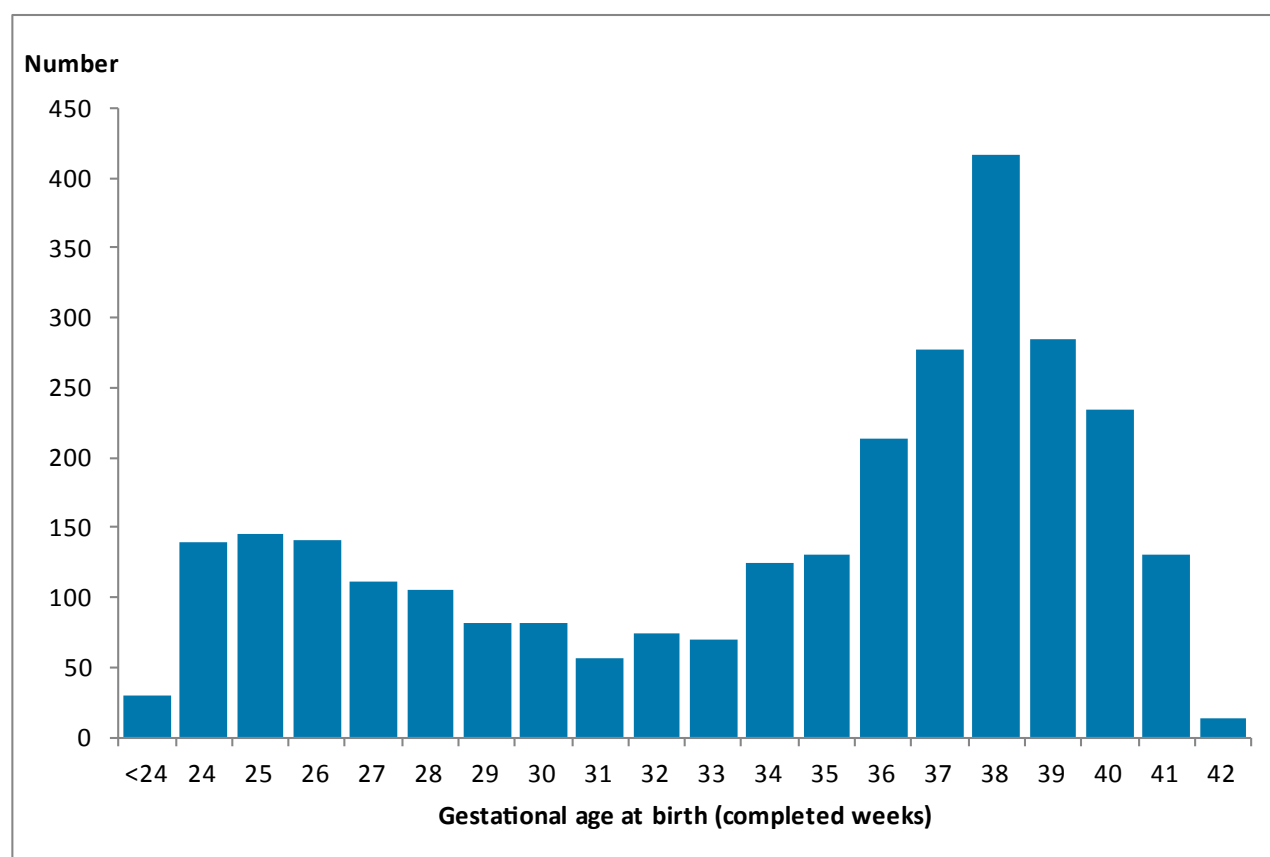
## 10. Neonatal surgery, 2007–2009

### Introduction

The information in the following tables contains data on ANZNN registrants who have undergone major surgery in the neonatal period in one of the 27 participating surgical units in ANZNN. These data relate to the infant's first admission to an NICU prior to discharge home. During the period 2007–2009, there were 2,865 infants registered with ANZNN who underwent major surgery in the newborn period (11.2%).

Almost half of the infants (47%) who underwent major surgery were born at term with the majority born at 33 or more weeks gestation (64%). One in five infants who underwent major surgery were born at less than 28 weeks gestation (Figure 18).

**FIGURE 18: ANZNN registrants who have undergone surgery by gestation age, 2007–2009**



Gastrointestinal procedures were most commonly performed with cardiac procedures the second most common (Table 70).

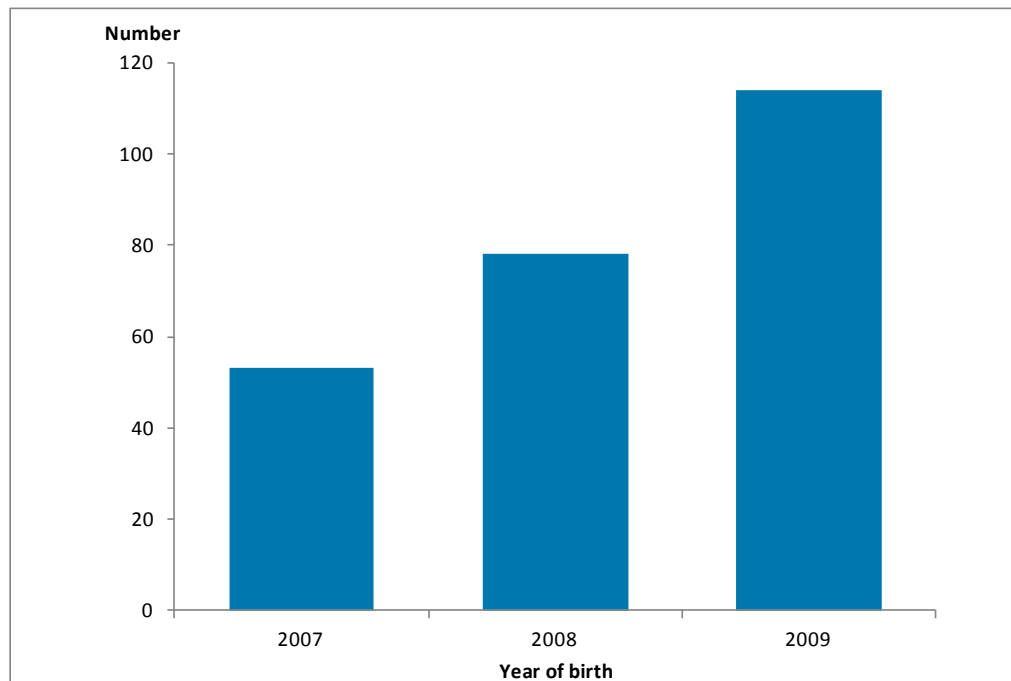
**TABLE 70: Surgical procedures for ANZNN registrants, 2007-2009**

Surgical procedures	Number of procedures
Gastrointestinal	2,723
Cardiac	1,052
Neurological	271
Respiratory	211
Eye	131
Urinary	92
Musculoskeletal	48
Plastics	26
Ear, nose and throat	18
<b>Total</b>	<b>4,572</b>

## Gastroschisis

In line with data from throughout the world, the prevalence of gastroschisis is increasing in ANZNN (Figure 19). The majority of infants were male (56%) and were born at more than 34 weeks gestation (92%). 42% of infants were born at 34–36 weeks.

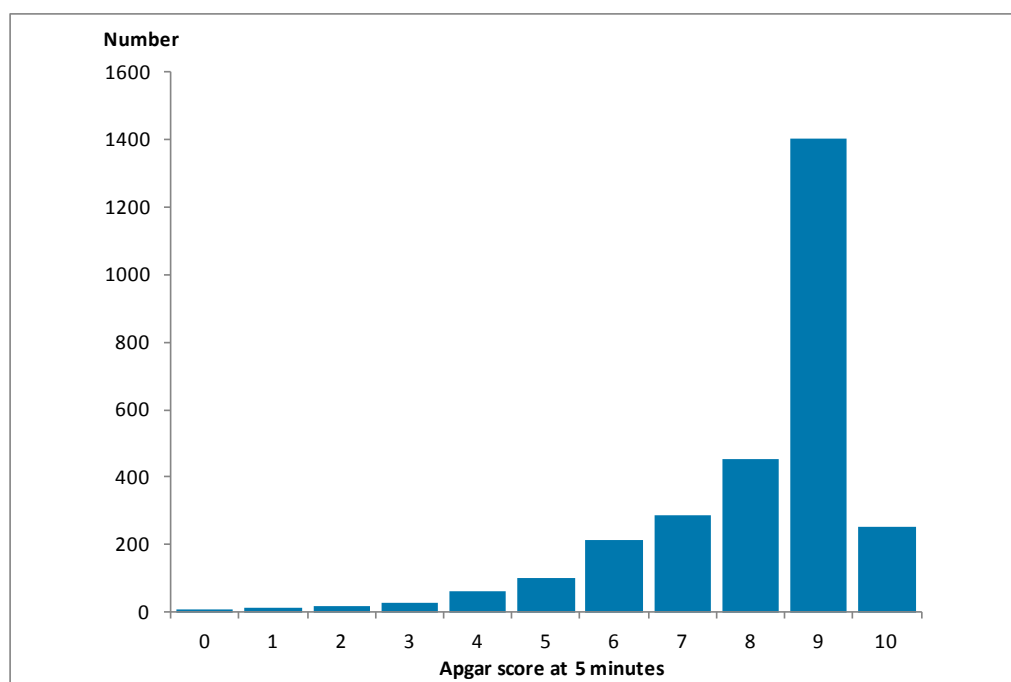
**FIGURE 19: Increasing incidence of gastroschisis in ANZNN registrants, 2007–2009**



## Five minute Apgar score

The majority of infants had a five minute Apgar score greater than 7 (74%) with only 8% having an Apgar score less than 5 at five minutes (Figure 20).

**FIGURE 20: Five minute Apgar score for ANZNN registrants who have undergone surgery by number of infants, 2007–2009**

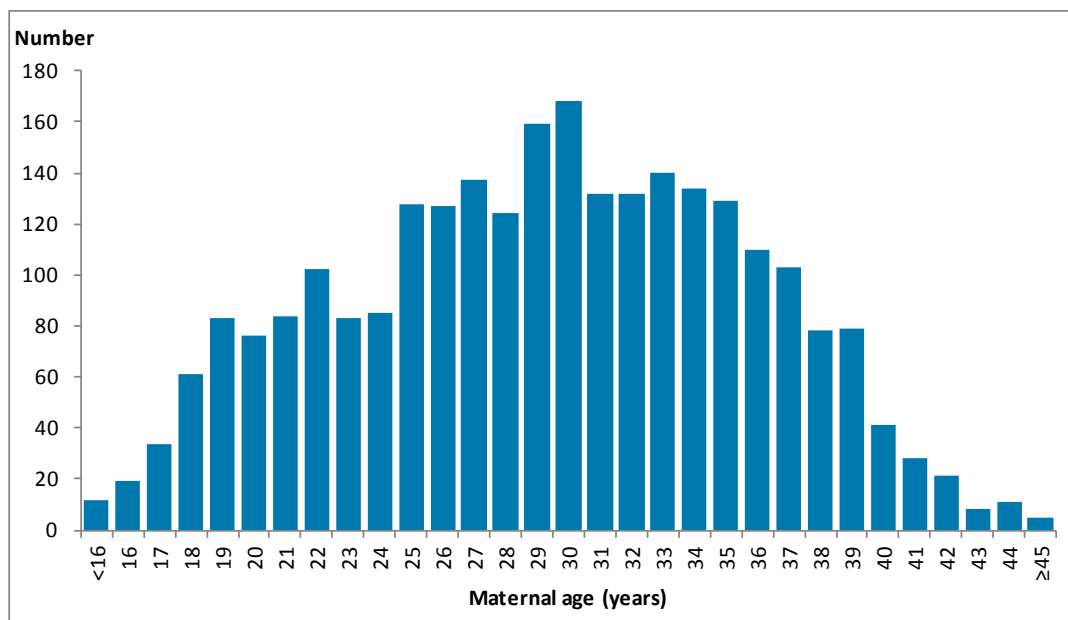


*Note: Apgar scores were not provided for 29 infants.*

## Maternal age

Between 2007 and 2009, the age of mothers of infants who underwent surgery ranged from 14 to 48 years (Figure 21), with a mean age of 29.3 years. There were 213 teenage mothers (7.9%).

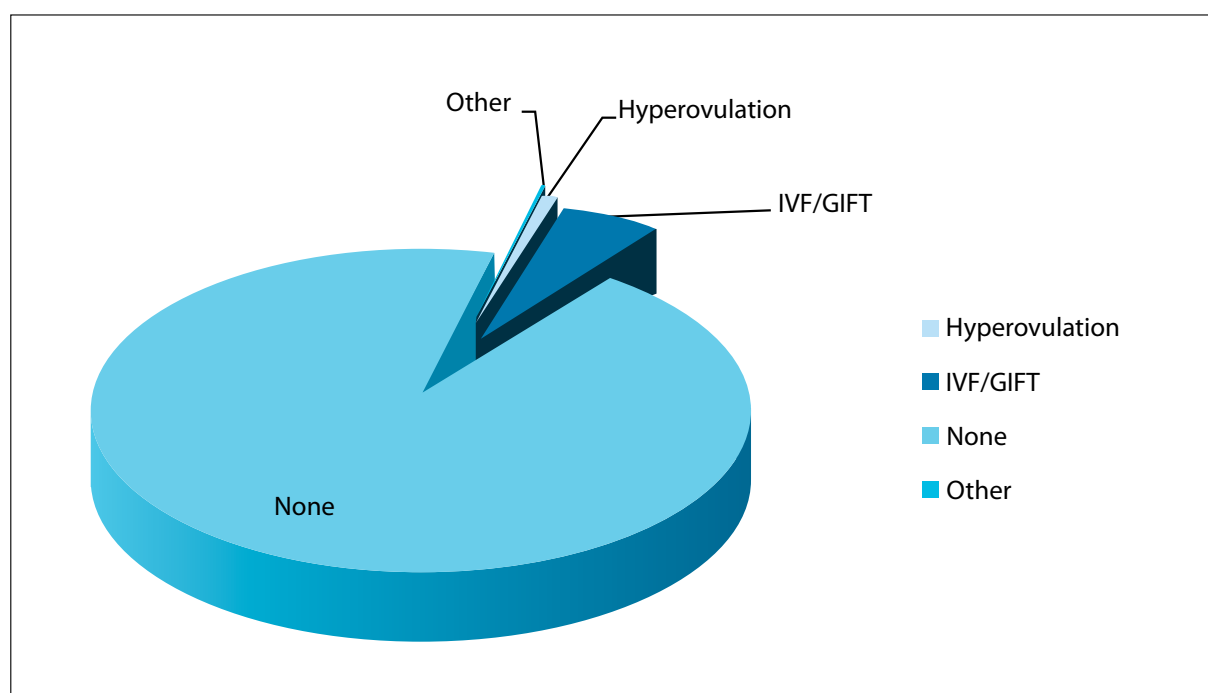
**FIGURE 21: Age of mothers of ANZNN registrants who have undergone surgery, 2007–2009**



## Assisted conception

Within the surgical cohort, only 6.4% of pregnancies were assisted conception, compared with 7.7–8.1% in the whole cohort. In vitro fertilisation (IVF/GIFT) was the most common method (5.6%) of assisted conception (Figure 22).

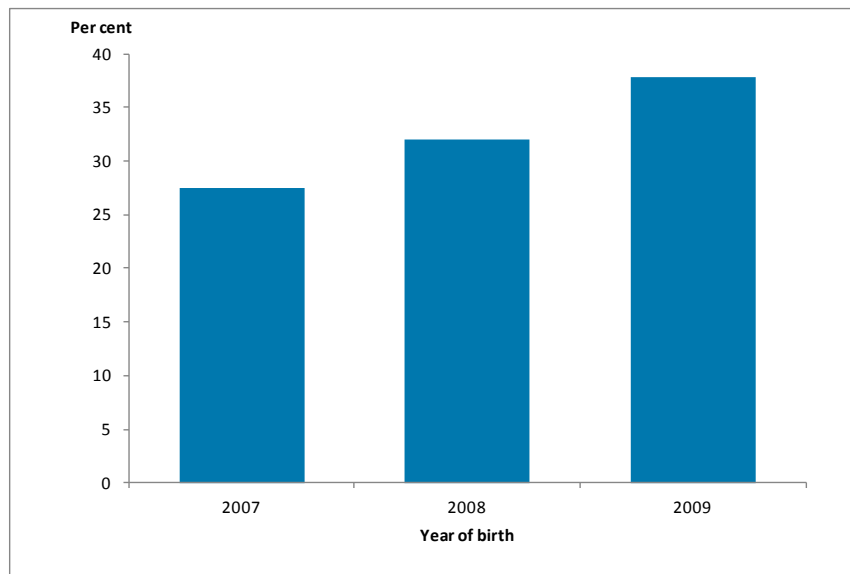
**FIGURE 22: Assisted conception status of mothers of ANZNN registrants who have undergone surgery, 2007–2009**



## Antenatal diagnosis

The frequency of antenatal diagnosis of congenital anomalies of ANZNN registrants who underwent surgery increased each year (Figure 23).

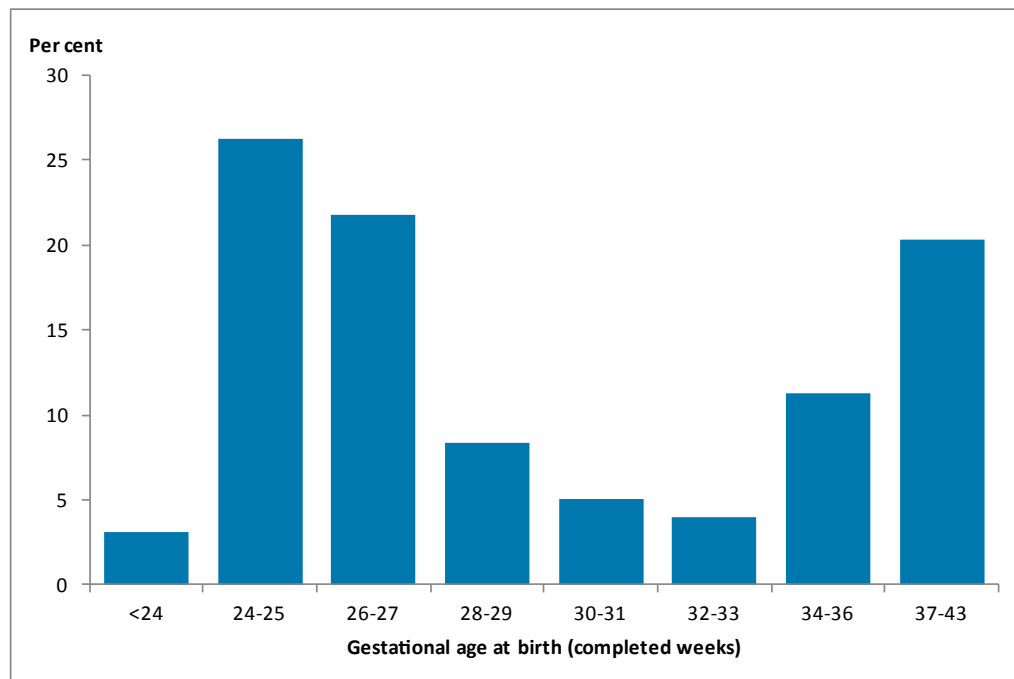
**FIGURE 23: Antenatal diagnosis of congenital anomalies in ANZNN registrants who have undergone surgery by year of birth, 2007–2009**



## Neonatal sepsis

The majority of episodes of sepsis were in the preterm population (Figure 24) with the overwhelming preponderance having coagulase negative staphylococci.

**FIGURE 24: Neonatal sepsis in ANZNN registrants who have undergone surgery by gestational age group, 2007–2009**

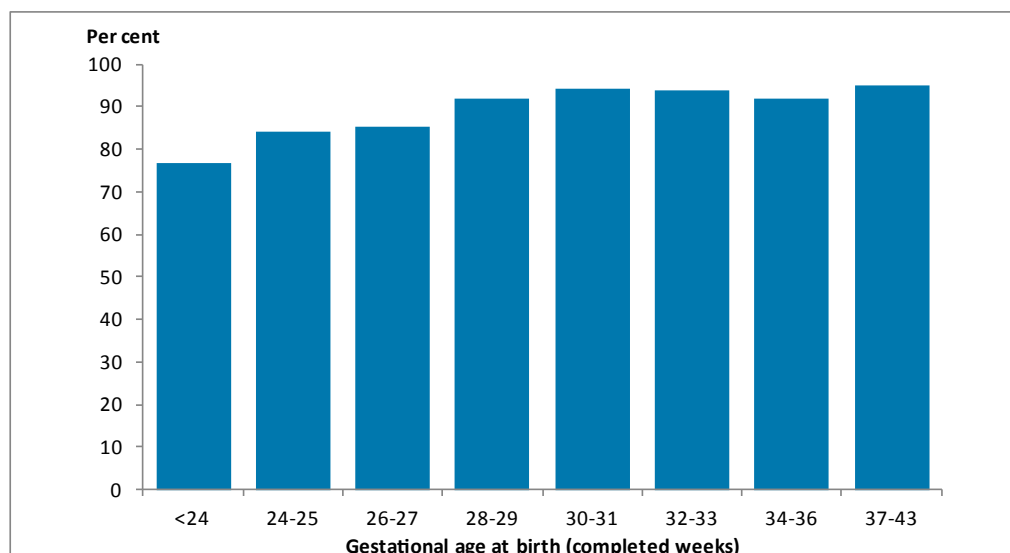




## Survival

Mortality has remained constant over the three year period from 2007 to 2009 (7–8%). Survival improves with increasing gestational age (Figure 25).

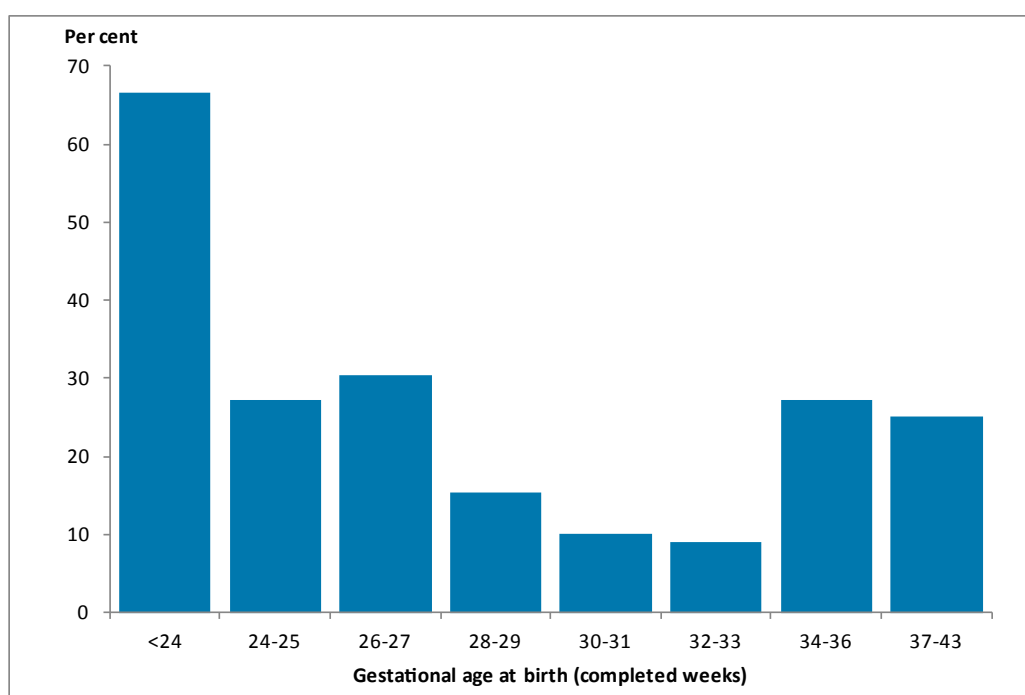
**FIGURE 25: Survival to discharge home for ANZNN registrants who have undergone surgery by gestational age group, 2007–2009**



## Necrotising enterocolitis

As is well known, necrotising enterocolitis (NEC) is more common in the preterm population (Figure 26) and is associated with increased mortality.

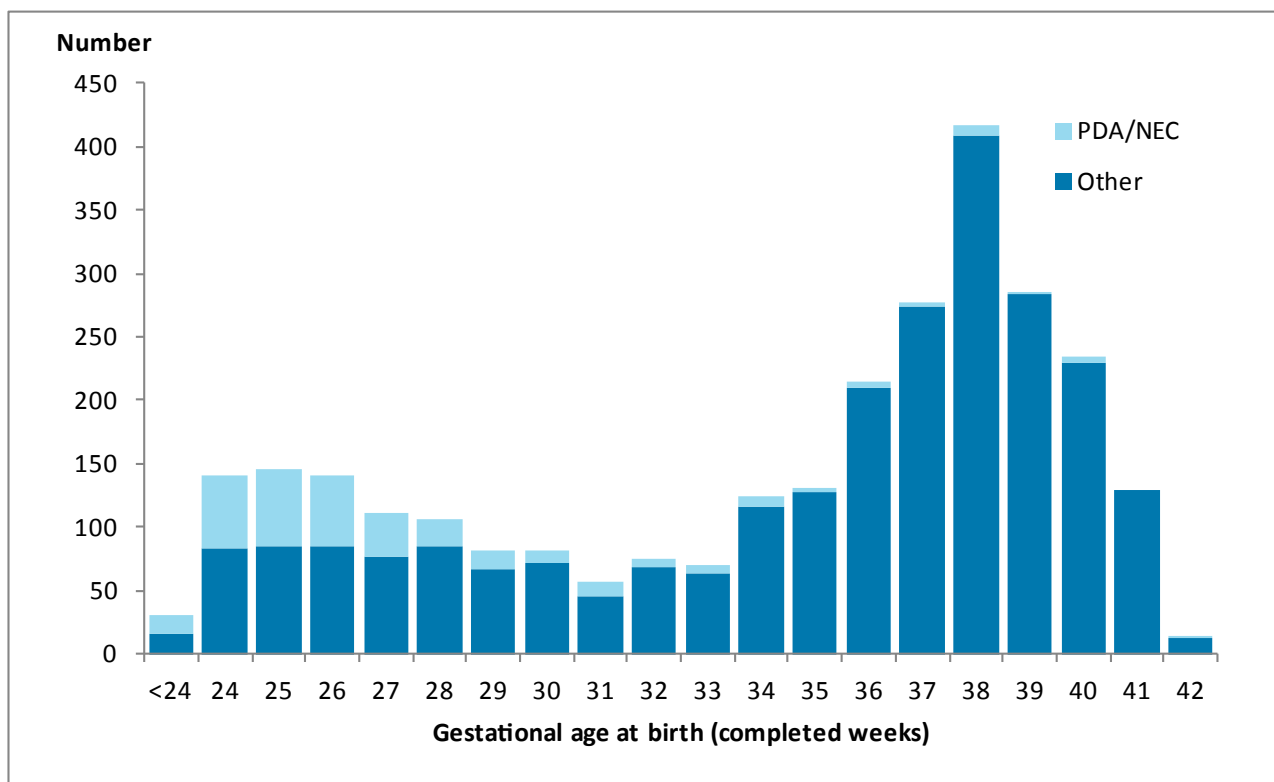
**FIGURE 26: Necrotising enterocolitis mortality for ANZNN registrants who have undergone surgery by gestational age group, 2007–2009**



## NEC and PDA surgery

Surgery for necrotising enterocolitis and patent ductus arteriosus (PDA) made up a significant proportion of surgery in the preterm group (Figure 27).

**FIGURE 27: NEC and PDA surgery for ANZNN registrants who have undergone surgery by gestational age, 2007–2009**



**TABLE 71: Characteristics of ANZNN registrants who have undergone surgery by year of birth, 2007–2009**

Characteristics	Year of birth		
	2007	2008	2009
Male	510	627	528
Female	360	457	378
Congenital anomaly present	569	740	628
Congenital anomaly diagnosed antenatally	240	347	343
Proven NEC	50	104	72
Died before discharge home	81	92	72
<b>Total</b>	<b>870</b>	<b>1,084</b>	<b>906</b>

**Note:** Gender was not provided for two babies in 2007, one baby in 2008 and one baby in 2009. Gender was ambiguous for one baby in 2007.

## Summary

Infants who undergo major surgery make up a significant number within the ANZNN cohort. There is a preponderance of term infants, with the majority of preterm infants having surgery to close a patent ductus arteriosus or for necrotising enterocolitis. Overall survival in the surgical cohort has not changed from 2007–2009. What would be interesting but difficult to quantify is the associated morbidity, and in particular neurodevelopmental outcome of babies who have undergone surgery during the neonatal period.

# APPENDICES

## Appendix 1: Trends

FIGURE 28: Trends in gestational age at birth of level III registrants, 2000–2009

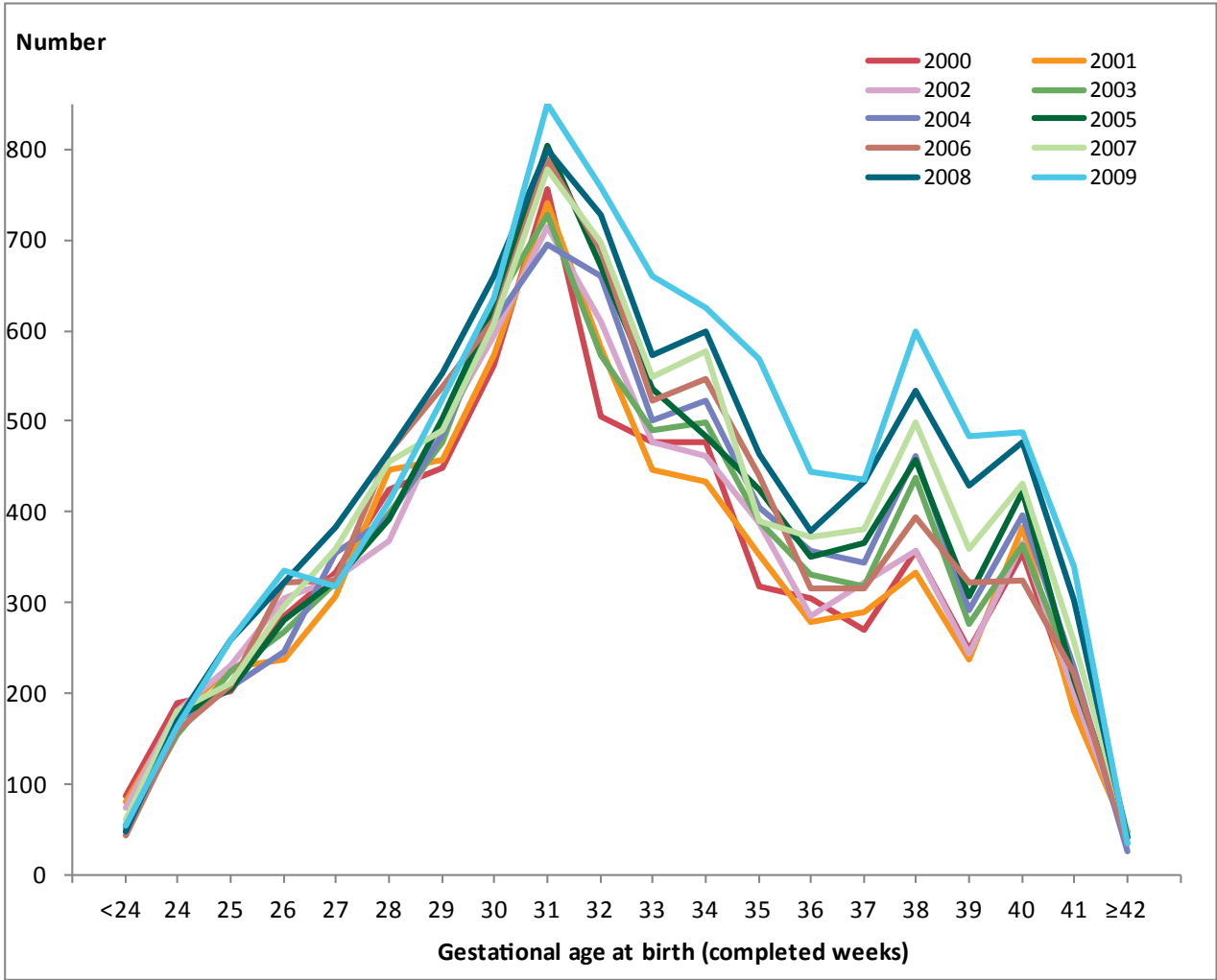
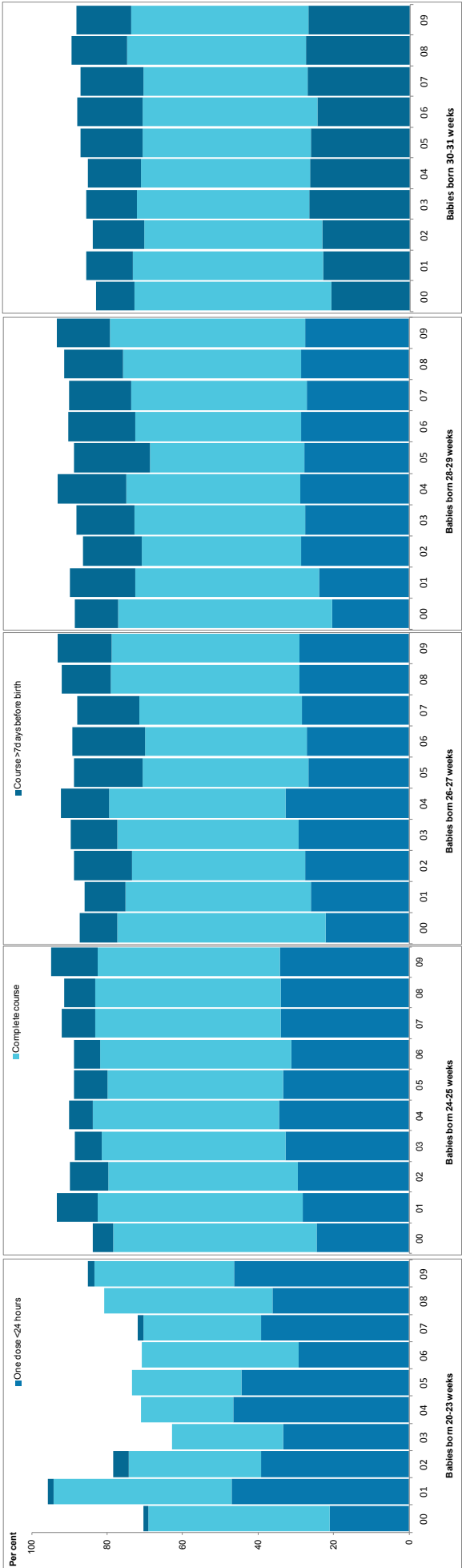
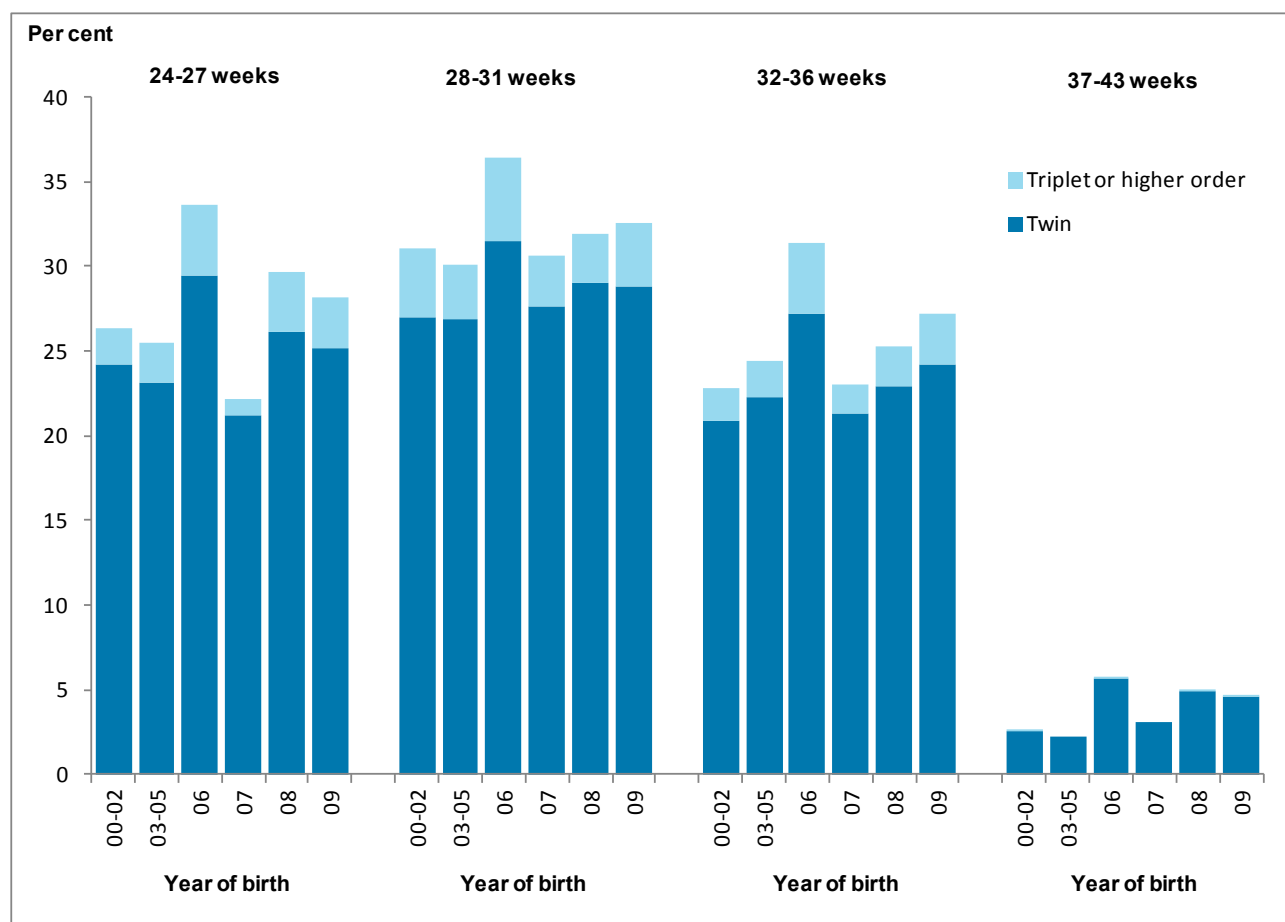


FIGURE 29: Trends in the use of corticosteroids for mothers of babies less than 32 weeks gestation, 2000–2009

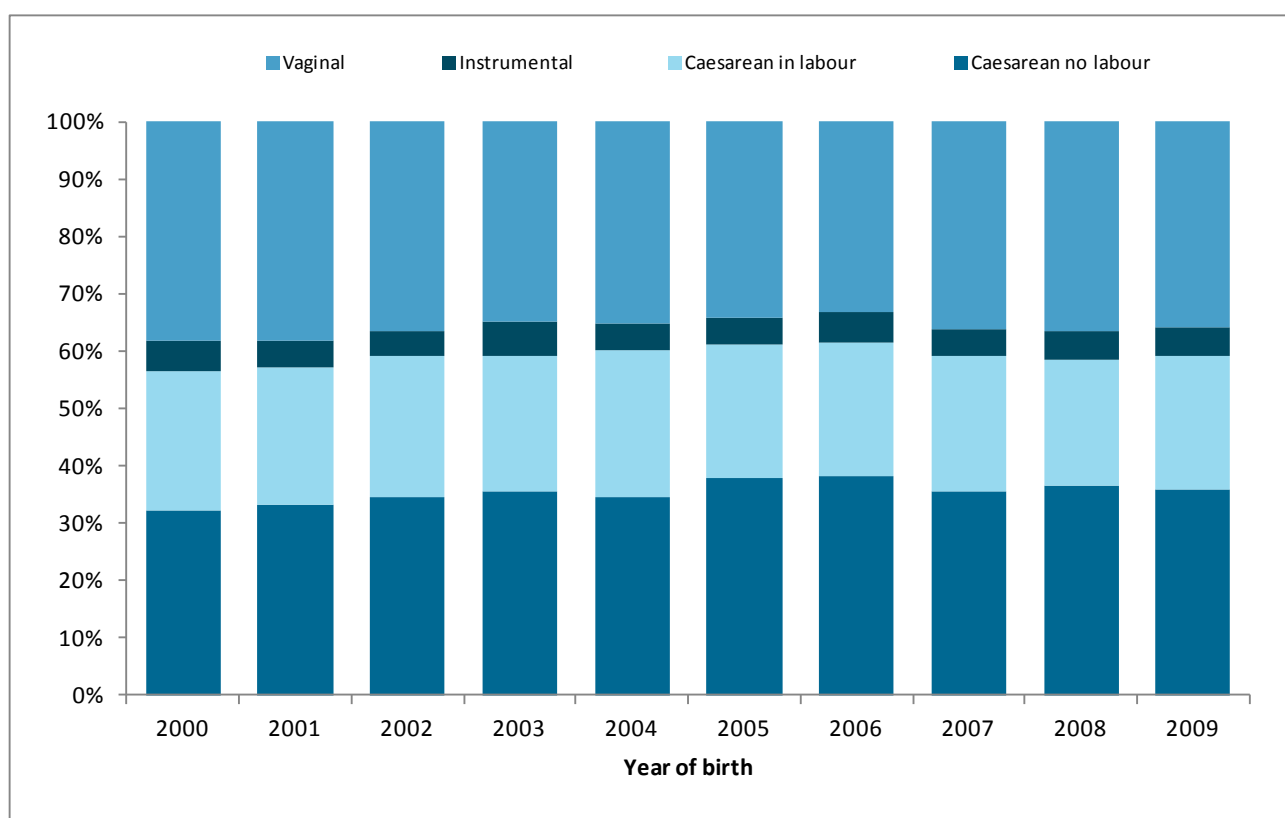


**Note:** Corticosteroid treatment to enhance fetal lung maturation is considered 'complete' when two doses are given, the first dose more than 24 hours and less than 8 days before the baby's birth. Stacked bars represent annual cumulative percentages.

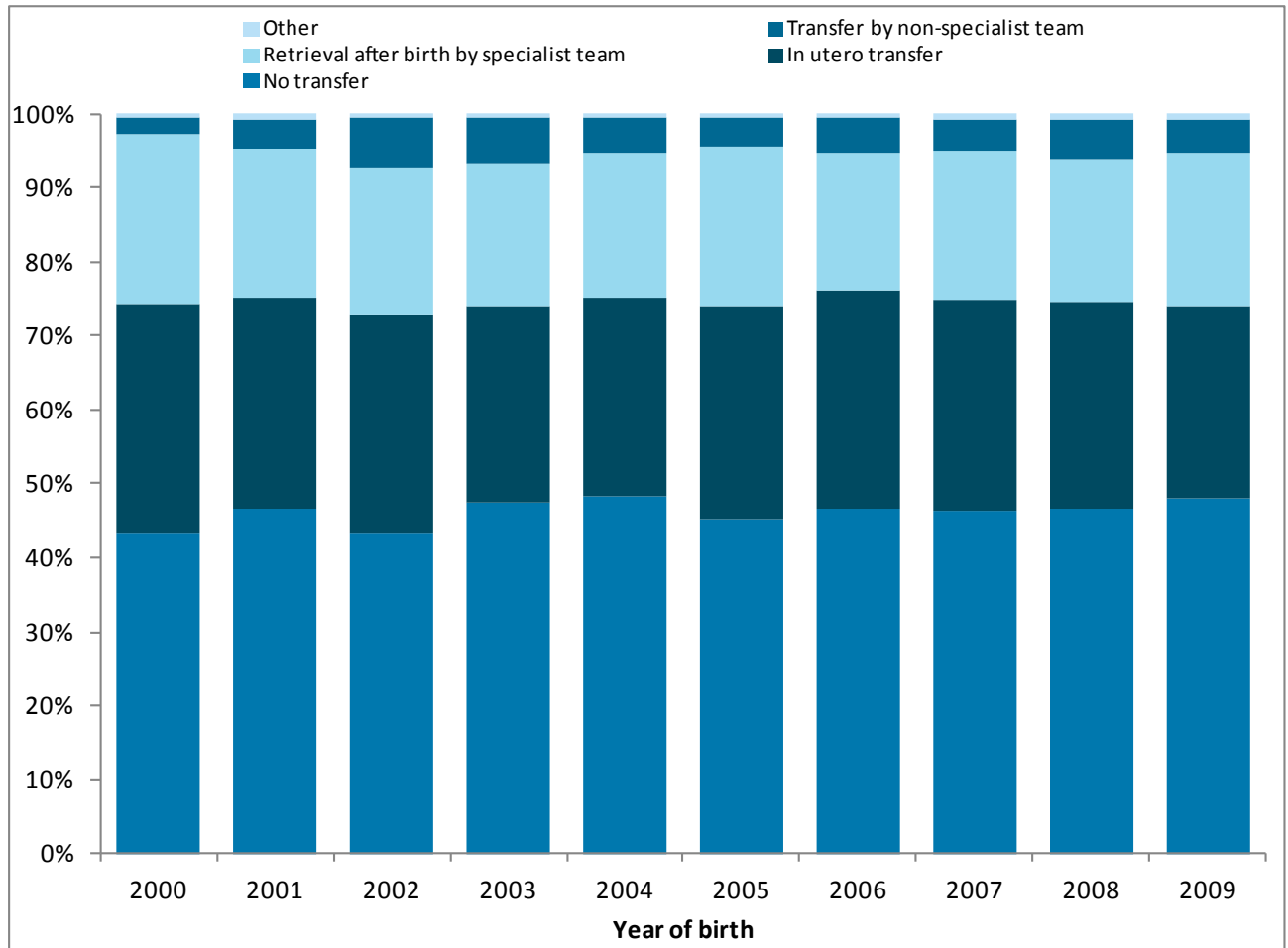
**FIGURE 30: Trends in multiple births of level III registrants by gestational age group, 2000–2009**



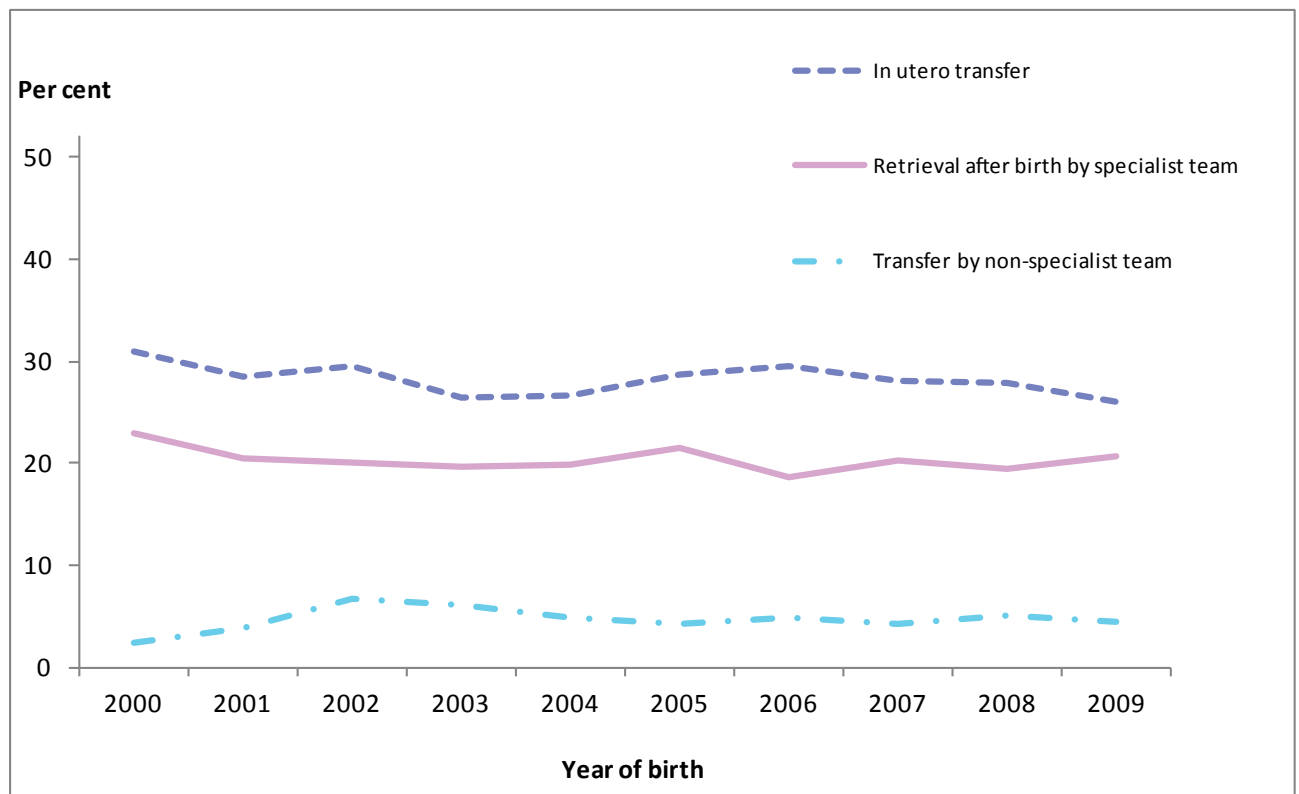
**FIGURE 31: Trends in method of birth for level III registrants by year of birth, 2000–2009**



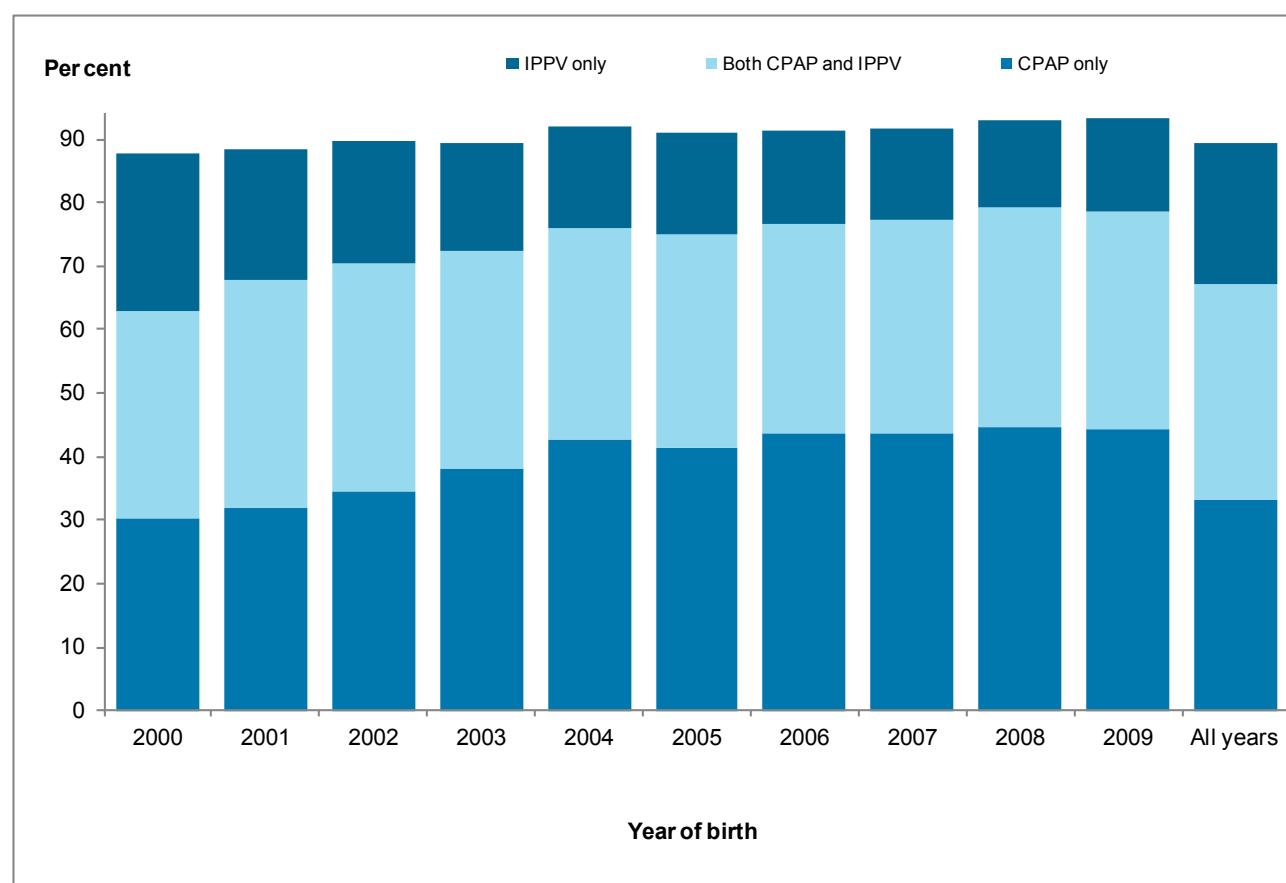
**FIGURE 32: Trends in referral source to level III NICU by year of birth, 2000–2009**



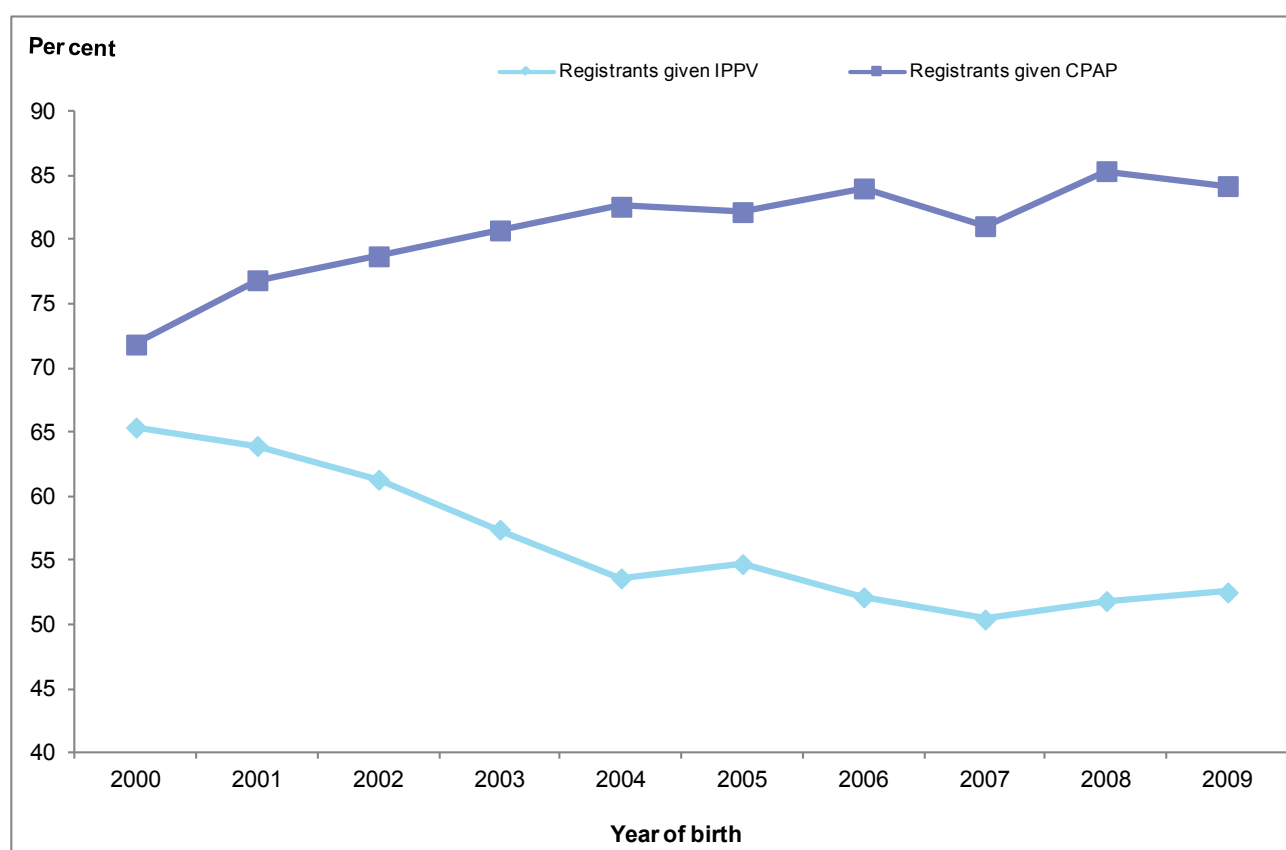
**FIGURE 33: Trends in mode of transport to level III NICU, 2000–2009**



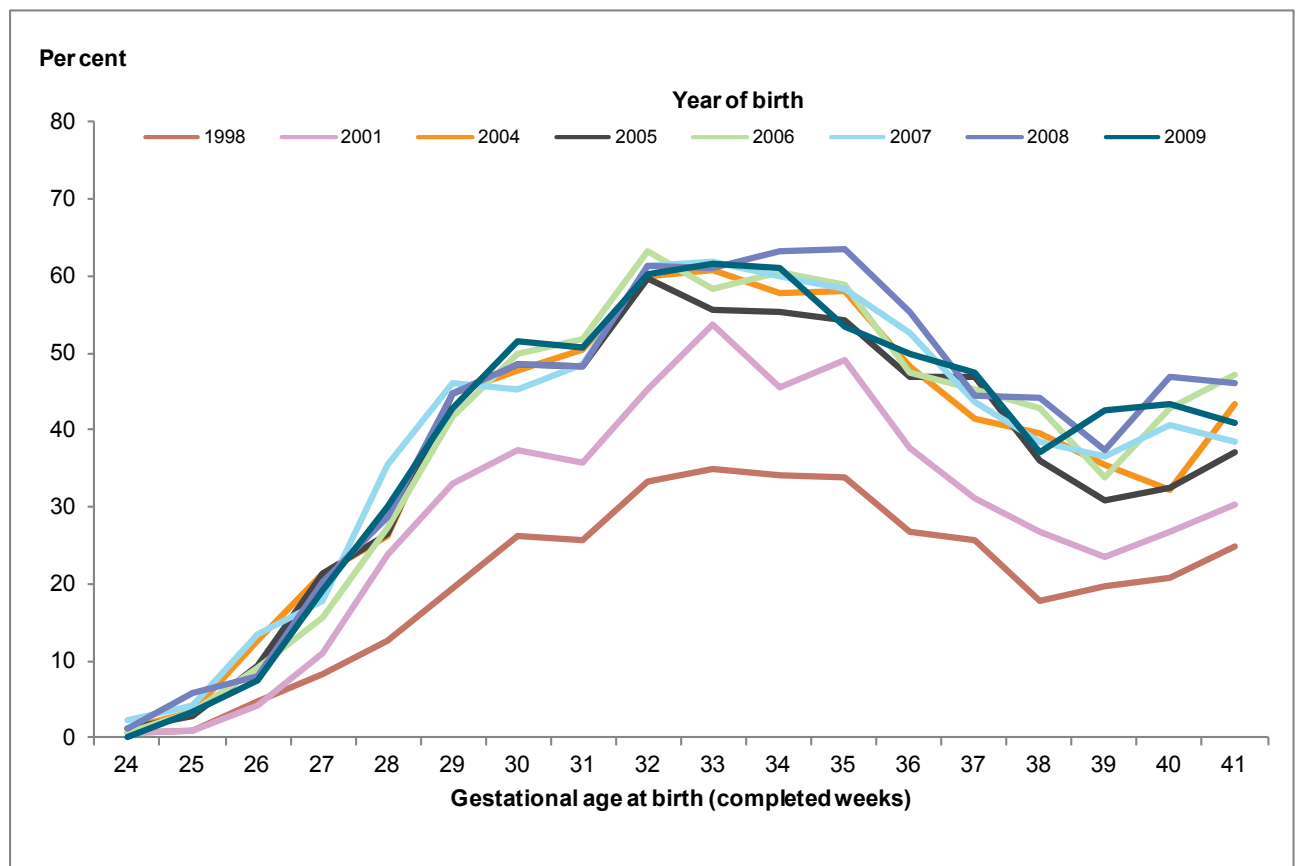
**FIGURE 34: Trends in mode of assisted ventilation for level III registrants, 2000–2009**



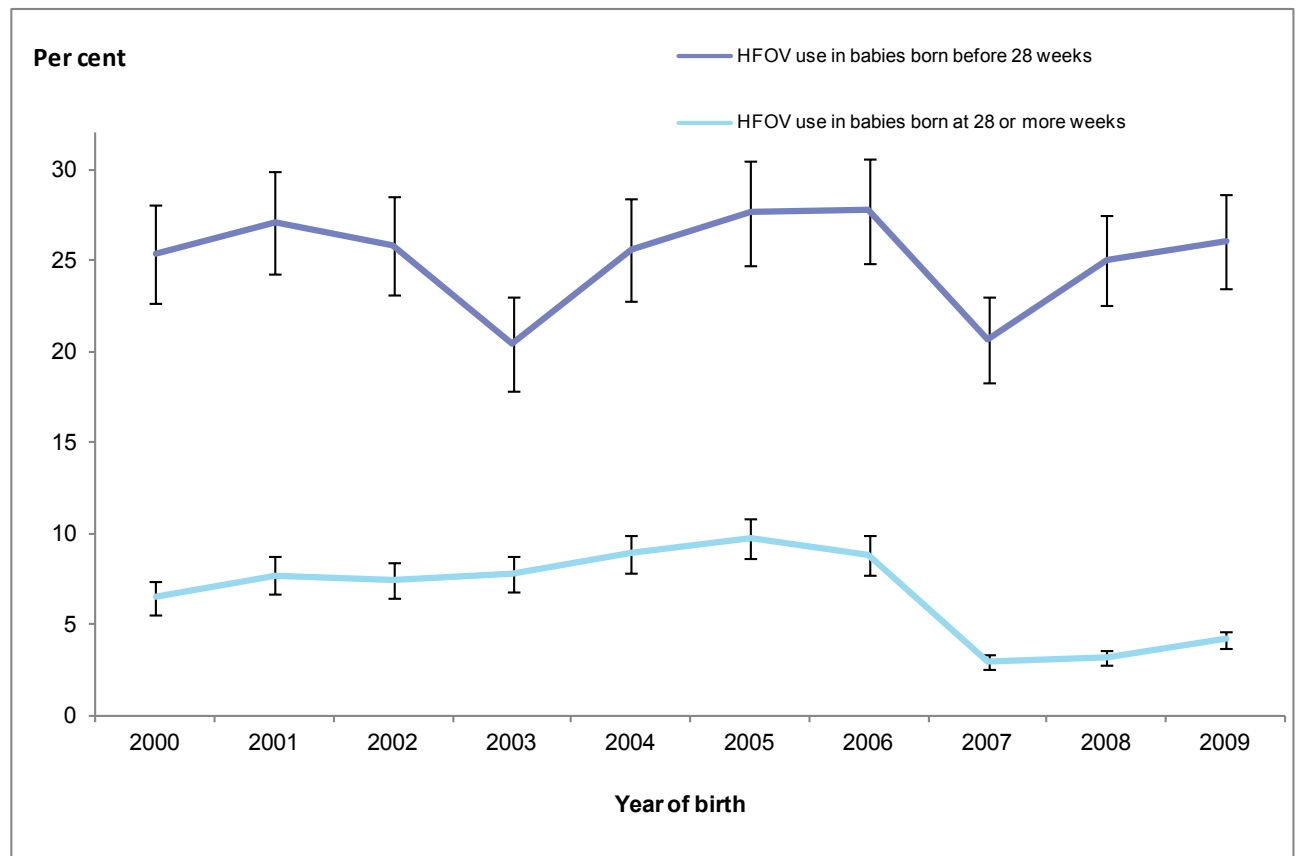
**FIGURE 35: Trends in provision of intermittent positive pressure ventilation and continuous positive pressure ventilation by year of birth for level III registrants ventilated, 2000–2009**



**FIGURE 36: Trends in the use of CPAP as the only form of ventilation by gestational age for level III registrants, 1998, 2001, 2004–2009**



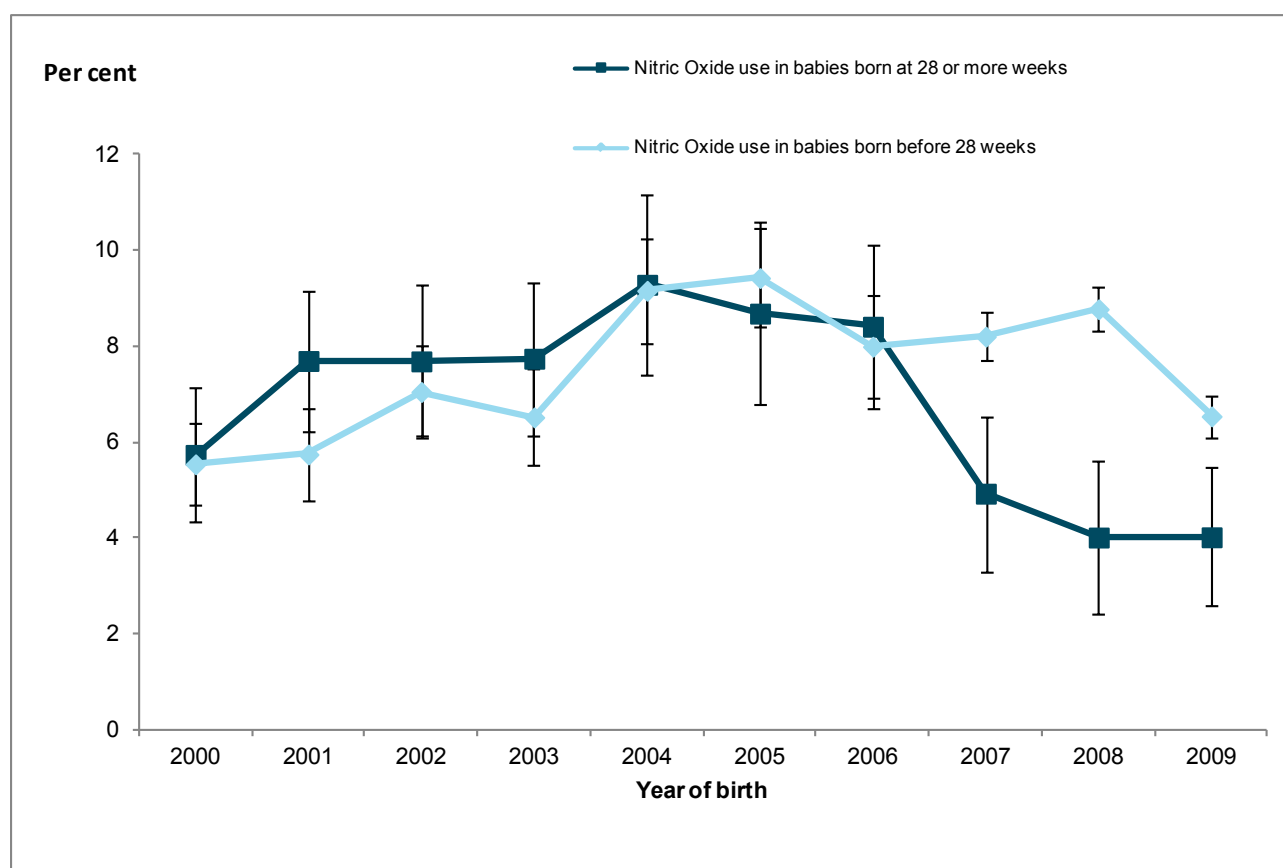
**FIGURE 37: Trends in provision of high frequency oscillatory ventilation (with 95% CI) for level III registrants, born before 28 weeks and at 28 or more weeks gestation, 2000–2009**



*Note: The results are given as the percentage of babies given IPPV.*

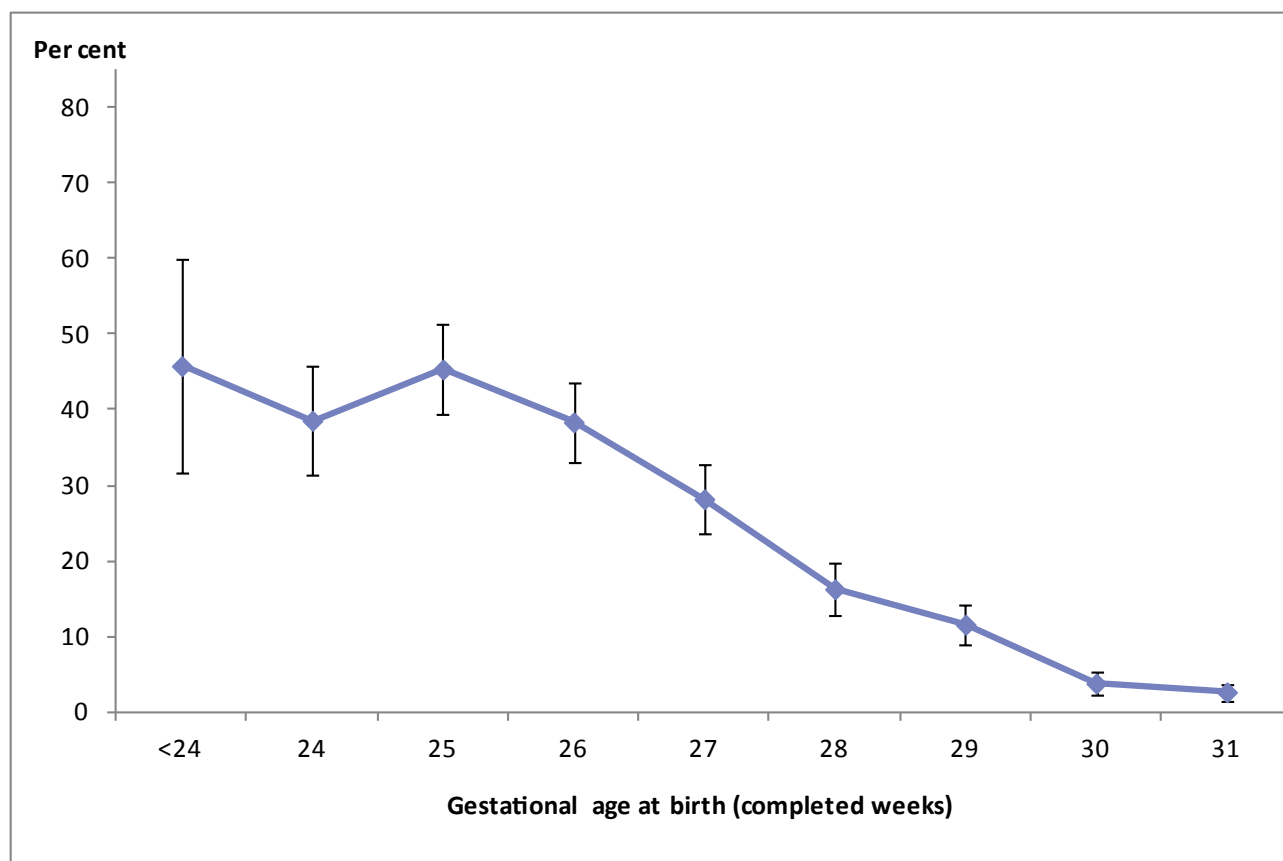


**FIGURE 38: Trends in nitric oxide (with 95% CI) provision for level III registrants born before 28 weeks and 28 or more weeks gestation, 2000–2009**

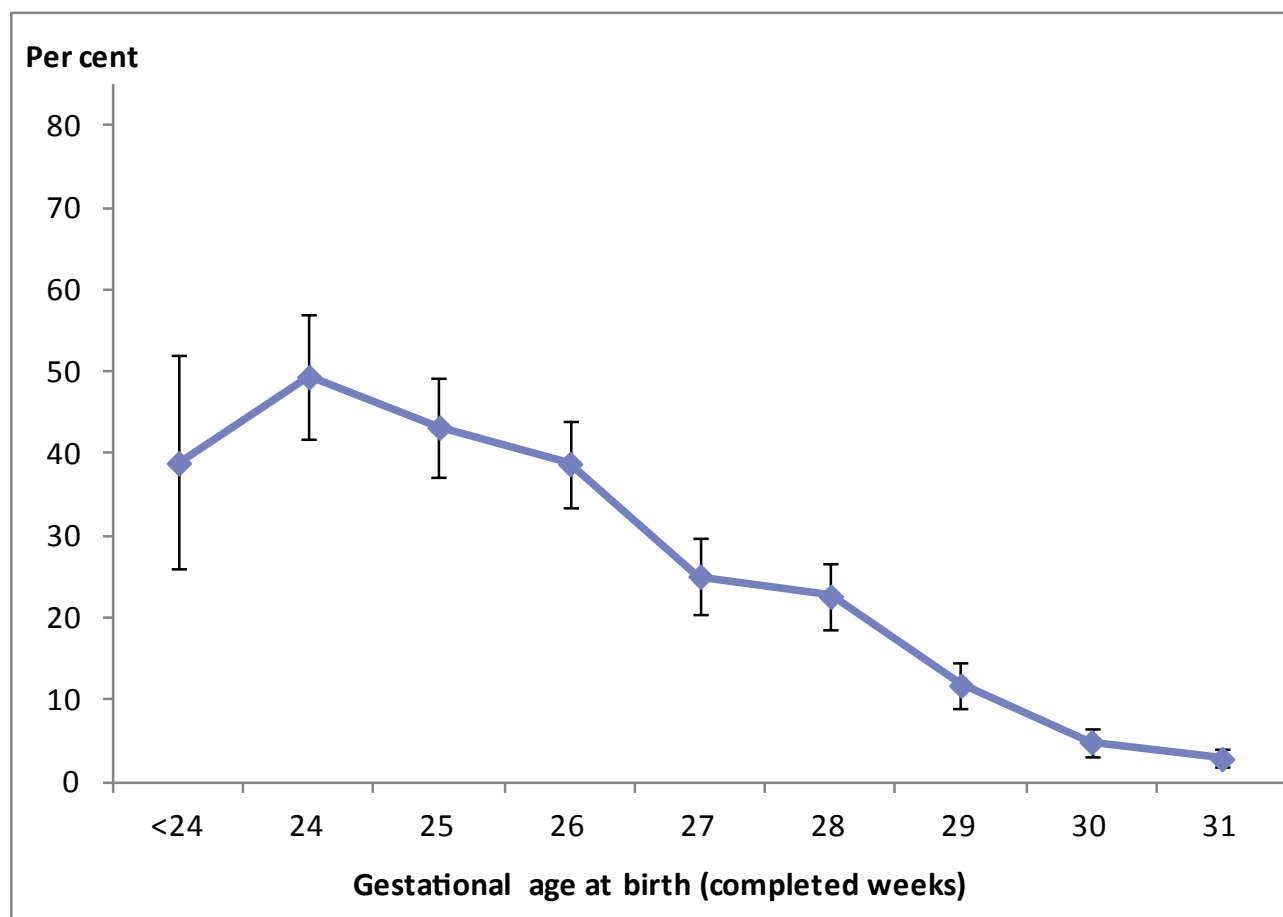


*Note: Results are given as the percentage of babies given IPPV.*

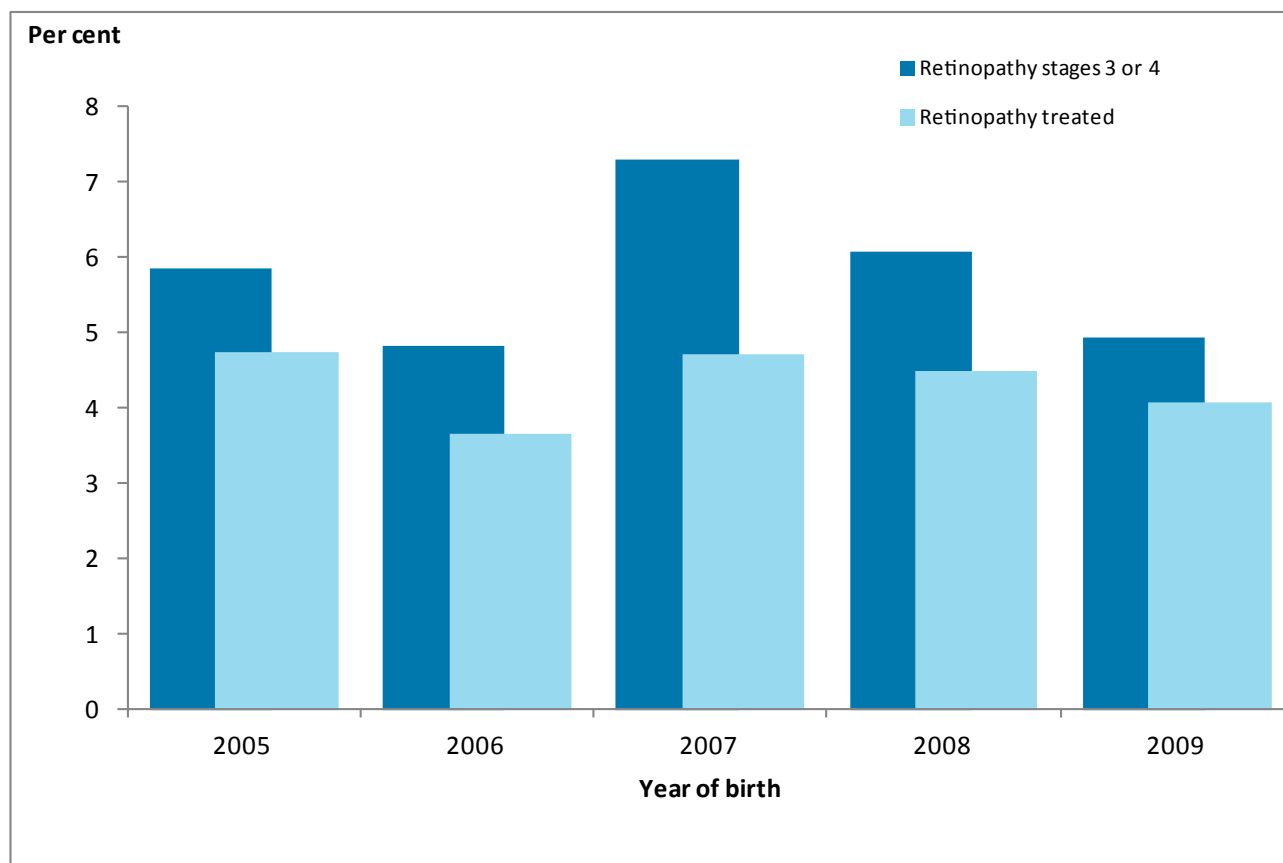
**FIGURE 39: Incidence of chronic lung disease (with 95% CI) for level III registrants by gestational age, 2008**



**FIGURE 40: Incidence of chronic lung disease (with 95% CI) for level III registrants by gestational age, 2009**

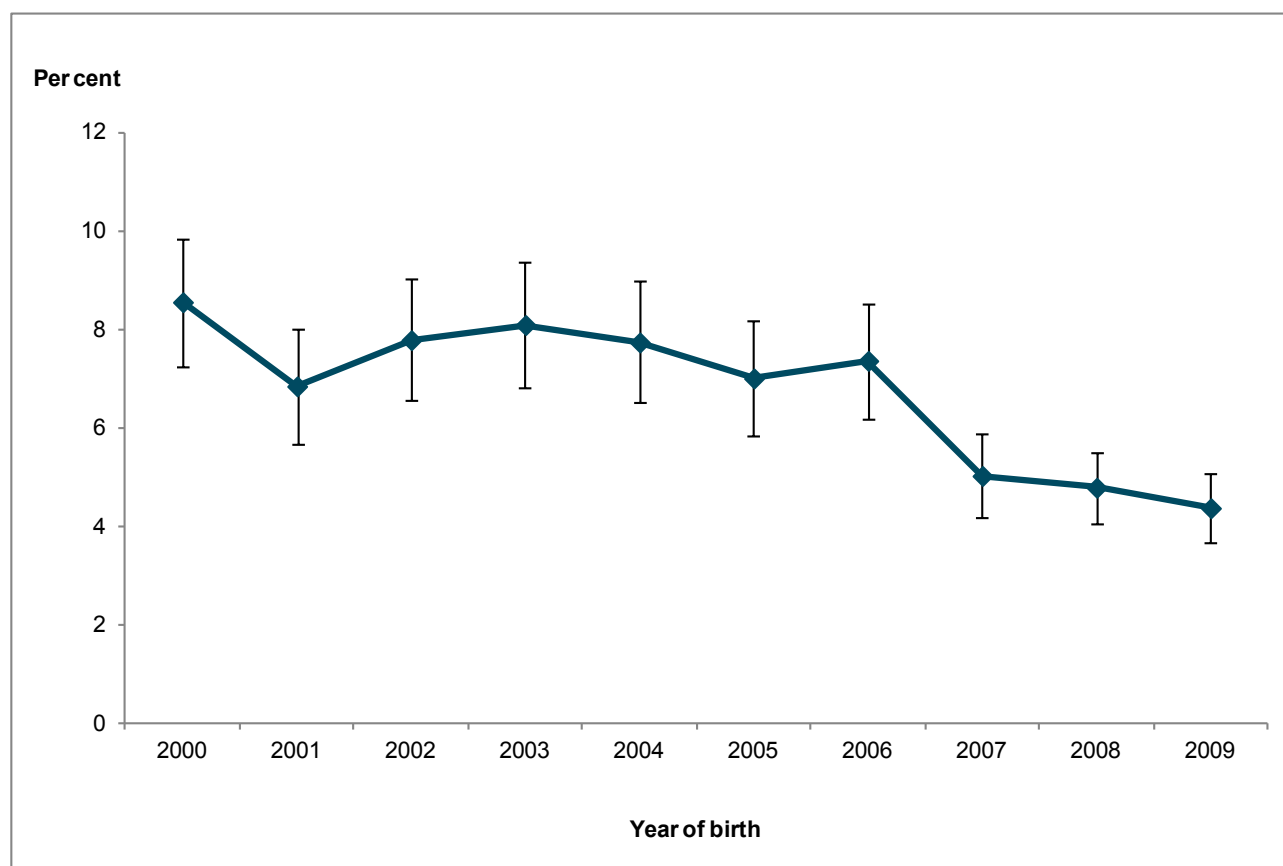


**FIGURE 41: Stage 3 or 4 retinopathy of prematurity and treated retinopathy among babies born before 31 weeks gestation and/or birthweight of less than 1,250 grams who survived to 36 weeks corrected age for level III registrants, 2005–2009**

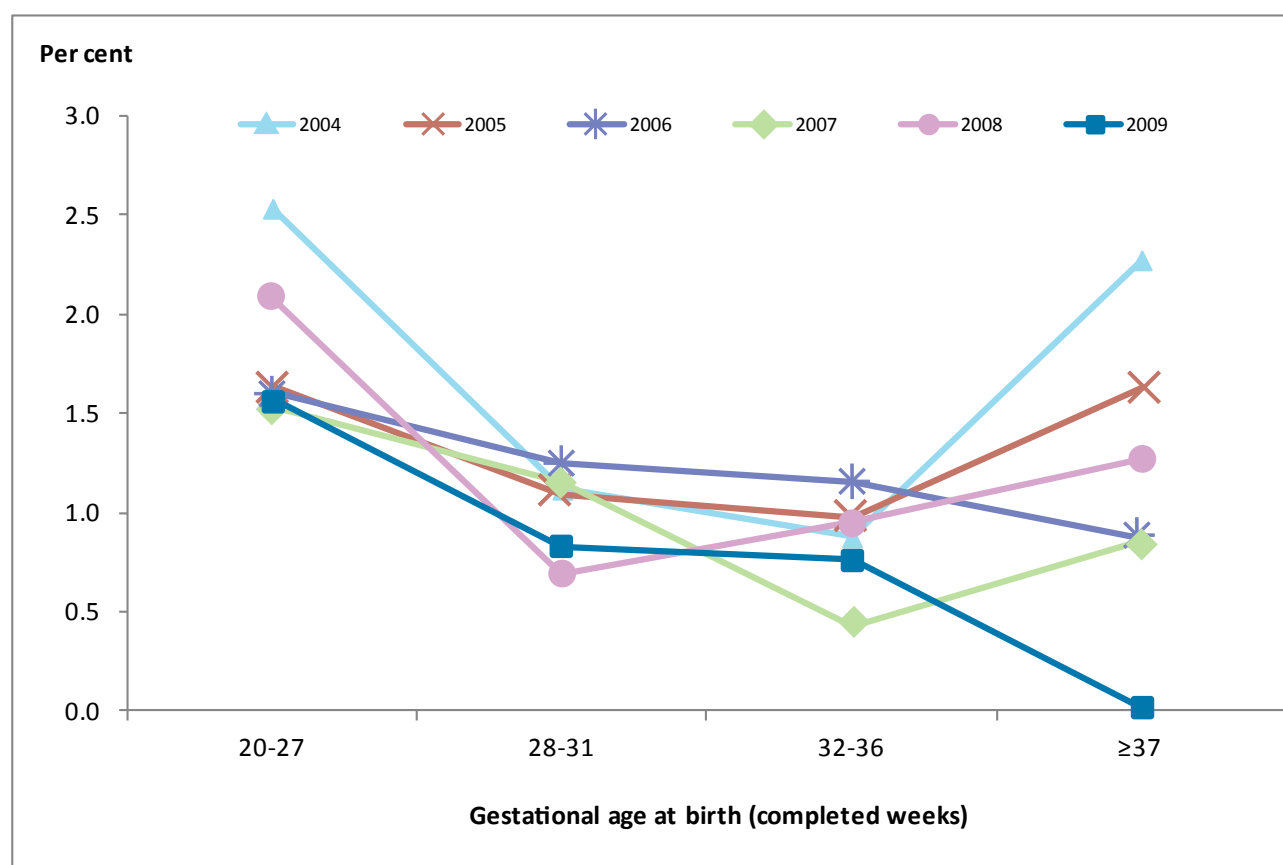


**Note:** To reflect the ROP examination criteria for ANZNN, the denominator for this figure has been updated to babies born before 31 weeks gestation and/or a birthweight of less than 1,250 grams. In previous ANZNN reports, the denominator for this figure was babies born before 32 weeks gestation.

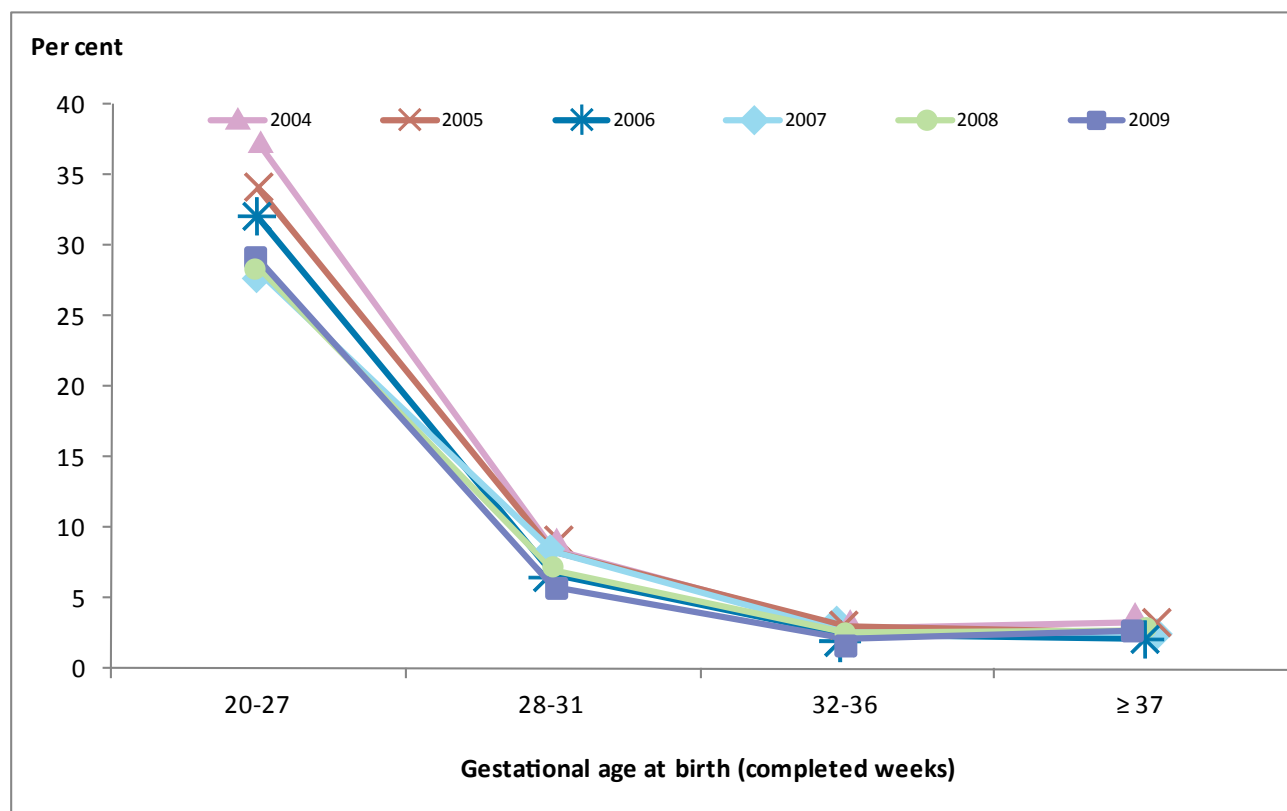
**FIGURE 42: Trends in grade 3 or 4 intraventricular haemorrhage (with 95% CI) in babies born at less than 32 weeks gestation who survived to day 3 for level III registrants, 2000–2009**



**FIGURE 43: Incidence of early sepsis for level III registrants by gestational age group, 2004–2009**



**FIGURE 44: Incidence of late sepsis for level III registrants by gestational age group, 2004–2009**



## Appendix 2: Data tables by birthweight, 2008 & 2009

**TABLE 72: Antenatal corticosteroid use for level III registrants by birthweight group, 2008**

Antenatal corticosteroids	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
None	4	36	56	95	126	277	507	659	767	495	271	3,293
Incomplete course	4	93	208	236	251	454	177	56	9	4	3	1,495
Course completed	18	211	341	415	488	650	229	84	28	11	4	2,479
Completed >7 days	7	46	86	121	142	238	118	79	25	10	2	874
Not stated	0	6	12	11	11	28	60	93	140	82	44	487
Total	33	392	703	878	1,018	1,647	1,091	971	969	602	324	8,628
Per cent												
None	12.1	9.3	8.1	11.0	12.5	17.1	49.2	75.1	92.5	95.2	96.8	40.4
Incomplete course	12.1	24.1	30.1	27.2	24.9	28.0	17.2	6.4	1.1	0.8	1.1	18.4
Course completed	54.5	54.7	49.3	47.9	48.5	40.1	22.2	9.6	3.4	2.1	1.4	30.5
Completed >7 days	21.2	11.9	12.4	14.0	14.1	14.7	11.4	9.0	3.0	1.9	0.7	10.7
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

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

**TABLE 73: Antenatal corticosteroid use for level III registrants by birthweight group, 2009**

Antenatal corticosteroids	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
	Number											
None	5	19	71	70	137	313	530	711	805	574	278	3,513
Incomplete course	8	100	199	212	241	422	214	60	16	4	1	1,477
Course completed	14	230	333	397	507	625	251	91	23	8	7	2,486
Completed >7 days	3	40	101	113	162	254	170	79	29	4	4	959
Not stated	1	1	9	10	17	37	55	128	138	109	46	551
Total	31	390	713	802	1,064	1,651	1,220	1,069	1,011	699	336	8,986
Per cent												
None	16.7	4.9	10.1	8.8	13.1	19.4	45.5	75.6	92.2	97.3	95.9	41.6
Incomplete course	26.7	25.7	28.3	26.8	23.0	26.1	18.4	6.4	1.8	0.7	0.3	17.5
Course completed	46.7	59.1	47.3	50.1	48.4	38.7	21.5	9.7	2.6	1.4	2.4	29.5
Completed >7 days	10.0	10.3	14.3	14.3	15.5	15.7	14.6	8.4	3.3	0.7	1.4	11.4
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 74: Plurality of level III registrants by birthweight group, 2008**

Plurality	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
Singleton	19	257	498	594	676	1,110	852	839	926	587	315	6,673
Twins	13	120	179	248	304	490	219	129	43	15	8	1,768
Triplets and higher orders	1	15	23	36	38	47	19	3	0	0	1	183
Not stated	0	0	3	0	0	0	1	0	0	0	0	4
Total	33	392	703	878	1,018	1,647	1,091	971	969	602	324	8,628
Per cent												
Singleton	57.6	65.6	70.8	67.7	66.4	67.4	78.1	86.4	95.6	97.5	97.2	77.3
Twins	39.4	30.6	25.6	28.2	29.9	29.8	20.1	13.3	4.4	2.5	2.5	20.5
Triplets and higher orders	3.0	3.8	3.3	4.1	3.7	2.9	1.7	0.3	0.0	0.0	0.3	2.1
Total	100.0	100.0	99.7	100.0	100.0	100.0	99.9	100.0	100.0	100.0	100.0	100.0

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

**TABLE 75: Plurality of level III registrants by birthweight group, 2009**

Plurality	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
	Number											
Singleton	20	272	510	545	697	1,084	906	939	961	671	327	6,932
Twins	8	99	186	226	322	497	286	125	49	28	9	1,835
Triplets and higher orders	3	19	17	31	45	70	28	4	1	0	0	218
Not stated	0	0	0	0	0	0	0	1	0	0	0	1
<b>Total</b>	<b>31</b>	<b>390</b>	<b>713</b>	<b>802</b>	<b>1,064</b>	<b>1,651</b>	<b>1,220</b>	<b>1,069</b>	<b>1,011</b>	<b>699</b>	<b>336</b>	<b>8,986</b>
Per cent												
Singleton	64.5	69.7	71.5	68.0	65.5	65.7	74.3	87.8	95.1	96.0	97.3	77.1
Twins	25.8	25.4	26.1	28.2	30.3	30.1	23.4	11.7	4.8	4.0	2.7	20.4
Triplets and higher orders	9.7	4.9	2.4	3.9	4.2	4.2	2.3	0.4	0.1	0.0	0.0	2.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>99.9</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

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

**TABLE 76: Method of delivery for level III registrants by birthweight group, 2008**

Method of Delivery	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
Vaginal	7	145	237	272	307	573	419	389	392	262	124	3,127
Vaginal instrumental birth	0	6	8	10	32	46	57	61	86	71	33	410
Caesarean in labour	2	76	152	191	246	365	227	216	208	121	87	1,891
Caesarean no labour	24	165	300	404	430	655	378	286	260	137	73	3,112
Not stated	0	0	6	1	3	8	10	19	23	11	7	88
<b>Total</b>	<b>33</b>	<b>392</b>	<b>703</b>	<b>878</b>	<b>1,018</b>	<b>1,647</b>	<b>1,091</b>	<b>971</b>	<b>969</b>	<b>602</b>	<b>324</b>	<b>8,628</b>
Per cent												
Vaginal	21.2	37.0	34.0	31.0	30.2	35.0	38.8	40.9	41.4	44.3	39.1	36.6
Vaginal instrumental birth	0.0	1.5	1.1	1.1	3.2	2.8	5.3	6.4	9.1	12.0	10.4	4.8
Caesarean in labour	6.1	19.4	21.8	21.8	24.2	22.3	21.0	22.7	22.0	20.5	27.4	22.1
Caesarean no labour	72.7	42.1	43.0	46.1	42.4	40.0	35.0	30.0	27.5	23.2	23.0	36.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

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

**TABLE 77: Method of delivery for level III registrants by birthweight group, 2009**

Method of Delivery	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
Vaginal	8	159	244	218	329	584	437	411	398	287	137	3,212
Vaginal instrumental birth	0	3	5	15	20	66	56	58	84	72	41	420
Caesarean in labour	2	72	169	193	257	374	290	246	225	187	78	2,093
Caesarean no labour	21	156	294	373	456	624	428	336	278	144	74	3,184
Not stated	0	0	1	3	2	3	9	18	26	9	6	77
Total	31	390	713	802	1,064	1,651	1,220	1,069	1,011	699	336	8,986
Per cent												
Vaginal	25.8	40.8	34.3	27.3	31.0	35.4	36.1	39.1	40.4	41.6	41.5	36.1
Vaginal instrumental birth	0.0	0.8	0.7	1.9	1.9	4.0	4.6	5.5	8.5	10.4	12.4	4.7
Caesarean in labour	6.5	18.5	23.7	24.2	24.2	22.7	23.9	23.4	22.8	27.1	23.6	23.5
Caesarean no labour	67.7	40.0	41.3	46.7	42.9	37.9	35.3	32.0	28.2	20.9	22.4	35.7
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

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

**TABLE 78: Level of hospital of birth for level III registrants by birthweight group, 2008**

Level of hospital	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
Tertiary	30	362	615	743	899	1422	845	653	579	370	206	6,724
Non-tertiary	2	28	80	128	113	215	239	313	379	224	116	1,837
Born before arrival	1	2	1	5	5	7	6	3	9	7	2	48
Not stated	0	0	7	2	1	3	1	2	2	1	0	19
Total	33	392	703	878	1,018	1,647	1,091	971	969	602	324	8,628
Per cent												
Tertiary	90.9	92.3	88.4	84.8	88.4	86.5	77.5	67.4	59.9	61.6	63.6	78.1
Non-tertiary	6.1	7.1	11.5	14.6	11.1	13.1	21.9	32.3	39.2	37.3	35.8	21.3
Born before arrival	3.0	0.5	0.1	0.6	0.5	0.4	0.6	0.3	0.9	1.2	0.6	0.6
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 79: Level of hospital of birth for level III registrants by birthweight group, 2009**

Level of hospital	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
Tertiary	29	358	626	695	934	1,404	929	695	610	421	206	6,907
Non-tertiary	2	31	77	98	117	230	270	364	387	264	125	1,965
Born before arrival	0	0	8	9	13	15	18	9	11	14	5	102
Not stated	0	1	2	0	0	2	3	1	3	0	0	12
Total	31	390	713	802	1,064	1,651	1,220	1,069	1,011	699	336	8,986
Per cent												
Tertiary	93.5	92.0	88.0	86.7	87.8	85.1	76.3	65.1	60.5	60.2	61.3	77.0
Non-tertiary	6.5	8.0	10.8	12.2	11.0	13.9	22.2	34.1	38.4	37.8	37.2	21.9
Born before arrival	0.0	0.0	1.1	1.1	1.2	0.9	1.5	0.8	1.1	2.0	1.5	1.1
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 80: Mode of transport for level III registrants to level III unit after birth by birthweight group, 2008

Mode of transport	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
Not transported	29	346	602	716	870	1,380	794	610	521	338	187	6,393
Specialist retrieval team	2	26	71	113	101	196	234	284	345	204	98	1,674
Non-specialist retrieval	1	12	19	33	32	51	44	68	94	49	35	438
Other	0	5	3	6	10	16	15	7	7	7	2	78
Not stated	1	3	8	10	5	4	4	2	2	4	2	45
Total	33	392	703	878	1,018	1,647	1,091	971	969	602	324	8,628
Per cent												
Not transported	90.6	88.9	86.6	82.5	85.9	84.0	73.0	63.0	53.9	56.5	58.1	74.5
Specialist retrieval team	6.3	6.7	10.2	13.0	10.0	11.9	21.5	29.3	35.7	34.1	30.4	19.5
Non-specialist retrieval	3.1	3.1	2.7	3.8	3.2	3.1	4.0	7.0	9.7	8.2	10.9	5.1
Other	0.0	1.3	0.4	0.7	1.0	1.0	1.4	0.7	0.7	1.2	0.6	0.9
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 81: Mode of transport for level III registrants to level III unit after birth by birthweight group, 2009

Mode of transport	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
Not transported	29	350	615	681	925	1,373	900	642	547	384	190	6,636
Specialist retrieval team	2	26	69	94	105	216	260	346	368	259	114	1,859
Non-specialist retrieval	0	11	16	19	26	44	41	73	85	53	30	398
Other	0	2	11	6	7	17	16	7	8	3	2	79
Not stated	0	1	2	2	1	1	3	1	3	0	0	14
Total	31	390	713	802	1,064	1,651	1,220	1,069	1,011	699	336	8,986
Per cent												
Not transported	93.5	90.0	86.5	85.1	87.0	83.2	74.0	60.1	54.3	54.9	56.5	74.0
Specialist retrieval team	6.5	6.7	9.7	11.8	9.9	13.1	21.4	32.4	36.5	37.1	33.9	20.7
Non-specialist retrieval	0.0	2.8	2.3	2.4	2.4	2.7	3.4	6.8	8.4	7.6	8.9	4.4
Other	0.0	0.5	1.5	0.8	0.7	1.0	1.3	0.7	0.8	0.4	0.6	0.9
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 82: Exogenous surfactant use by level III registrants by birthweight group, 2008**

Exogenous surfactant	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
	Number											
None	8	41	144	388	672	1,189	881	819	829	538	286	5,795
Curosurf	20	284	429	363	221	259	146	109	84	39	16	1,970
Survanta	4	63	121	120	114	190	59	39	53	23	19	805
Surv+Curo	0	1	3	1	5	4	2	2	1	1	1	21
Exosurf	0	0	0	1	0	1	0	2	0	0	0	4
Any combination	0	2	2	2	0	1	0	0	0	0	0	7
Not stated	1	1	4	3	6	3	3	0	2	1	2	26
Total	33	392	703	878	1,018	1,647	1,091	971	969	602	324	8,628
Per cent												
None	25.0	10.5	20.6	44.3	66.4	72.3	81.0	84.3	85.7	89.5	88.8	67.4
Curosurf	62.5	72.6	61.4	41.5	21.8	15.8	13.4	11.2	8.7	6.5	5.0	22.9
Survanta	12.5	16.1	17.3	13.7	11.3	11.6	5.4	4.0	5.5	3.8	5.9	9.4
SurvCuro	0.0	0.3	0.4	0.1	0.5	0.2	0.2	0.2	0.1	0.2	0.3	0.2
Exosurf	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0
Any combination	0.0	0.5	0.3	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1
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 83: Exogenous surfactant use by level III registrants by birthweight group, 2009**

Exogenous surfactant	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
None	3	36	151	357	718	1,180	939	856	863	593	279	5,975
Curosurf	24	282	444	337	252	334	182	138	88	71	34	2,186
Survanta	4	71	109	103	92	133	93	69	59	34	22	789
Surv+Curo	0	1	1	2	1	2	4	3	1	1	0	16
Exosurf	0	0	2	0	0	0	1	0	0	0	0	3
Any combination	0	0	2	3	0	1	0	2	0	0	0	8
Not stated	0	0	4	0	1	1	1	1	0	0	1	9
Total	31	390	713	802	1,064	1,651	1,220	1,069	1,011	699	336	8,986
Per cent												
None	9.7	9.2	21.3	44.5	67.5	71.5	77.0	80.1	85.4	84.8	83.3	66.6
Curosurf	77.4	72.3	62.6	42.0	23.7	20.2	14.9	12.9	8.7	10.2	10.1	24.4
Survanta	12.9	18.2	15.4	12.8	8.7	8.1	7.6	6.5	5.8	4.9	6.6	8.8
SurvCuro	0.0	0.3	0.1	0.2	0.1	0.1	0.3	0.3	0.1	0.1	0.0	0.2
Exosurf	0.0	0.0	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Any combination	0.0	0.0	0.3	0.4	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.1
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 84: Assisted ventilation for level III registrants by birthweight group, 2008**

Assisted ventilation	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
CPAP	24	309	630	762	798	1,361	895	752	664	412	242	6,849
IPPV	29	359	580	508	386	581	393	410	497	283	134	4,160
Oxygen given	27	324	563	524	451	793	566	557	585	339	198	4,927
HFOV	14	147	115	42	27	25	22	35	45	32	8	512
NO	6	53	36	27	20	27	24	51	79	50	31	404
ECMO	0	0	0	0	0	0	1	4	2	1	2	10
Total	33	392	703	878	1,018	1,647	1,091	971	969	602	324	8,628
Per cent												
CPAP	72.7	78.8	89.6	86.8	78.4	82.6	82.0	77.4	68.5	68.4	74.7	79.4
IPPV	87.9	91.6	82.5	57.9	37.9	35.3	36.0	42.2	51.3	47.0	41.4	48.2
Oxygen given	81.8	82.7	80.1	59.7	44.3	48.1	51.9	57.4	60.4	56.3	61.1	57.1
Per cent of babies given IPPV												
HFOV	48.3	40.9	19.8	8.3	7.0	4.3	5.6	8.5	9.1	11.3	6.0	12.3
NO	20.7	14.8	6.2	5.3	5.2	4.6	6.1	12.4	15.9	17.7	23.1	9.7
ECMO	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	0.4	0.4	1.5	0.2

**TABLE 85: Assisted ventilation for level III registrants by birthweight group, 2009**

Assisted ventilation	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
CPAP	15	314	648	714	803	1,383	1,018	766	685	476	230	7,052
IPPV	29	369	585	459	378	591	451	505	516	355	161	4,399
Oxygen given	29	363	606	554	584	997	798	747	710	513	247	6,148
HFOV	17	138	142	47	28	42	33	47	54	48	30	626
NO	5	26	39	20	19	20	26	56	71	71	37	390
ECMO	0	0	0	0	0	1	1	5	4	5	1	17
Total	31	390	713	802	1,064	1,651	1,220	1,069	1,011	699	336	8,986
Per cent												
CPAP	48.4	80.5	90.9	89.0	75.5	83.8	83.4	71.7	67.8	68.1	68.5	78.5
IPPV	93.5	94.6	82.0	57.2	35.5	35.8	37.0	47.2	51.0	50.8	47.9	49.0
Oxygen given	93.5	93.1	85.0	69.1	54.9	60.4	65.4	69.9	70.2	73.4	73.5	68.4
Per cent of babies given IPPV												
HFOV	58.6	37.4	24.3	10.2	7.4	7.1	7.3	9.3	10.5	13.5	18.6	14.2
NO	17.2	7.0	6.7	4.4	5.0	3.4	5.8	11.1	13.8	20.0	23.0	8.9
ECMO	0.0	0.0	0.0	0.0	0.0	0.2	0.2	1.0	0.8	1.4	0.6	0.4

TABLE 86: Medians and interquartile ranges of assisted ventilation for level III registrants by birthweight group, 2008

Median & Interquartile range (IQR)	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
IPPV (hours)												
Median	467	286	75.5	31	22	24	37	45.5	50	43	41.5	43
IQR	258–790	58–653	20–307	12–95.5	11–58	12–61	17–76	18–95	23–92	19–103	20–89	16–119
CPAP (hours)												
Median	1,079	1,065	820.5	281	82	39	25	22	22	15	17	47
IQR	149.5–1,299	559–1,444	320–1,132	69–692	23–212	15–92	11–62	10–57	8–52.5	7–38	8–38	15–173
Oxygen (days)												
Median	97	70	50	19	3	2	2	3	3	2	2	3
IQR	24–119.5	25–113	20–85	2–44	1–16	1–5	1–5	1–5	1–7	1–6	1–7	1–19

TABLE 87: Medians and interquartile ranges of assisted ventilation for level III registrants by birthweight group, 2009

Median and Interquartile range (IQR)	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
IPPV (hours)												
Median	153	253	84	31	22	25	36	45	49.5	41	51	45
IQR	18–439	56–647	23–287	14–91	11–55	13–67	16–70	19–86	23–98	17–100	22–100	18–98
CPAP (hours)												
Median	1,134	1,084	833.5	284.5	70	32	24	22	18	18	18	32
IQR	59–1,756	625–1,394	380–1,131.5	65–683	21–200	13–90	11–62	9–50	8–45	8–41	9–36	13–90
Oxygen (days)												
Median	22	73	52	19	4	3	3	3	4	3	3	4
IQR	4–96	30–113	20–84	3–48	2–17	1–6	2–6	2–6	2–7	2–8	2–8	2–8

TABLE 88: Chronic lung disease for level III registrants by birthweight group, 2008

Chronic lung disease (CLD)	Birthweight group (grams)							Total
	<500	500–749	750–999	1000–1249	1250–1499	1500–1999	≥2000	
Number								
No CLD	16	202	467	758	981	1,625	3,955	8,004
CLD	17	190	236	120	37	22	2	624
▪ CLD & survived	15	177	232	119	37	20	2	602
▪ CLD and died	2	13	4	1	0	2	0	22
<b>Total</b>	<b>33</b>	<b>392</b>	<b>703</b>	<b>878</b>	<b>1,018</b>	<b>1,647</b>	<b>3,957</b>	<b>8,628</b>
Per cent								
No CLD	48.5	51.5	66.4	86.3	96.4	98.7	99.9	92.8
CLD	51.5	48.5	33.6	13.7	3.6	1.3	0.1	7.2
▪ CLD & survived	88.2	93.2	98.3	99.2	100.0	90.9	100.0	96.5
▪ CLD and died	11.8	6.8	1.7	0.8	0.0	9.1	0.0	3.5

TABLE 89: Chronic lung disease for level III registrants by birthweight group, 2009

Chronic lung disease (CLD)	Birthweight group (grams)							Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	≥2000	
Number								
No CLD	22	187	467	684	1,030	1,630	4,332	8,352
CLD	9	203	246	118	34	21	3	634
▪ CLD & survived	8	198	239	115	33	19	3	615
▪ CLD and died	1	5	7	3	1	2	0	19
Total	31	390	713	802	1,064	1,651	4,335	8,986
Per cent								
No CLD	71.0	47.9	65.5	85.3	96.8	98.7	99.9	92.9
CLD	29.0	52.1	34.5	14.7	3.2	1.3	0.1	7.1
▪ CLD & survived	88.9	97.5	97.2	97.5	97.1	90.5	100.0	97.0
▪ CLD and died	11.1	2.5	2.8	2.5	2.9	9.5	0.0	3.0

**TABLE 90: Supplemental oxygen therapy for level III registrants by gestational age group, 2008**

Oxygen therapy	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
No oxygen on day 28	2	41	118	341	560	841	513	397	370	257	123	3,563
Oxygen on day 28	30	343	575	532	455	801	573	569	592	343	198	5,011
▪ survived to discharge home	18	226	499	492	433	763	532	526	538	317	189	4,533
▪ died before discharge	12	117	76	40	22	38	41	43	54	26	9	478
Not stated	1	8	10	5	3	5	5	5	7	2	3	54
Total	33	392	703	878	1,018	1,647	1,091	971	969	602	324	8,628
Number												
Babies given home oxygen	5	62	70	20	13	9	3	5	9	4	3	203
Per cent												
No oxygen on day 28	6.3	10.7	17.0	39.1	55.2	51.2	47.2	41.1	38.5	42.8	38.3	41.6
Oxygen on day 28	93.8	89.3	83.0	60.9	44.8	48.8	52.8	58.9	61.5	57.2	61.7	58.4
▪ survived to discharge home	60.0	65.9	86.8	92.5	95.2	95.3	92.8	92.4	90.9	92.4	95.5	90.5
▪ died before discharge	40.0	34.1	13.2	7.5	4.8	4.7	7.2	7.6	9.1	7.6	4.5	9.5
Per cent												
Babies given home oxygen	27.8	27.4	14.0	4.1	3.0	1.2	0.6	1.0	1.7	1.3	1.6	4.5

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

**TABLE 91: Supplemental oxygen therapy for level III registrants by gestational age group, 2009**

Birthweight group (grams)												
Oxygen therapy	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	Total
Number												
No oxygen on day 28	3	35	225	538	941	1,532	1,143	983	939	633	309	7,281
Oxygen on day 28	28	355	488	264	123	119	77	85	72	66	27	1,704
▪ survived to discharge home	10	258	401	231	96	63	28	34	33	16	8	1,178
▪ died before discharge	18	97	87	33	27	56	49	51	39	50	19	526
Not stated	0	0	0	0	0	0	0	1	0	0	0	1
Total	31	390	713	802	1,064	1,651	1,220	1,069	1,011	699	336	8,986
Number												
Babies given home oxygen	4	70	69	22	12	11	1	12	6	5	6	218
Per cent												
No oxygen on day 28	9.7	9.0	31.6	67.1	88.4	92.8	93.7	92.0	92.9	90.6	92.0	81.0
Oxygen on day 28	90.3	91.0	68.4	32.9	11.6	7.2	6.3	8.0	7.1	9.4	8.0	19.0
▪ survived to discharge home	35.7	72.7	82.2	87.5	78.0	52.9	36.4	40.0	45.8	24.2	29.6	69.1
▪ died before discharge	64.3	27.3	17.8	12.5	22.0	47.1	63.6	60.0	54.2	75.8	70.4	30.9
Per cent												
Babies given home oxygen	40.0	27.1	17.2	9.5	12.5	17.5	3.6	35.3	18.2	31.3	75.0	18.5

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

**TABLE 92: Transfer after registration of level III registrants by level of destination hospital by birthweight group, 2008**

Method of Delivery	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
Not transferred	23	268	393	412	403	709	622	631	698	442	239	4,840
Level III hospital	2	10	28	39	38	28	18	13	12	4	3	195
Level II hospital	5	81	253	413	561	878	427	282	205	123	66	3,294
Children's hospital	2	33	29	14	16	32	24	45	54	33	16	298
Not stated	1	0	0	0	0	0	0	0	0	0	0	1
Total	33	392	703	878	1,018	1,647	1,091	971	969	602	324	8,628
Per cent												
Not transferred	71.9	68.4	55.9	46.9	39.6	43.0	57.0	65.0	72.0	73.4	73.8	56.1
Level III hospital	6.3	2.6	4.0	4.4	3.7	1.7	1.6	1.3	1.2	0.7	0.9	2.3
Level II hospital	15.6	20.7	36.0	47.0	55.1	53.3	39.1	29.0	21.2	20.4	20.4	38.2
Children's hospital	6.3	8.4	4.1	1.6	1.6	1.9	2.2	4.6	5.6	5.5	4.9	3.5
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

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

**TABLE 93: Transfer after registration of level III registrants by level of destination hospital by birthweight group, 2009**

Method of Delivery	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
	Number											
Not transferred	26	238	363	326	446	707	676	693	710	511	253	4,949
Level III hospital	0	11	45	37	22	34	19	15	11	9	3	206
Level II hospital	2	95	270	423	577	876	489	322	227	136	67	3,484
Children's hospital	3	45	35	16	19	34	36	39	63	43	13	346
Not stated	0	1	0	0	0	0	0	0	0	0	0	1
Total	31	390	713	802	1,064	1,651	1,220	1,069	1,011	699	336	8,986
Per cent												
Not transferred	83.9	61.2	50.9	40.6	41.9	42.8	55.4	64.8	70.2	73.1	75.3	55.1
Level III hospital	0.0	2.8	6.3	4.6	2.1	2.1	1.6	1.4	1.1	1.3	0.9	2.3
Level II hospital	6.5	24.4	37.9	52.7	54.2	53.1	40.1	30.1	22.5	19.5	19.9	38.8
Children's hospital	9.7	11.6	4.9	2.0	1.8	2.1	3.0	3.6	6.2	6.2	3.9	3.9
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 94: Retinopathy of prematurity for level III registrants by birthweight group, 2008**

Retinopathy of prematurity (ROP)	Birthweight group (grams)						Total
	<500	500-749	750-999	1000-1249	1250-1499	≥1500	
Number							
No ROP	5	67	265	453	387	245	1,422
▪ Stage 1 ROP	3	58	110	115	53	18	357
▪ Stage 2 ROP	5	89	151	64	23	6	338
▪ Stage 3 ROP	8	59	56	5	2	0	130
▪ Stage 4 ROP	0	3	4	0	1	0	8
Not examined	0	6	36	156	395	5,181	5,774
Not stated	12	110	81	85	157	154	599
<b>Total</b>	<b>33</b>	<b>392</b>	<b>703</b>	<b>878</b>	<b>1,018</b>	<b>5,604</b>	<b>8,628</b>
Number							
Treatment for ROP	7	47	44	2	3	0	103
Per cent							
No ROP	23.8	24.3	45.2	71.1	83.0	91.1	63.1
▪ Stage 1 ROP	14.3	21.0	18.8	18.1	11.4	6.7	15.8
▪ Stage 2 ROP	23.8	32.2	25.8	10.0	4.9	2.2	15.0
▪ Stage 3 ROP	38.1	21.4	9.6	0.8	0.4	0.0	5.8
▪ Stage 4 ROP	0.0	1.1	0.7	0.0	0.2	0.0	0.4
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
Per cent							
Treatment for ROP	87.5	75.8	73.3	40.0	100.0	0.0	74.6

**Note:** Weight criterion less than 1,250 grams for ANZNN but 1,500 grams for some individual units.

Percentages for babies with ROP who received treatment have been calculated using as the denominator the total number in each birthweight group who had stages 3-4.

Not stated and not examined data are excluded from per cent calculations.



TABLE 95: Retinopathy of prematurity for level III registrants by birthweight group, 2009

Retinopathy of prematurity (ROP)	Birthweight group (grams)						Total
	<500	500-749	750-999	1000-1249	1250-1499	≥1500	
Number							
No ROP	7	86	297	414	352	213	1,369
▪ Stage 1 ROP	2	53	102	82	40	14	293
▪ Stage 2 ROP	2	79	128	50	25	7	291
▪ Stage 3 ROP	1	45	41	10	3	0	100
▪ Stage 4 ROP	0	1	0	0	0	0	1
Not examined	17	110	96	77	147	151	598
Not stated	2	16	49	169	497	5,601	6,334
<b>Total</b>	<b>31</b>	<b>390</b>	<b>713</b>	<b>802</b>	<b>1,064</b>	<b>5,986</b>	<b>8,986</b>
Number							
Treatment for ROP	2	45	26	10	0	1	84
Per cent							
No ROP	58.3	32.6	52.3	74.5	83.8	91.0	66.7
▪ Stage 1 ROP	16.7	20.1	18.0	14.7	9.5	6.0	14.3
▪ Stage 2 ROP	16.7	29.9	22.5	9.0	6.0	3.0	14.2
▪ Stage 3 ROP	8.3	17.0	7.2	1.8	0.7	0.0	4.9
▪ Stage 4 ROP	0.0	0.4	0.0	0.0	0.0	0.0	0.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
Per cent							
<b>Treatment for ROP</b>	200.0 <sup>(a)</sup>	97.8	63.4	100.0	0.0	0.0	83.2

(a) Received more than one treatment for ROP.

**Note:** Weight criterion less than 1,250 grams for ANZNN but 1,500 grams for some individual units.

Percentages for babies with ROP who received treatment have been calculated using as the denominator the total number in each birthweight group who had stages 3-4.

Not stated and not examined data are excluded from per cent calculations.

**TABLE 96: Intraventricular haemorrhage for level III registrants by birthweight group, 2008<sup>(a)</sup>**

Intraventricular haemorrhage	Birthweight group (grams)						Total
	<500	500-749	750-999	1000-1249	1250-1499	≥1500	
Number							
None	22	222	484	618	594	713	2,653
▪ Grade 1 IVH	3	60	89	78	81	76	387
▪ Grade 2 IVH	0	30	45	22	13	12	122
▪ Grade 3 IVH	2	15	12	16	8	5	58
▪ Grade 4 IVH	2	32	36	17	10	4	101
Not examined	1	10	14	29	69	171	294
Not stated	0	2	13	91	239	4,604	4,949
<b>Total</b>	<b>30</b>	<b>371</b>	<b>693</b>	<b>871</b>	<b>1,014</b>	<b>5,585</b>	<b>8,564</b>
Per cent							
None	75.9	61.8	72.7	82.3	84.1	88.0	79.9
▪ Grade 1 IVH	10.3	16.7	13.4	10.4	11.5	9.4	11.7
▪ Grade 2 IVH	0.0	8.4	6.8	2.9	1.8	1.5	3.7
▪ Grade 3 IVH	6.9	4.2	1.8	2.1	1.1	0.6	1.7
▪ Grade 4 IVH	6.9	8.9	5.4	2.3	1.4	0.5	3.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*Note: Weight criterion for IVH is a birthweight of less than 1,500 grams.*

*Not stated and not examined data are excluded from per cent calculations.*

**TABLE 97: Intraventricular haemorrhage for level III registrants by birthweight group, 2009<sup>(a)</sup>**

Intraventricular haemorrhage	Birthweight group (grams)						Total
	<500	500-749	750-999	1000-1249	1250-1499	≥1500	
	Number						
None	18	220	482	553	586	706	2,565
▪ Grade 1 IVH	1	56	84	73	77	78	369
▪ Grade 2 IVH	1	29	54	41	25	19	169
▪ Grade 3 IVH	1	9	10	6	8	6	40
▪ Grade 4 IVH	3	35	38	16	7	3	102
Not examined	0	3	10	16	64	122	215
Not stated	1	0	11	88	289	4,955	5,344
<b>Total</b>	<b>25</b>	<b>352</b>	<b>689</b>	<b>793</b>	<b>1,056</b>	<b>5,889</b>	<b>8,804</b>
Per cent							
None	75.0	63.0	72.2	80.3	83.4	86.9	79.0
▪ Grade 1 IVH	4.2	16.0	12.6	10.6	11.0	9.6	11.4
▪ Grade 2 IVH	4.2	8.3	8.1	6.0	3.6	2.3	5.2
▪ Grade 3 IVH	4.2	2.6	1.5	0.9	1.1	0.7	1.2
▪ Grade 4 IVH	12.5	10.0	5.7	2.3	1.0	0.4	3.1
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

*Note: Weight criterion for IVH is a birthweight of less than 1,500 grams.*

*Not stated and not examined data are excluded from per cent calculations.*

**TABLE 98: Neonatal sepsis for level III registrants by birthweight group, 2008**

Sepsis	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
No sepsis	20	244	527	762	951	1,578	1,053	932	934	577	313	7,891
Sepsis	13	148	176	116	67	69	38	39	35	25	11	737
▪ <48 hrs	1	7	6	11	9	15	9	10	12	10	5	95
▪ ≥48 hrs	11	137	167	104	56	53	29	28	23	15	6	629
▪ both <48 and ≥48 hrs	1	4	3	1	2	1	0	1	0	0	0	13
Babies alive on day 2	30	371	693	871	1,014	1,643	1,090	963	966	600	323	8,564
Babies who did not survive to day 2	3	21	10	7	4	4	1	8	3	2	1	64
Total	33	392	703	878	1,018	1,647	1,091	971	969	602	324	8,628
Per cent												
No sepsis <sup>(a)</sup>	60.6	62.2	75.0	86.8	93.4	95.8	96.5	96.0	96.4	95.8	96.6	91.5
Sepsis <sup>(a)</sup>	39.4	37.8	25.0	13.2	6.6	4.2	3.5	4.0	3.6	4.2	3.4	8.5
▪ <48 hrs <sup>(a)</sup>	3.0	1.8	0.9	1.3	0.9	0.9	0.8	1.0	1.2	1.7	1.5	1.1
▪ ≥48 hrs <sup>(b)</sup>	36.7	36.9	24.1	11.9	5.5	3.2	2.7	2.9	2.4	2.5	1.9	7.3
▪ both <48 and ≥48 hrs <sup>(a)</sup>	3.0	1.0	0.4	0.1	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.2

(a) Denominator is all registrants

(b) Denominator is registrants alive at 48 hours

**Note:** Denominator for these calculations are all ANZNN registrants

**TABLE 99: Neonatal sepsis for level III registrants by birthweight group, 2009**

Sepsis	Birthweight group (grams)											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
No sepsis	27	258	532	706	1,002	1,579	1,186	1,025	984	678	320	8,297
Sepsis	4	132	181	96	62	72	34	44	27	21	16	689
▪ <48 hrs	0	4	11	6	8	17	8	16	11	7	8	96
▪ ≥48 hrs	4	124	167	88	54	55	26	28	16	14	8	584
▪ both <48 and ≥48 hrs	0	4	3	2	0	0	0	0	0	0	0	9
Babies alive on day 2	27	364	694	798	1,059	1,641	1,211	1,053	1,005	682	333	8,867
Babies who did not survive to day 2	4	26	19	4	5	10	9	16	6	17	3	119
Total	31	390	713	802	1,064	1,651	1,220	1,069	1,011	699	336	8,986
Per cent												
No sepsis <sup>(a)</sup>	87.1	66.2	74.6	88.0	94.2	95.6	97.2	95.9	97.3	97.0	95.2	92.3
Sepsis <sup>(a)</sup>	12.9	33.8	25.4	12.0	5.8	4.4	2.8	4.1	2.7	3.0	4.8	7.7
▪ <48 hrs <sup>(a)</sup>	0.0	1.0	1.5	0.7	0.8	1.0	0.7	1.5	1.1	1.0	2.4	1.1
▪ ≥48 hrs <sup>(b)</sup>	14.8	34.1	24.1	11.0	5.1	3.4	2.1	2.7	1.6	2.1	2.4	6.6
▪ both <48 and ≥48 hrs <sup>(a)</sup>	0.0	1.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

(a) Denominator is all registrants.

(b) Denominator is registrants alive at 48 hours.

**Note:** Denominator for these calculations are all ANZNN registrants.

Not stated data are excluded from per cent calculations.

**TABLE 100: Median length of stay for level III registrants who survived until discharge home by birthweight group, 2008**

<b>Birthweight group (grams)</b>	<b>Number of babies</b>	<b>Median LOS (in days)</b>	<b>Interquartile range (in days)</b>
<500	20	124	110–148.5
500–749	267	114	99–131
750–999	617	88	74–104
1000–1249	832	66	51–80
1250–1499	993	47	37–58
1500–1999	1,603	35	28–44
2000–2499	1,045	21	14–29
2500–2999	923	14	8–21
3000–3499	908	11	7–19
3500–3999	574	9	6–17
≥4000	312	8	5.5–15
<b>Total</b>	<b>8,094</b>	<b>31</b>	<b>13–55</b>

**TABLE 101: Median length of stay for level III registrants who survived until discharge home by birthweight group, 2009**

<b>Birthweight group (grams)</b>	<b>Number of babies</b>	<b>Median LOS (in days)</b>	<b>Interquartile Range (in days)</b>
<500	13	119.5	102–129
500–749	293	111	97–133
750–999	626	87	72–104
1000–1249	769	64	51–78
1250–1499	1,037	46	37–59
1500–1999	1,595	35	27–45
2000–2499	1,171	20	15–28
2500–2999	1,017	13	8–21
3000–3499	972	10	6–19
3500–3999	649	8	5–18
≥4000	317	7	5–16
<b>Total</b>	<b>8,459</b>	<b>35</b>	<b>27–45</b>

TABLE 102: Survival to discharge home level III registrants by birthweight group, 2008

Survival until discharge home	Birthweight group											Total
	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	
Number												
Lethal congenital anomalies	0	2	3	5	9	23	21	19	17	10	2	111
Babies alive on day 7	28	339	661	856	1,003	1,631	1,072	946	937	589	315	8,377
Babies alive on day 28	24	306	638	843	997	1,618	1,061	934	921	580	313	8,235
Survived to go home	20	267	617	832	993	1603	1,045	923	908	574	312	8,094
Total	33	392	703	878	1,018	1,647	1,091	971	969	602	324	8,628
Per cent												
Survived to go home	60.6	68.1	87.8	94.8	97.5	97.3	95.8	95.1	93.7	95.3	96.3	93.8

TABLE 103: Survival to discharge home level III registrants by birthweight group, 2009

	Birthweight group (grams)											
Survival until discharge home	<500	500-749	750-999	1000-1249	1250-1499	1500-1999	2000-2499	2500-2999	3000-3499	3500-3999	≥4000	Total
Number												
Lethal congenital anomalies	0	5	3	3	14	32	23	22	14	13	4	133
Babies alive on day 7	21	331	674	790	1,051	1,626	1,193	1,038	986	660	324	8,694
Babies alive on day 28	17	313	652	778	1,041	1,610	1,179	1,028	979	653	319	8,569
Survived to go home	13	293	626	769	1,037	1,595	1,171	1,017	972	649	317	8,459
Total	31	390	713	802	1,064	1,651	1,220	1,069	1,011	699	336	8,986
Per cent												
Survived to go home	41.9	75.1	87.8	95.9	97.5	96.6	96.0	95.1	96.1	92.8	94.3	94.1

## Appendix 3: Methods used in this report

The ANZNN data collection was moved to the 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. Updated data for the ANZNN audit of babies born in 2008 and 2009 who qualified as high-risk neonates were requested from each participating unit in June 2009 with a deadline of January 2012. The data submitted were checked for consistency and completeness using a newly developed validation program, run sequentially on each batch of data entered. Exception reports were returned to units with details of missing and inconsistent data values in records identified as problematic. Most, but not all, units returned corrected records in time for the production of this report.

An extract from the database was made in January 2012. 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:

<b>Survival to day n</b>	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.
<b>Survival to 36 weeks post menstrual age</b>	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.
<b>Chronic lung disease (CLD)</b>	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 airways pressure (CPAP) 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 $\{[(\text{Hours of IPPV} + \text{Hours of CPAP})/168] + \text{Gestational age}\} > 35.9 \text{ weeks}$
<b>Length of stay</b>	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 2008 and 2009 reports were carried out using Statistical Analysis Systems (SAS) 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 Perinatal & Reproductive Epidemiology Research Unit (PRERU), 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 Perinatal & Reproductive Epidemiology Research Unit (PRERU) 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 2012.
- The ANZNN Data Collection will be housed at PRERU. It will be managed according to existing data security procedures as for other data collections at PRERU. The Data Custodian is the Director of PRERU.

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 Management Committee and the ANZNN Advisory Committee; two members appointed by the PRERU; and the Chairperson appointed by the ANZNN Management Committee. The operations and progress of ANZNN Data Collection will be reported quarterly by ANZNN DCOC to the ANZNN Management Committee.

PRERU 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 ANZNN Management Committee and PRERU. 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 PRERU 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

The electronic version of this data is maintained in a secure partition at the University of New South Wales. Access to the server is limited to authorised named staff and further protected by the use of a high-level password. Attempted security breaches are monitored and investigated. Hard copy patient identifiable data and electronic backup files are kept in secured and locked safe cabinets. Master lists of code material and source record identifiers are kept away from the database in a separate locked area. All rooms and offices used by the ANZNN are locked when not in use. Filing cabinets containing data are locked when not in use. Computerised data on the server are protected by high-level passwords known only to each person who has access to computerised data. Potentially identifiable data will not leave the site of the ANZNN. Security disposal of data is available through use of designated bags or a shredding machine and must be witnessed by at least two staff members. A destruction certificate stating the name of the data and the date on which they are destroyed is to be issued and retained in the records.



## Appendix 5: Minimum Data Set variables

### 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 intrafallopian transfer, zygote intrafallopian 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 (eg. Fijian Indian).
- 3: Caucasian – all of Caucasoid heritage, including, European, Russian, Middle Eastern and Arabic.
- 4: Other – includes African Negroes, Inuit, American Blacks and Indians, Melanesian.
- 5: Pacific Islander – all from Pacific Islander background, including Samoan, Cook Islands Maori, Niuean, Tokelauan, and other Pacific Islands groups (eg. Hawaiian, Tahitian). Excludes Maori.
- 6: Maori – a person of New Zealand Maori descent who identifies as Maori.

## 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 a 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.

## Other antenatal complications

Definition: Any other antenatal complication.

Coding: 99: unknown.

- 0: no other antenatal complication present.
- 1: yes, other antenatal complication present.

## Prolonged rupture of membranes (ROM)

Definition: Confirmed spontaneous ROM.

An obvious gush of clear amniotic fluid from vagina or if fluid available, by differentiation with urine or vaginal secretions, for more than 24 hours before birth.

Coding: 99: unknown.

0: no, membranes intact/ruptured for < 24 hrs.

-1: yes, membranes ruptured for > 24 hours.

## Preterm labour

Definition: Regular painful contractions, leading to progressive effacement and dilatation of the cervix, eventually leading to the birth of the baby, and commencing before 37 weeks gestation.

Coding: 99: unknown.

0: no, labour did not commence before term.

-1: yes, labour commenced in preterm period.

## Hypertension in pregnancy

Definition: A systolic blood pressure (BP) > 140 mmHg and/or diastolic BP > 90 mmHg, or a rise in systolic BP > 25 mmHg and/or a rise in diastolic BP > 15 mmHg from a reading before conception or in 1st trimester; confirmed by 2 readings 6 hours apart

Coding: 99: unknown.

0: no hypertension in pregnancy detected.

-1: yes, hypertension in pregnancy diagnosed.

## Antepartum haemorrhage

Definition: Significant haemorrhage in the time from 20 weeks gestation to the end of second stage of labour (excludes a 'show').

Coding: 99: unknown.

0: no antepartum haemorrhage noted.

-1: yes, antepartum haemorrhage.

## Suspected intrauterine growth restriction

Definition: A condition of the fetus in which it fails to reach its genetically predetermined full growth potential due to intrinsic or extrinsic factors based on more than one obstetric ultrasound.

Coding: 99: unknown.

0: no intrauterine growth restriction.

-1: yes, intrauterine growth restriction suspected.

## Fetal distress

Definition: Any 'distress' of this fetus leading to intervention by the obstetric team.

Coding: 99: unknown.

0: no intervention necessary.

-1: yes, obstetric intervention required.

## Antenatal diagnosis of fetal malformation

Definition: A fetal malformation is diagnosed prior to the baby's birth, by any method.

Coding: 99: unknown.

0: no.

-1: yes, malformation detected prior to birth.

Guide for use: The diagnosis of the malformation may or may not be confirmed after birth.

## Other antenatal complication

Definition: Complication, not specified.

Coding: 99: unknown.

0: no other significant antenatal complication.

-1: yes, other antenatal complication present.

## 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'.

## 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  $\geq 400$  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/l. 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 (RD) in an infant requiring respiratory support (combines previous items transient tachypnoea of newborn and immature lung).
- 3: hyaline membrane disease – increasing RD or oxygen (O<sub>2</sub>) 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 – RD 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 – RD with proven or suspected infection (toxic blood count), and chest x-ray showing persisting opacities.
- 6: persistent pulmonary hypertension – echocardiatic (shunting or clinical evidence – O<sub>2</sub> need unexplained by chest x-ray or loud P<sub>2</sub>, or differential pre /post ductal TCPO<sub>2</sub>).
- 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 RD, e.g. diaphragmatic hernia (list malformation in appropriate field).
- 10: other – unspecified other RD.
- 11: peri surgical – no RD, 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: Any treatment with exogenous surfactant.

Coding: 0: unknown.

- 1: none – no exogenous surfactant ever given.
- 2: Exosurf – any treatment using 'Exosurf'.
- 3: Survanta – any treatment using 'Survanta'.
- 4: any combination – any combination of surfactant.
- 5: Curosurf – any treatment using 'Curosurf'.
- 6: Curosurf and Survanta.

Guide for use: Includes incomplete use.

## **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 airways pressure (CPAP)**

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

Coding: 4–digit number – CPAP hours

Guide for use: As for hours of IPPV.

## **High frequency ventilation (HFV)**

Definition: Mechanical ventilation presented at high frequencies (small tidal volumes with frequencies > 4Hz) initiated for this baby.

Coding: 99: unknown.

0: no high frequency ventilation not initiated.

-1: yes, HFV was initiated.

## **Nitric oxide**

Definition: Nitric oxide was used in any form or dose for respiratory support of the baby.

Coding: 99: unknown.

0: no, nitric oxide therapy never used.

-1: yes, nitric oxide therapy used.

## **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 oxygen therapy**

Definition: Date supplemental oxygen (O<sub>2</sub>) ceased appropriately.

Coding: DD / MM / YYYY

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



## Nasal high flow therapy

Definition: Blended air and oxygen mix with a delivery flow of greater than 1 litre/min through any high flow device with humidification.

Coding: 99: unknown.

0: nasal high flow was never initiated.

-1: yes, nasal high flow was used for more than four hours.

## Chronic lung disease

Definition: The baby received respiratory support (supplemental O<sub>2</sub> or any form of assisted ventilation) for a chronic pulmonary disorder at 36 weeks post menstrual age.

Coding: 99: unknown.

0: no chronic lung disease.

-1: yes, chronic lung disease.

Guide for use: Four consecutive hours in any one 24-hour period constitutes respiratory support on that day.

## 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: Did this baby have major surgery that involved opening a body cavity?

Coding: 99: unknown.

0: no.

-1: yes.

## Proven necrotising enterocolitis (NEC)

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 four of the following symptoms:

1. At least one systemic sign: temperature instability, apnoea, bradycardia or lethargy; and one intestinal sign: a residual of more than 25% of the previous feed on 2 consecutive occasions, abdominal distension, vomiting or faecal blood.
2. Has profile consistent with definite NEC including at least one of the following: abdominal wall cellulitis and palpable abdominal mass, or pneumatosis intestinalis, or portal vein gas, or a persistent dilated loop on serial x-rays, or a surgical or post mortem diagnosis.
3. Plus the baby warranted treatment for NEC, which included nil by mouth and antibiotics.

## Therapeutic hypothermia

Definition: Intentional cooling of an infant of any gestational age to a core temperature <35.0°C

Coding: 99: unknown.

0: no.

-1: yes.

Guide for use: Record if therapeutic hypothermia has occurred.

## Early infection

Definition: An episode of systemic sepsis with initial symptoms occurring before 48 hours after birth.

Coding: 99: unknown.

0: no early infection noted.

-1: yes, early infection noted.

Guide for use: These conditions must apply:

Isolation of an organism from at least one blood culture and, after consideration of the clinical and laboratory evidence, a decision is made to give antibiotics with therapeutic intent against this organism. Mixed coagulase negative staphylococci or other skin flora – contaminant are not included.

## Episodes of late-onset sepsis

Definition: At least one episode of systemic sepsis with initial symptoms from 48 hours after birth.

Coding: 2-digit field representing total episodes of late onset sepsis.

Guide for use: Isolation of organisms from one blood culture and, after considering clinical / laboratory evidence, decision made to give antibiotics with therapeutic intent against this organism. The following must not apply: mixed coagulase negative staphylococci or other skin flora contaminant. Same blood organism isolated from blood during previous 14 days – repeat isolate.

## Maximum grade of intraventricular haemorrhage

Definition: Worst level of IVH seen on either side by ultrasound or post mortem examination.

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

1: Grade 1 – subependymal germinal matrix haemorrhage.

2: Grade 2 – intraventricular haemorrhage with no ventricular distension.

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

4: Grade 4 – intraparenchymal haemorrhage.

5: Not examined– by ultrasound or by post mortem examination.

## Date of late head ultrasound

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

Coding: DD / MM / YYYY

## Ventricle size

Definition: Size of ventricle at the ultrasound closest to six weeks of age (date above). Ventricular index (VI) is measured as the furthest lateral extent of each ventricle from the midline measured at the level of Foramen of Monro.

Coding: 0: unknown.

1: no dilatation – VI less than 97th centile.

2: dilatation – VI equal to 97th centile / 97th centile + 4mm.

3: hydrocephalus – VI greater than 97th centile + 4mm or hydrocephalus present requiring a shunt or drainage (permanent or transient).

## Ventricular Index (VI)

Definition: Size of ventricle at the ultrasound closest to six weeks of age (date above).

Coding: 4-digit number representing VI in mm correct to one decimal place.

Guide for use: Record if ventricular dilatation is present, i.e. 'dilatation' or 'hydrocephalus'.

## Cerebral cystic formations

Definition: Changes in brain parenchyma seen at the scan closest to six weeks of age.

Coding: 0: unknown.

- 1: no cysts – none seen on ultrasound.
- 2: porencephalic cyst(s) – parenchymal lesions corresponding to grade 4 IVH.
- 3: periventricular leukomalacia (PVL) – ischaemic brain injury affecting periventricular white matter in the boundary zones supplied by terminal branches of both centripetal and centrifugal arteries.
- 4: encephaloclastic porencephaly – relatively late development on cerebral scan of extensive dense, cystic lesions involving the periphery of the brain (ANZNN 2009).

## 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.

## Therapy for retinopathy of prematurity

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

Coding: 99: unknown.

0: no therapy for ROP received.

-1: yes, 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.

# 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).

**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.

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

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

**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.

**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.

**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 (completed weeks)** 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 completed weeks of gestation.

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

**Preterm birth:** birth before 37 completed 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.

## References

1. Abeywardana S. ANZNN (Australian and New Zealand Neonatal Network) 2006. Report of the Australian and New Zealand Neonatal Network, 2005.
2. ANZNN (Australian and New Zealand Neonatal Network) 2011. Report of the Australian and New Zealand Neonatal Network, 2007. Sydney: ANZNN <[www.preru.unsw.edu.au/ANZNN](http://www.preru.unsw.edu.au/ANZNN)>.
3. Crowley PA 1995. Antenatal corticosteroid therapy: a meta-analysis of the randomized trials, 1972 to 1994. *American Journal of Obstetrics & Gynecology* 173:322–35.
4. Finer NN & Barrington KJ 2000. Nitric oxide for respiratory failure in infants born at or near term (Cochrane Review). In: *The Cochrane Library*, Issue 1, 2003. Oxford: Update Software.
5. Laws PJ, Li Z & Sullivan EA 2010. Australian mothers and babies 2008. Perinatal statistics series no. 24. Cat. No. PER 50. Canberra: AIHW National Perinatal Statistics Unit <[www.npsu.unsw.edu.au](http://www.npsu.unsw.edu.au)>.
6. Li Z, McNally L, Hilder L & Sullivan EA 2011. Australian mothers and babies 2009. Perinatal statistics series no. 25. Cat. No. PER 52. Sydney: AIHW National Perinatal Statistics Unit <[www.npsu.unsw.edu.au](http://www.npsu.unsw.edu.au)>.
7. Papile LA, Burstein J, Burstein R & Hoffer 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):529–34.
8. Statistics New Zealand 2008. Demographic tables 2008. Wellington: Statistics New Zealand <[www.stats.govt.nz](http://www.stats.govt.nz)>.
9. Statistics New Zealand 2009. Demographic tables 2009. Wellington: Statistics New Zealand <[www.stats.govt.nz](http://www.stats.govt.nz)>.
10. Wilkinson D, Andersen C, O'Donnell CP & De Paoli AG 2011. High flow nasal cannula for respiratory support in preterm infants. *Cochrane Database Syst Rev* 11(5). 93

# List of Tables

<b>Table 1:</b> Level III registrants born at each completed week of gestation, 2008.....	8	<b>Table 26:</b> Survival to discharge home for level III registrants by gestational age at birth, 2008 .....	30
<b>Table 2:</b> Level III registrants in each birthweight group, 2008 ...	9	<b>Table 27:</b> Level II registrants born at each completed week of gestation, 2008 .....	32
<b>Table 3:</b> Age group of mothers of level III registrants by gestational age group, 2008.....	10	<b>Table 28:</b> Level II registrants by birthweight group, 2008 .....	32
<b>Table 4:</b> Mother's presenting antenatal problem for level III registrants by gestational age group, 2008.....	11	<b>Table 29:</b> Mothers of level II registrants presenting antenatal problem by gestational age group, 2008 .....	33
<b>Table 5:</b> Antenatal corticosteroid use for mothers of level III registrants by gestational age group, 2008 .....	13	<b>Table 30:</b> Antenatal corticosteroid use by mothers of level II registrants by gestational age group, 2008.....	34
<b>Table 6:</b> Plurality of level III registrants by gestational age group, 2008.....	13	<b>Table 31:</b> Method of delivery for level II registrants by gestational age group, 2008.....	34
<b>Table 7:</b> Method of birth for level III registrants by gestational age group, 2008.....	14	<b>Table 32:</b> Indication for respiratory support for level II registrants by gestational age group, 2008.....	35
<b>Table 8:</b> Level of hospital of birth for level III registrants by gestational age group, 2008.....	14	<b>Table 33:</b> Duration of assisted ventilation and oxygen use by level II registrants by gestational age group, 2008 .....	36
<b>Table 9:</b> Mode of transport to level III NICU after birth for level III registrants by gestational age, 2008.....	15	<b>Table 34:</b> Survival to discharge home for level II registrants by gestational age group, 2008.....	37
<b>Table 10:</b> Apgar scores at birth for level III registrants by gestational age group, 2008.....	16	<b>Table 35:</b> Level III registrants born at each completed week of gestation, 2009.....	41
<b>Table 11:</b> Median admission temperature and interquartile ranges for level III registrants by gestational age group, 2008.....	17	<b>Table 36:</b> Level III registrants in each birthweight group, 2009 .....	42
<b>Table 12:</b> Indication for respiratory support for level III registrants by gestational age, 2008.....	18	<b>Table 37:</b> Age group of mothers of level III registrants by gestational age group, 2009.....	43
<b>Table 13:</b> Exogenous surfactant use for level III registrants by gestational age group, 2008.....	19	<b>Table 38:</b> Mother's presenting antenatal problem for level III registrants by gestational age group, 2009.....	44
<b>Table 14:</b> Duration of assisted ventilation and oxygen use by level III registrants by gestational age group, 2008.....	20	<b>Table 39:</b> Antenatal corticosteroid use for mothers of level III registrants by gestational age group, 2009.....	46
<b>Table 15:</b> Assisted ventilation for level III registrants by gestational age group, 2008.....	20	<b>Table 40:</b> Plurality of level III registrants by gestational age group, 2009.....	46
<b>Table 16:</b> Supplemental oxygen therapy for level III registrants by gestational age group, 2008.....	22	<b>Table 41:</b> Method of birth for level III registrants by gestational age group, 2009.....	47
<b>Table 17:</b> Chronic lung disease for level III registrants by gestational age group, 2008.....	22	<b>Table 42:</b> Level of hospital of birth for level III registrants by gestational age group, 2009.....	47
<b>Table 18:</b> Pulmonary air leak for level III registrants by gestational age group, 2008.....	23	<b>Table 43:</b> Mode of transport to level III NICU after birth for level III registrants by gestational age, 2009.....	48
<b>Table 19:</b> Neonatal sepsis for level III registrants by gestational age group, 2008.....	23	<b>Table 44:</b> Apgar scores at birth for level III registrants by gestational age group, 2009.....	49
<b>Table 20:</b> Retinopathy of prematurity for level III registrants by gestational age, 2008.....	24	<b>Table 45:</b> Median admission temperature and interquartile ranges for level III registrants by gestational age group, 2009.....	50
<b>Table 21:</b> Intraventricular haemorrhage for level III registrants born before 32 weeks and survived to day 3 by gestational age, 2008 .....	25	<b>Table 46:</b> Indication for respiratory support for level III registrants by gestational age, 2009.....	51
<b>Table 22:</b> Late cerebral ultrasound results for level III registrants born before 32 weeks by gestational age, 2008 ....	26	<b>Table 47:</b> Exogenous surfactant use for level III registrants by gestational age group, 2009.....	52
<b>Table 23:</b> Necrotising enterocolitis in level III registrants by year of birth, 1999–2008 .....	27	<b>Table 48:</b> Duration of assisted ventilation and oxygen use by level III registrants by gestational age group, 2009.....	53
<b>Table 24:</b> Transfer after registration of level III registrants by level of destination hospital and gestational age group, 2008 .....	28	<b>Table 49:</b> Assisted ventilation for level III registrants by gestational age group, 2009.....	53
<b>Table 25:</b> Median length of stay for level III registrants who survived until discharge home by gestational age, 2008 .....	29	<b>Table 50:</b> Supplemental oxygen therapy for level III registrants by gestational age group, 2009.....	55
		<b>Table 51:</b> Nasal high flow respiratory support for level III registrants by gestational age group, 2009.....	55



<b>Table 52:</b> Chronic lung disease for level III registrants by gestational age group, 2009.....	56	<b>Table 78:</b> Level of hospital of birth for level III registrants by birthweight group, 2008.....	90
<b>Table 53:</b> Pulmonary air leak for level III registrants by gestational age group, 2009 .....	56	<b>Table 79:</b> Level of hospital of birth for level III registrants by birthweight group, 2009.....	90
<b>Table 54:</b> Neonatal sepsis for level III registrants by gestational age group, 2009.....	57	<b>Table 80:</b> Mode of transport for level III registrants to level III unit after birth by birthweight group, 2008.....	91
<b>Table 55:</b> Retinopathy of prematurity for level III registrants by gestational age, 2009.....	58	<b>Table 81:</b> Mode of transport for level III registrants to level III unit after birth by birthweight group, 2009.....	91
<b>Table 56:</b> Intraventricular haemorrhage for level III registrants born before 32 weeks and survived to day 3 by gestational age, 2009 .....	59	<b>Table 82:</b> Exogenous surfactant use by level III registrants by birthweight group, 2008.....	92
<b>Table 57:</b> Late cerebral ultrasound results for level III registrants born before 32 weeks by gestational age, 2009 ....	60	<b>Table 83:</b> Exogenous surfactant use by level III registrants by birthweight group, 2009.....	92
<b>Table 58:</b> Necrotising enterocolitis in level III registrants by year of birth, 2000–2009 .....	61	<b>Table 84:</b> Assisted ventilation for level III registrants by birthweight group, 2008.....	93
<b>Table 59:</b> Transfer after registration of level III registrants by level of destination hospital and gestational age group, 2009 .....	62	<b>Table 85:</b> Assisted ventilation for level III registrants by birthweight group, 2009.....	93
<b>Table 60:</b> Median length of stay for level III registrants who survived until discharge home by gestational age, 2009 .....	63	<b>Table 86:</b> Medians and interquartile ranges of assisted ventilation for level III registrants by birthweight group, 2008.....	94
<b>Table 61:</b> Survival to discharge home for level III registrants by gestational age at birth, 2009 .....	64	<b>Table 87:</b> Medians and interquartile ranges of assisted ventilation for level III registrants by birthweight group, 2009.....	94
<b>Table 62:</b> Level II registrants born at each completed week of gestation, 2009.....	66	<b>Table 88:</b> Chronic lung disease for level III registrants by birthweight group, 2008.....	95
<b>Table 63:</b> Level II registrants by birthweight group, 2009 ...	66	<b>Table 89:</b> Chronic lung disease for level III registrants by birthweight group, 2009.....	95
<b>Table 64:</b> Mothers of level II registrants presenting antenatal problem by gestational age group, 2009 .....	67	<b>Table 90:</b> Supplemental oxygen therapy for level III registrants by gestational age group, 2008.....	96
<b>Table 65:</b> Antenatal corticosteroid use by mothers of level II registrants by gestational age group, 2009.....	68	<b>Table 91:</b> Supplemental oxygen therapy for level III registrants by gestational age group, 2009.....	96
<b>Table 66:</b> Method of delivery for level II registrants by gestational age group, 2009.....	68	<b>Table 92:</b> Transfer after registration of level III registrants by level of destination hospital by birthweight group, 2008.....	97
<b>Table 67:</b> Indication for respiratory support for level II registrants by gestational age group, 2009.....	69	<b>Table 93:</b> Transfer after registration of level III registrants by level of destination hospital by birthweight group, 2009.....	97
<b>Table 68:</b> Duration of assisted ventilation and oxygen use by level II registrants by gestational age group, 2009 .....	69	<b>Table 94:</b> Retinopathy of prematurity for level III registrants by birthweight group, 2008 .....	98
<b>Table 69:</b> Survival to discharge home for level II registrants by gestational age group, 2009.....	70	<b>Table 95:</b> Retinopathy of prematurity for level III registrants by birthweight group, 2009 .....	99
<b>Table 70:</b> Surgical procedures for ANZNN registrants, 2007–2009 .....	71	<b>Table 96:</b> Intraventricular haemorrhage for level III registrants by birthweight group, 2008 <sup>(a)</sup> .....	100
<b>Table 71:</b> Characteristics of ANZNN registrants who have undergone surgery by year of birth, 2007–2009.....	76	<b>Table 97:</b> Intraventricular haemorrhage for level III registrants by birthweight group, 2009 <sup>(a)</sup> .....	100
<b>Table 72:</b> Antenatal corticosteroid use for level III registrants by birthweight group, 2008.....	87	<b>Table 98:</b> Neonatal sepsis for level III registrants by birthweight group, 2008.....	101
<b>Table 73:</b> Antenatal corticosteroid use for level III registrants by birthweight group, 2009 .....	87	<b>Table 99:</b> Neonatal sepsis for level III registrants by birthweight group, 2009.....	101
<b>Table 74:</b> Plurality of level III registrants by birthweight group, 2008.....	88	<b>Table 100:</b> Median length of stay for level III registrants who survived until discharge home by birthweight group, 2008.....	102
<b>Table 75:</b> Plurality of level III registrants by birthweight group, 2009.....	88	<b>Table 101:</b> Median length of stay for level III registrants who survived until discharge home by birthweight group, 2009.....	102
<b>Table 76:</b> Method of delivery for level III registrants by birthweight group, 2008.....	89	<b>Table 102:</b> Survival to discharge home level III registrants by birthweight group, 2008.....	103
<b>Table 77:</b> Method of delivery for level III registrants by birthweight group, 2009.....	89	<b>Table 103:</b> Survival to discharge home level III registrants by birthweight group, 2009.....	103

# List of Figures

<b>Figure 1:</b> Schematic flow chart of ANZNN.....	2	<b>Figure 25:</b> Survival to discharge home for ANZNN registrants who have undergone surgery by gestational age group, 2007–2009 .....	75
<b>Figure 2:</b> Babies registered to ANZNN audit of level III units each year as a percentage of liveborn babies in Australia and New Zealand 1999–2008.....	6	<b>Figure 26:</b> Necrotising enterocolitis mortality for ANZNN registrants who have undergone surgery by gestational age group, 2007–2009 .....	75
<b>Figure 3:</b> Number of level III registrants born at each neonatal intensive care unit, 2008 .....	7	<b>Figure 27:</b> NEC and PDA surgery for ANZNN registrants who have undergone surgery by gestational age, 2007–2009 .....	76
<b>Figure 4:</b> Level III registrants by registration criteria, 1999–2008 .....	9	<b>Figure 28:</b> Trends in gestational age at birth of level III registrants, 2000–2009.....	77
<b>Figure 5:</b> Presenting antenatal problem for mothers of level III registrants by gestational age group, 2008.....	12	<b>Figure 29:</b> Trends in the use of corticosteroids for mothers of babies less than 32 weeks gestation, 2000–2009 .....	78
<b>Figure 6:</b> Retinopathy of prematurity for level III registrants by gestational age in 2008 .....	25	<b>Figure 30:</b> Trends in multiple births of level III registrants by gestational age group, 2000–2009 .....	79
<b>Figure 7:</b> Intraventricular haemorrhage in level III registrants born at less than 32 weeks gestation and survived to day 3, by gestational age, 2008 .....	26	<b>Figure 31:</b> Trends in method of birth for level III registrants by year of birth, 2000–2009 .....	79
<b>Figure 8:</b> Survival of level III registrants to discharge home (with 95% CI) by gestational age, 2008.....	31	<b>Figure 32:</b> Trends in referral source to level III NICU by year of birth, 2000–2009 .....	80
<b>Figure 9:</b> Survival of level III registrants to discharge home (with 95% CI) by birthweight group, 2008.....	31	<b>Figure 33:</b> Trends in mode of transport to level III NICU, 2000–2009 .....	80
<b>Figure 10:</b> Babies registered to ANZNN audit of level III units each year as a percentage of liveborn babies in Australia and New Zealand 2000–2009.....	40	<b>Figure 34:</b> Trends in mode of assisted ventilation for level III registrants, 2000–2009.....	81
<b>Figure 11:</b> Number of level III registrants born at each neonatal intensive care unit, 2009.....	41	<b>Figure 35:</b> Trends in provision of intermittent positive pressure ventilation and continuous positive pressure ventilation by year of birth for level III registrants ventilated, 2000–2009.....	81
<b>Figure 12:</b> Level III registrants by registration criteria, 2000–2009.....	42	<b>Figure 36:</b> Trends in the use of CPAP as the only form of ventilation by gestational age for level III registrants, 1998, 2001, 2004–2009 .....	82
<b>Figure 13:</b> Presenting antenatal problem for mothers of level III registrants by gestational age group, 2009.....	45	<b>Figure 37:</b> 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, 2000–2009.....	82
<b>Figure 14:</b> Retinopathy of prematurity for level III registrants by gestational age in 2009 .....	58	<b>Figure 38:</b> Trends in nitric oxide (with 95% CI) provision for level III registrants born before 28 weeks and 28 or more weeks gestation, 2000–2009 .....	83
<b>Figure 15:</b> Intraventricular haemorrhage in level III registrants born at less than 32 weeks gestation and survived to day 3, by gestational age, 2009 .....	60	<b>Figure 39:</b> Incidence of chronic lung disease (with 95% CI) for level III registrants by gestational age, 2008 .....	83
<b>Figure 16:</b> Survival of level III registrants to discharge home (with 95% CI) by gestational age, 2009.....	64	<b>Figure 40:</b> Incidence of chronic lung disease (with 95% CI) for level III registrants by gestational age, 2009 .....	84
<b>Figure 17:</b> Survival of level III registrants to discharge home (with 95% CI) by birthweight group, 2009.....	65	<b>Figure 41:</b> Stage 3 or 4 retinopathy of prematurity and treated retinopathy among babies born before 31 weeks gestation and/or birthweight of less than 1,250 grams who survived to 36 weeks corrected age for level III registrants, 2005–2009.....	84
<b>Figure 18:</b> ANZNN registrants who have undergone surgery by gestation age, 2007–2009.....	71	<b>Figure 42:</b> 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, 2000–2009.....	85
<b>Figure 19:</b> Increasing incidence of gastroschisis in ANZNN registrants, 2007–2009.....	72	<b>Figure 43:</b> Incidence of early sepsis for level III registrants by gestational age group, 2004–2009 .....	85
<b>Figure 20:</b> Five minute Apgar score for ANZNN registrants who have undergone surgery by number of infants, 2007–2009.....	72	<b>Figure 44:</b> Incidence of late sepsis for level III registrants by gestational age group, 2004–2009 .....	86
<b>Figure 21:</b> Age of mothers of ANZNN registrants who have undergone surgery, 2007–2009.....	73		
<b>Figure 22:</b> Assisted conception status of mothers of ANZNN registrants who have undergone surgery, 2007–2009.....	73		
<b>Figure 23:</b> Antenatal diagnosis of congenital anomalies in ANZNN registrants who have undergone surgery by year of birth, 2007–2009 .....	74		
<b>Figure 24:</b> Neonatal sepsis in ANZNN registrants who have undergone surgery by gestational age group, 2007–2009.....	74		

