THE NATIONAL MATERNITY HOSPITAL

NEONATAL CLINICAL REPORT FOR THE YEAR 2022

THE NATIONAL MATERNITY HOSPITAL

Department of Neonatology

The National Maternity Hospital

Annual Neonatal Clinical Report 2022

Department of Neonatology

Front cover image: *Rebecca Moriarty and Mikey Devitt with their baby boy Ollie Moriarty-Devitt, born at just 27 weeks gestation. Ollie spent 72 days in the NMH NICU. (Little Shadow Photography)*

Contents

Resident and Visiting Medical Staff

Master

Prof Shane Higgins

Department of Paediatrics and Neonatology

Director: Dr Anne Twomey (to Oct) / Dr Deirdre Sweetman (from Oct)
Dr Anna Curley
Dr Jan Franta
Dr Lisa McCarthy
Prof John F Murphy
Dr Eoin O'Currain
Prof Colm O'Donnell
Dr Jyothsna Purna

Department of Pathology and Laboratory Medicine

Director: Dr Eoghan Mooney
Dr Paul Downey
Dr Joan Fitzgerald
Prof David Gibbons
Dr Susan Knowles
Dr Karen Murphy

Specialist Registrars/ Registrars in Neonatology/Paediatrics

Dr Emma Dunne (SpR)
Dr Neidin Bussman (SpR)
Dr Erica Crothers (SpR)
Dr Katie Flinn (SpR)
Dr Aoife Flynn (SpR)
Dr Kevin Gaughan (SpR)
Dr Husnain Mohamed (SpR)
Dr Sharon Dempsey (SpR)
Dr Robert McGrath (SpR)
Dr Tim Hurley (SpR)
Dr Hope Murphy O'Connor (SpR)
Dr Laura Ryan (SpR)
Dr Maria Iantan (SpR)
Dr Nese Aber Gadzama (SpR)
Dr Daniel Hardiman (SpR)
Dr Robert Joyce (SpR)
Dr Stephen Carroll (SpR)
Dr Aisling Garvey (SpR)
Dr Janey Hattingh (Reg)
Dr Georgia Dugaci (Reg)
Dr Jsun Loong Wong (Reg)

Senior House Officers in Neonatology

Dr Liam Ó'Cuiv
Dr Ciara Broderick Farrell
Dr Sally Cahill
Dr Eleanor Burke
Dr Ava McDonald
Dr Nadzirah Muhamed
Dr Elysha Brennan
Dr Conor Ring
Dr Shauna Harte
Dr Jessica Lazar
Dr Sorcha Moore
Dr Edmond Power
Aishling Busher
Dr Bailey Crolwy
Dr Aine English
Dr Mark Glynn
Dr Mansi Shah
Dr Lorna Holcroft
Dr Sabha Joyce Costello
Dr Hufaiza Azam

Fellows/Research Registrars

Dr Caitriona Ni Chathasaigh, Neonatal Researcher
Dr Carmel Moore, Fellow - Neonatal Haemovigilance and Transfusion
Dr Emma Dunne, Neonatal Research Fellow
Dr Lucy Geraghty, Neonatal Research Fellow

*Non-Consultant Hospital Doctors: Doctors in the lists above have spent between 3 and 12 months in The NMH. Some Doctors may appear under more than one heading if they were employed at different levels during the year.

Nursing Staff

Director of Midwifery & Nursing
Mary Brosnan

Assistant Director of Midwifery/Nursing
Geraldine Duffy

Clinical Midwife / Nurse Managers 3
Hilda Wall

Advanced Nurse Practitioner (Neonatology)
Shirley Moore

Candidate Advanced Nurse Practitioner (Neonatology)
Linda Smiles (From Nov)

Clinical Midwife / Nurse Specialists

Neonatal Liaison Service
Caroline McCafferty
Ciara Murphy

Neonatal Clinical Skills Facilitator
Fidelma Martin
Thankamma Mathew

Neonatal Resuscitation Officer
Laura Eager
Linda Smiles

CNM 2 Neonatal MRI
Linda Smiles (0.5 WTE)

Neonatal Transport CNS
Blaithin Quinlan

Lactation
Ramita Dangol
Helen Batson

Clinical Midwife / Nurse Managers 2

Baby Clinic
Petria O'Connell
Lorraine White

Neonatal Unit
Emily Barriga
Mariola Buczkowska
Emma Ruth Candeleria
Breda Coronella (retired Jun)
Rebekah Prabakaran
Sara Rock
Jisha Vijayan
Emma Candelaria
Linda Collins

Clinical Midwife / Nurse Managers 1
Julie Miague (retired Jun)
Emma Candelaria
Jennifer Galang-Doyle
Geraldine Walsh
Leia Sacopaso
Avril Kearney
Tigi Jose
Sarah Hennigan

Multi-task Attendants
Patricia McNevin (retired Nov)
Ingrid Kus
Petruta Perhaita
Charles-Edouard Cattier

Staff Nurses/Staff Midwifes

Ramita Dangol
Wilma Reodica
Emma Thompson
Ana Pereira
Mary Ann Legaspi
Sharon Maher
Josephina Garay
Elsa Santos
Agnes Licudine
Grace Viloria (retired)
Erica Quiambao
Sheila M Fronda
Jessie Castillo
Jessy Thomas
Marie Louise Gante
Joseph Talento
Darjure Balonzo
Genoveva Lanuza
Beverly Lat Chan

Beverly Abellanosa
Lily Cudiamat
Josephina Simplina
Avril Kearney
Paula Cashin
Sarah Hennigan
Veronica Sexton
Jonathan Ermitano
Jophet Gongora
Eloise Pangilinan
Marites Lopez
Catherine Comerford
Tigi Jose
Beena Paulose
Rosamma Xavier
Leia Sacopaso
Petra Miletinova
Mairead McMorrow
Anna O'Loughlin

Meaghan Cronin
Poiter Perez
Justine Mercado
Nisha Rajan
Radhika Rajesh
Nanette Llego
Neethu Sebastian
Rachel Slamon
Manju Alex
Bincy Anthony
Shayne Apon
Mildred Lunar
Marie Juan
Tincy Thomas
Ann Yaguel
Sheila Cuidno
Adeliza Ramirez
Angelina Moreles
Chrystelle Bulalacao

Clarence Francisco
Kristiane Flores
Victoria Belleza
Jocelyn Mollasgo
Judy Paredes
Oshya George
Divya mol thomas
Chriselda Mallari
Zyra Navarro
Mathew Babu
Sheila Cuidno
Jennifer Galong
Sarah Tomoling
Jenny Christian
Grace Donnelly
Eimear Kilduff
Katherine Manalili
Rajee Babu

Radiology
Director: Dr Gabrielle C. Colleran
Dr Ian Robinson
Dr Niamh Adams

Medical Social Workers
Laura Harrington, HMSW
Ciara McKenna, SMSW
Sinead Stakelum, SMSW
Karen McCormack, SMSW
Ciara Buggy, SMSW
Doireann Kavanagh, SMSW
Ryan Cassidy, SMSW (to Oct)
Gillian McMurray, SMSW
Aoife Shannon, MSW (to May)
Saoirse Bolger, MSW (to Aug)
Tina Moley, MSW (from Dec)
Deirdre Real, MSW (from Dec)

Physiotherapy
Jo Egan, Clinical Specialist Physio
Eithne Lennon, Senior Physiotherapist
Sarah Fitzmaurice Senior Physiotherapist

Data Analyst
Cillian Power

Opthalmology
Dr Stephen Farrell
Dr Claire Hartnett

Clinical Nutrition and Dietetics
Roberta McCarthy, Dietitian Manager
Roísín Gowan, Clinical Specialist Dietitian
Orla Haughey, Senior Dietitian (0.2 WTE temporary) to Feb (maternity leave from 2021)
Eimear Ryan, Senior Dietitian (0.6 WTE) to Oct
Catherine Shortall, Senior Dietitian (0.5 WTE temporary) to Mar

Clinical Engineering
Eoghan Hayden
Maighread Gallagher (to Mar)
Vasanth Pillai
Mark Power (from Jul)
Oleg Shrolik

Consultant Geneticist
Dr William Reardon
Dr Samantha Doyle

Clinical Psychologist
Marie Slevin

Information Officer
Fionnuala Byrne

Household
Florina Bugnari
Tanya Murphy
Nicoleta Sabau
Ewa Obszanska
Marina Cicherca
Vicky Berinde

NICU Administration
Danielle Nolan
Nisha Raj
Patricia Misiara

Baby Clinic Administration
Aayushi

Clinical Specialist, Speech & Language Therapist
Zelda Greene

Honorary Consulting Staff

We wish to acknowledge all the Honorary Consulting Paediatric Staff, both surgical and medical, attached to Our Lady's Hospital for Sick Children and Children's University Hospital, who give of their time and expertise so freely and who come to consult on our newborn babies any time when requested. In view of the large number of staff involved, it is not possible to list them individually. Their contribution to the care that we provide to our newborn infants is invaluable

Introduction

The annual NMH Neonatal Clinical Report is now in its 17th year of publication.
In 2022, we entered the third year of the global Covid-19 pandemic. While surges of infection were still occurring, the vast majority of the work within our Department had thankfully returned to "business as usual" – a very welcome relief for our families and staff.

During 2022, the NICU admitted 1132 infants and cared for 120 very low birth weight (VLBW) infants. It ventilated a total of 147 infants. Fourteen (14) infants were offered therapeutic hypothermia. In all, the NICU provided 1208 days of "Intensive Care" and 2659 days of "High Dependency Care".

Our NICU is one of four designated tertiary care NICUs in this country that provides specialised care to the most premature of infants. Last year, we looked after 120 VLBW (Very Low Birth Weight) Infants. These infants are extremely vulnerable and often spend several weeks in hospital, frequently not being discharged home before their due date. Because of major advances in neonatal intensive care medicine over the past few decades, survival across all gestational ages is increasing. Unfortunately, many of our most extremely premature infants face ongoing challenges in terms of their long-term neurodevelopmental outcome. Research has shown us that optimising babies' early neurosensory experiences, and social environment, impacts on their long-term neurodevelopmental outcome. By providing individualised, neuroprotective care to each baby, it has been shown that babies have better long-term physical, cognitive and emotional outcomes. Such developmental care principles underpin all of our care practices in the NICU. Early identification of developmental delay is also important as early intervention is likely more effective in decreasing impairment. One of the major initiatives in our Department this year was the introduction of our ACoRN (Allied Care of at Risk Newborns) Programme in February 2022. This is a teamed approach providing ongoing formal developmental assessments and interventions by Physiotherapy (PT), Speech and Language Therapy (SLT), Dietetics, Medical Social Work (MSW), Pharmacy and Psychology in conjunction with the NICU Medical and Nursing teams. The ACoRN NICU Programme incorporates a structured weekly allied health developmental ward round on all infants at risk of developmental delay during their time in the NICU. This is complimented by the ACoRN Outpatients Clinic (OPD) Programme which follows up all our VLBW infants at 3, 6, 9, 12, 18 and 24 months corrected age when they attend their medical outpatient appointments. The introduction of this programme now means that our infants have access to a structured therapeutic developmental pathway from their time of birth through to their discharge from the NICU until a corrected age of 2 years. The programme is comprehensive and supportive allowing for the early detection and management of developmental delays and facilitating timely onward referral which is in keeping with international recommendations for at-risk infants. Funding was also secured for a Neonatal Occupational Therapy post in 2022 and we look forward to welcoming Aoife Tonge, Neonatal Occupational Therapist, to our MDT team in 2023.

Another highlight for the Department this year has been the further expansion of our antenatal consultation service for women with complex pregnancies. We continue to work very closely with our colleagues in the Fetal Medicine Department who provide a national tertiary referral service and receive referrals from every obstetric service in the country. Women with complex pregnancies are reviewed regularly throughout their pregnancy by a multidisciplinary (MDT team) which now includes fetal medicine specialists, neonatologists, paediatric cardiology (Prof. Colin Mc Mahon), paediatric neurosurgery (Mr Darach Crimmins, Mr John Caird and Ms Tafadzwa Mandiwanza), perinatal genetics (Dr Samantha Doyle) and paediatric palliative care (Dr John Allen). Such a collaborative approach ensures that the woman and her family have the information they require to make a plan, in consultation with the MDT team, for the optimal management and care of her newborn baby soon after birth. The success of this programme is evidenced by the increasing number of antenatal consultations undertaken by our Department and this has necessitated the allocation of dedicated consultant neonatal sessions to this service.

In 2022, we were delighted to welcomed Dr Madeleine Murphy back to our NICU as a locum consultant neonatologist. We also welcomed Dr Niamh Adams, Consultant Paediatric Radiologist and Dr John Allen, Consultant in Paediatric Palliative Care to the team. Dr John Murphy, our consultant colleague, retired after a phenomenal 36 years of service to NMH. He has made a huge contribution to our NICU and was always so supportive of our staff. It is no surprise that shortly before his retirement, he was awarded the prestigious RCPI Kathleen Lynn Medal for exceptional service on behalf of children. It is the highest award in Ireland to recognise paediatricians that have been outstanding in their careers and in their contribution to paediatrics. He will be missed but we are delighted to know that he is still continuing in his national role as Clinical Lead in Neonatology. During the year, we also said goodbye to some very valued members of our staff namely Breda Coronella (CMM2), Julie Miague (CNM1), Grace Viloria and Josephina Garay (senior staff nurses) and Trish McNevin (MTA). We are so thankful for their many years of dedicated service and wish them a long and enjoyable retirement. We must also acknowledge the incredible service provided to this hospital by Professor Michael O'Keeffe, Consultant Paediatric Ophthalmologist, who retired from NMH in 2021 and who very sadly died earlier this year (2023). He established a screening and treatment programme for retinopathy of prematurity, the first of its kind in this country. Because of this expertise, our NICU soon became recognised as a centre of excellence for this condition, both nationally and internationally and many babies around the country were specifically transferred to our NICU for his expert opinion. We, and the babies from whom he cared, are very grateful for his tremendous contribution.

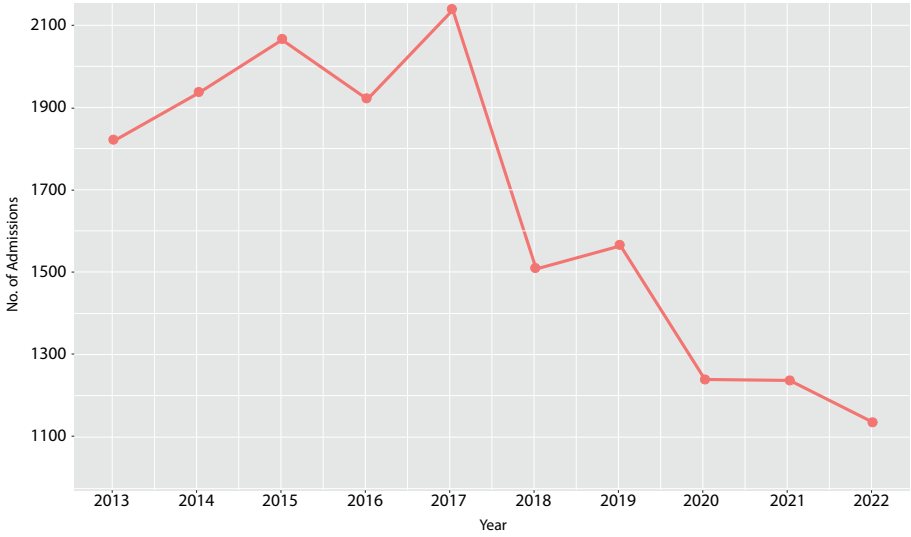
As in previous years, may I extend my sincere thanks to all members of the neonatal multidisciplinary team including the medical, nursing, paramedical, household and administrative staff of the unit for their hard work and dedication. I would like to acknowledge the written contributions made by Marie Slevin (NICU Clinical Psychologist), Roberta McCarthy (Senior Neonatal Dietitian), Montse Corderroura (Clinical Pharmacist), Jo Egan (Clinical Specialist Physiotherapist in Neonatology), Zelda Greene (Speech and Language Therapist), Dr Eoghan Mooney (Consultant Pathologist) and Marie Culliton (Laboratory Manager). I would also like to thank my two consultant colleagues, Dr Lisa McCarthy and Dr Eoin O'Currain who write the sections on "Mortality" and "Neonatal Encephalopathy". Last but not least, I wish to thank Cillian

Power (Data Analyst) and Fionnuala Byrne (Information Officer), since without their assistance, this report would not be possible. This year marks the final year that I will be editing this report as I have just taken a secondment from the Department to undertake another role within the hospital. May I say that I have learned so much over the years through my involvement with the Annual Report and the Vermont Oxford Network as both enabled our Department to review our practices and outcomes over time. It is only by auditing our outcomes that we can truly hope to improve our care. Looking over the past 17 years, I think our Department should be very proud of its many achievements, the proof of which has been outlined in these reports.

Dr Anne Twomey
Consultant Neonatologist

SECTION 1: Admission Details

1.1 Number of Admissions to the Neonatal Intensive Care Unit (NICU)

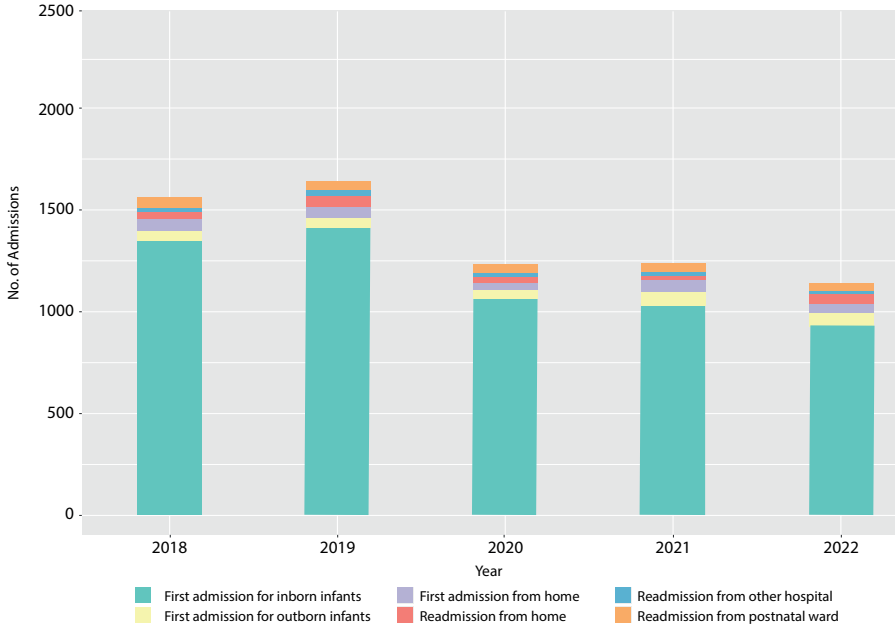


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number	1823	1944	2083	1926	2090	1517	1579	1240	1242	1132

1. Since 2018, the NICU introduced an Early Onset Sepsis calculator which led to a reduction in the number of infants being admitted for sepsis evaluations.

2. Since 2020, the NICU introduced new practices to increase the number of babies with hypoglycaemia that could be managed on the postnatal ward.

1.2 Sources of Admission to the NICU



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
First admission for inborn infants	1612 (88%)	1720 (89%)	1809 (87%)	1703 (88%)	1907 (91%)	1341 (88%)	1417 (90%)	1107 (89%)	1058 (85%)	957 (84%)
- Delivery Ward	649	644	729	715	780	915	950	772	782	715
- Theatre	532	603	629	590	629	Inc. above	Inc. above	Inc. above	Inc. above	Inc. above
- Postnatal Ward	430	473	451	399	498	426	467	335	276	242
First admission for Outborn infants	62 (3%)	52 (3%)	48 (2%)	45 (2%)	55 (3%)	41 (3%)	38 (2%)	46 (4%)	60 (5%)	59 (5%)
First admission from home	69 (4%)	60 (3%)	91 (5%)	82 (4%)	67 (4%)	42 (3%)	38 (2%)	30 (2%)	59 (5%)	46 (4%)
Readmission from postnatal ward	34 (2%)	46 (2%)	60 (3%)	39 (2%)	30 (2%)	39 (3%)	41 (3%)	21 (2%)	15 (1%)	29 (3%)
Readmission from other hospital	19 (1%)	20 (1%)	27 (1%)	14 (1%)	12 (1%)	16 (1%)	21 (1%)	12 (1%)	14 (1%)	11 (1%)
Readmission from home	27 (2%)	46 (2%)	48 (2%)	43 (2%)	19 (1%)	38 (2%)	24 (2%)	24 (2%)	36 (3%)	30 (3%)
Total	**1823 (100%)**	**1944 (100%)**	**2083 (100%)**	**1926 (100%)**	**2090 (100%)**	**1517 (100%)**	**1579 (100%)**	**1240 (100%)**	**1242 (100%)**	**1132 (100%)**

1. Since 2013, any infant who is admitted to the NICU, even if only for a very brief evaluation, is included in the figures.
2. Since 2018, admissions from Delivery Ward and Theatre are combined.

1.3 Clinical Reasons for First Admission of Inborn and Outborn Infants

Diagnostic Categories for Admission

At the time of admission, all infants are assigned a primary clinical reason for admission. These are broad diagnostic categories and reflect the primary symptom at the time of presentation. The "reasons for admission" currently applied in NMH are as follows:

Respiratory: To include any infants admitted with any cause of respiratory distress, which includes TTN, meconium aspiration, RDS, acidosis, apnoea and cyanotic episodes**.**

Gastroenterology: To include cases of jaundice, poor feeding, hypoglycaemia, vomiting, dehydration, failure to thrive, poor weight gain, etc.

Prematurity: To include all infants admitted <37 weeks gestation if this is the primary reason for admission.

Infection: To include any infant who is admitted with a suspected or proven infection. This includes UTIs, skin infections, positive blood cultures, infants with risk factors for sepsis.

Small for Dates: To include any infant born 37 weeks GA but who is 2.5kg and is otherwise well.

Haematological: To include infants with anaemia, polycythemia, thrombocytopenia and/or bleeding problems.

Cardiac: To include infants with suspected or proven cardiac disease.

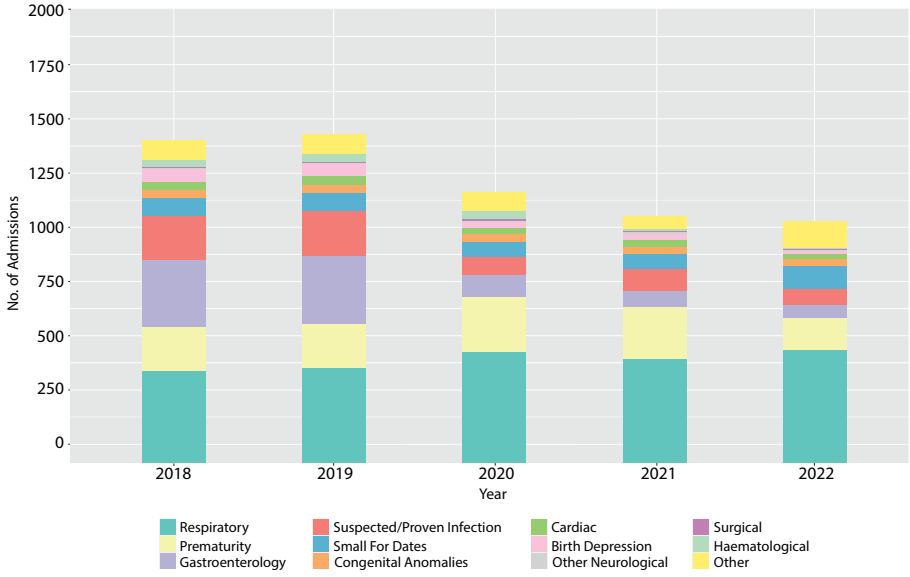
Birth Depression: To include infants with low cord pH's, low Apgars and/or evidence of Neonatal Encephalopathy.

Other Neurological: To include infants with drug withdrawal, seizures without evidence of encephalopathy, irritability, question of seizures, jerking movements etc.

Congenital Anomalies: To include infants admitted with known or suspected congenital anomalies.

Surgical: To include infants admitted with surgical problems such as pyloric stenosis.

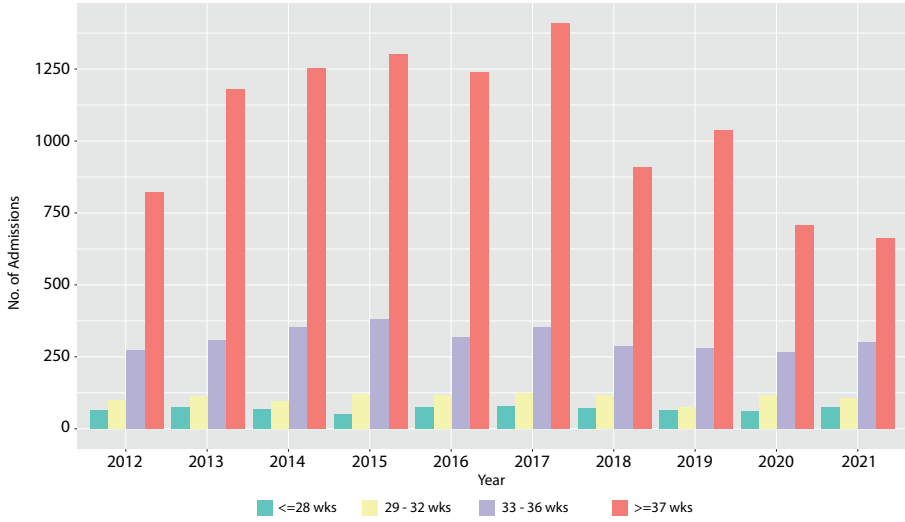
Other: Any other reason not included in the above.



Clinical Reason	2013		2014		2015		2016		2017		2018		2019		2020		2021		2022	
Respiratory	454	27%	476	27%	438	24%	294	17%	426	22%	360	26%	517	36%	399	35%	394	35%	405	40%
Prematurity	186	11%	201	11%	240	13%	282	16%	211	11%	207	15%	204	14%	259	22%	248	22%	134	13%
Gastroenterology	139	8%	145	8%	171	9%	164	9%	293	15%	319	23%	306	21%	189	16%	109	10%	81	8%
Suspected/ Proven Infection	639	38%	628	35%	701	38%	695	40%	670	34%	185	13%	139	9%	77	7%	111	10%	75	7%
Small for Dates	58	3%	96	5%	88	5%	97	6%	94	5%	95	7%	73	5%	63	5%	81	7%	136	13%
Congenital Anomalies	49	3%	59	3%	50	3%	33	2%	29	1%	30	2%	42	3%	30	3%	36	3%	30	3%
Cardiac	24	1%	34	2%	42	2%	47	3%	50	3%	44	3%	42	3%	32	3%	41	4%	34	3%
Birth Depression	27	2%	31	2%	25	1%	31	2%	34	2%	13	1%	27	2%	17	1%	17	2%	9	1%
Other Neurological	18	1%	13	1%	16	1%	10	<1%	15	1%	11	1%	18	1%	12	1%	20	2%	11	1%
Surgical	4	<1%	9	<1%	10	<1%	5	<1%	6	<1%	2	<1%	7	<1%	4	<1%	6	<1%	2	<1%
Haematological	3	<1%	6	<1%	5	<1%	23	1%	33	2%	23	2%	28	2%	23	2%	14	1%	10	1%
Other	73	5%	74	4%	71	4%	67	4%	101	5%	93	8%	52	4%	48	4%	41	4%	89	9%
Total	**1674**	**100%**	**1772**	**100%**	**1857**	**100%**	**1748**	**100%**	**1962**	**100%**	**1382**	**100%**	**1455**	**100%**	**1153**	**100%**	**1118**	**100%**	**1016**	**100%**

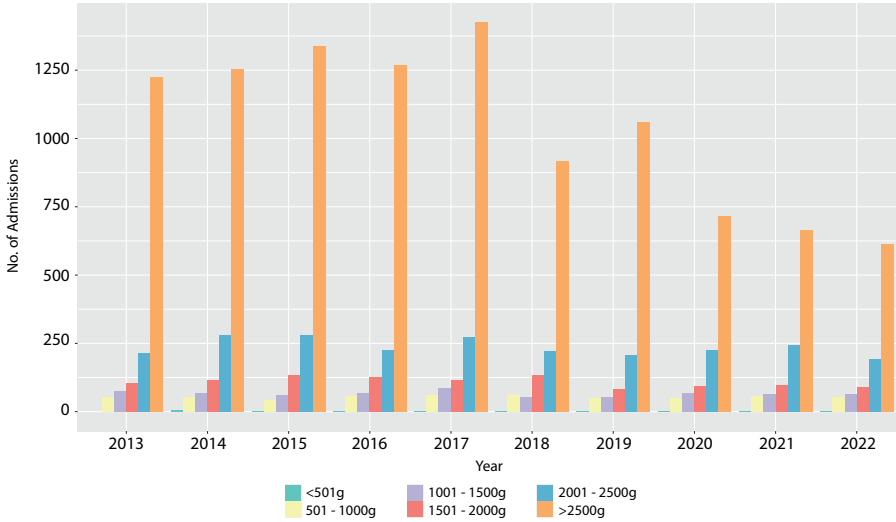
**Diagnostic categories applied are outlined in section 1.3*

1.4 First time admissions by gestational age for inborn and Outborn infants



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
≤ 28 wks	76	69	52	76	78	70	64	62	72	70
29 - 32 wks	112	96	121	116	124	117	75	117	110	86
33 - 36 wks	307	354	382	318	352	287	280	267	279	275
≥ 37 wks	1179	1253	1302	1238	1408	908	1036	707	657	585
Total	**1674**	**1772**	**1857**	**1748**	**1962**	**1382**	**1455**	**1153**	**1118**	**1016**

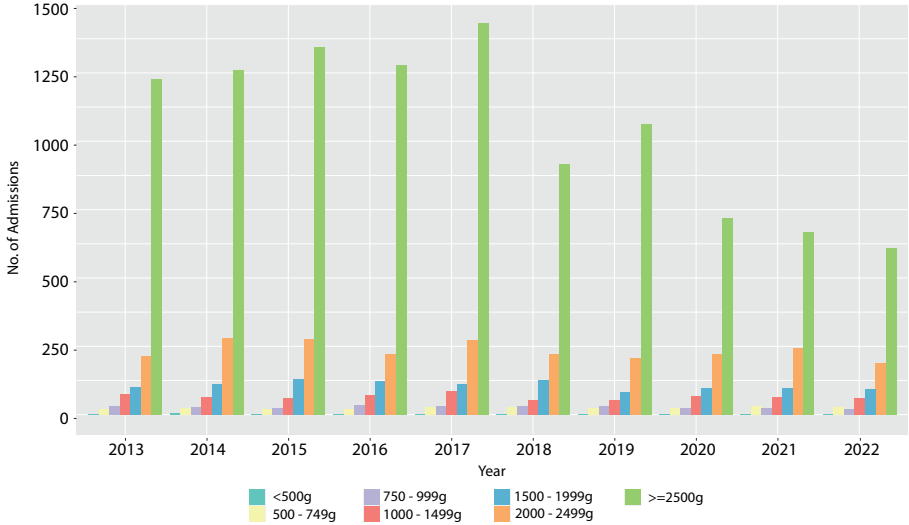
1.5 First time admissions by Birthweight for Inborn and Outborn infants (as defined by VON)



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
<501g	2	4	2	2	2	2	2	3	3	3
501 - 1000g	54	52	41	57	60	59	51	48	58	55
1001 - 1500g	74	66	62	68	87	52	53	67	59	56
1501 - 2000g	104	115	133	127	115	132	84	95	97	98
2001 - 2500g	215	281	280	225	273	221	207	224	243	190
>2500g	1225	1254	1339	1269	1425	916	1058	716	658	614
Total	**1674**	**1772**	**1857**	**1748**	**1962**	**1382**	**1455**	**1153**	**1118**	**1016**

**Vermont Oxford Network (VON) Birthweight Categories*

1.6 First time admissions by Birthweight for Inborn and Outborn Infants (as defined by ESRI)



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
<500g	2	4	1	2	2	2	1	2	3	3
500 - 749g	21	24	20	19	27	26	22	23	34	25
750 - 999g	32	28	22	36	32	32	30	24	24	30
1000 - 1499g	74	65	61	70	87	53	53	66	57	56
1500 - 1999g	102	112	131	122	112	128	81	97	97	95
2000 - 2499g	215	279	277	221	271	223	205	221	244	188
≥2500g	1228	1260	1345	1278	1431	918	1063	720	659	619
Total	**1674**	**1772**	**1857**	**1748**	**1962**	**1382**	**1455**	**1153**	**1118**	**1016**

**The Economic and Social Research Institute (ERSI) Birthweight Categories*

1.7 Multiple Pregnancy

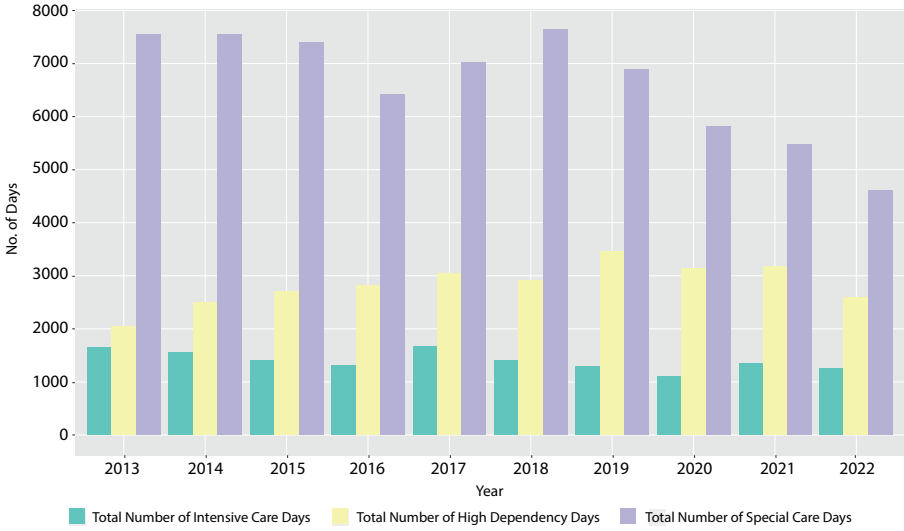
Category	Total
Mothers Delivered ≥24 wks and/or ≥500g	6815
All Babies Born ≥24 wks and/or ≥500g wks (including stillbirths)	6948
Liveborn Babies Born ≥24 wks and/or ≥500g	6920
Liveborn Babies Born ≥22wks and/or >400g	6925

Multiple Births	Mothers Delivered	Babies Born	Liveborn Babies Born	Liveborn Babies Born
Type	≥24 wks and/or ≥500g		≥24 wks and/or ≥500g	≥22wks and/or >400g
Twins	126	251	251	251
Triplets	4	12	12	12
Quads	0	0	0	0
Totals	**130**	**263**	**263**	**263**

1.8 Admission Rates to the NICU for Inborn Infants of Multiple Gestations

EGA	All liveborn singletons	Singletons admitted to NICU	% of singletons admitted to NICU	All liveborn multiples	Multiples admitted to NICU	% of Multiples admitted to NICU	Total No. of Inborn admissions	Admissions of multiple births as percent of the total number of inborn admissions to NICU (n=956)
≤28 wks	45	36	80%	21	18	86%	54	33%
29-32 wks	48	46	96%	32	32	100%	78	41%
33-34 wks	65	63	97%	30	30	100%	93	32%
35-36 wks	207	110	53%	90	63	70%	173	36%
≥37 wks	6297	538	9%	90	20	22%	558	4%
Total	**6662**	**793**	**12%**	**263**	**163**	**62%**	**956**	**17%**

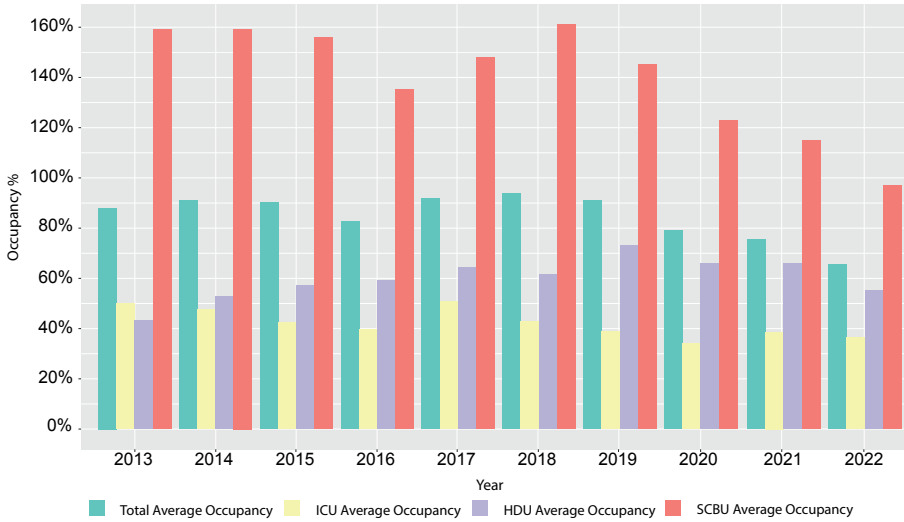
1.9 Levels of Neonatal Care



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Number of Intensive Care Days	1647	1561	1397	1307	1664	1403	1289	1105	1295	1208
Total Number of High Dependency Care Days	2047	2499	2712	2813	3051	2916	3457	3134	3142	2659
Total Number of Special Care Days	7553	7557	7401	6423	7021	7644	6882	5822	5440	4591

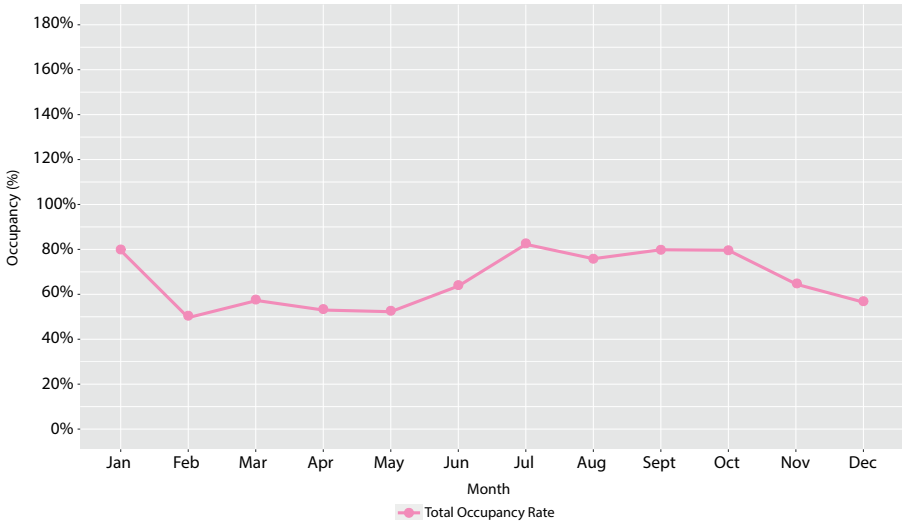
**British Association of Perinatal Medicine. Categories of Care 2011 (August 2011).*
http://www.bapm.org/publications/documents/guidelines/CatsofcarereportAug11.pdf

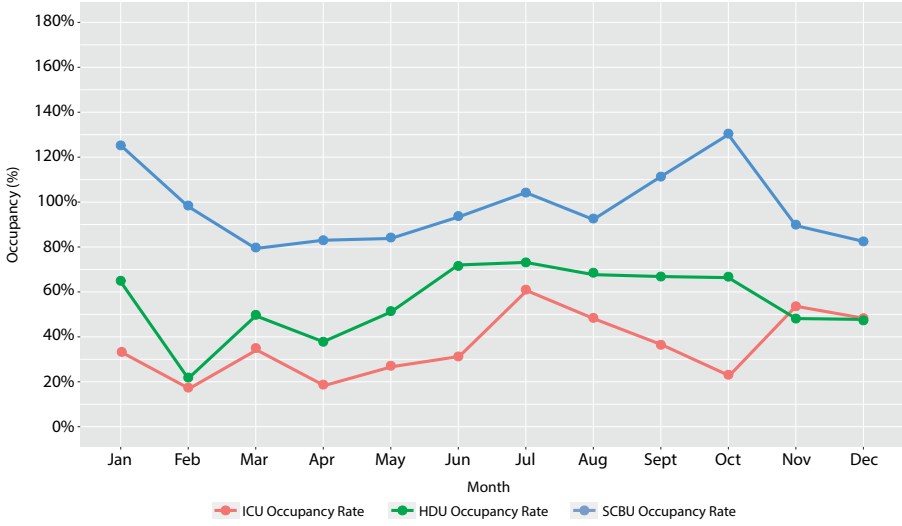
1.10 NICU Occupancy Rates



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Average Occupancy	88%	91%	85%	82%	92%	94%	91%	79%	77%	66%
ICU Average Occupancy	50%	48%	42%	40%	51%	43%	39%	34%	39%	37%
HDU Average Occupancy	43%	53%	57%	59%	64%	61%	73%	66%	66%	56%
SCBU Average Occupancy	160%	159%	156%	135%	148%	161%	145%	123%	115%	97%

1.11 NICU Monthly Occupancy Rates (%)





Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Occupancy Rate	80%	50%	57%	54%	53%	64%	83%	75%	79%	78%	64%	57%
Level 1 ICU (n=9)	34%	18%	35%	19%	28%	32%	61%	49%	37%	23%	54%	49%
Level 2 HDU (n=13)	66%	23%	50%	50%	39%	56%	76%	77%	74%	64%	49%	48%
Level 3 SCBU (n=13)	125%	99%	80%	83%	84%	93%	104%	92%	113%	131%	85%	72%

n = number of cots

Table 1.12: NNTP (National Neonatal Transport Programme) Statistics

Year	2019	2020	2021	2022
Total No. of transports conducted by NNTP	567	546	677	577
No. of transports conducted by the NNTP Team when NMH on service	206 (36%)	193 (35%)	219 (32%)	175 (30%)
No. of NNTP transports admitted to NMH • Referred for neonatal care from non-tertiary neonatal units • Referred from tertiary neonatal units • Hospital transports (from paediatric and adult hospitals)	46 (8%) • 34 (74%) • 8 (17%) • 4 (9%)	48 (9%) • 37 (77%) • 1 (2%) • 10 (21%)	61 (9%) • 44 (72%) • 1 (2%) • 16 (26%)	58 (10%) • 41 (71%) • 3 (5%) • 14 (24%)
No. of NNTP transports originating from NMH • Transferred to tertiary paediatric centres • Transferred back to referring centres	78 (14%) • 67 (86%) • 9 (14%)	78 (14%) • 58 (74%) • 9 (19%)	97 (14%) • 70 (72%) • 27 (28%)	74 (13%) • 65 (88%) • 9 (12%)

**NMH accepted 41% (n=41) of all referrals for neonatal care that were made to one of the three Dublin Maternity Hospitals (n=101)*

1.13 Outpatient Clinic Attendances

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Actual clinics	388	419	417	381	428	395	248	250	250	389
New patients (first visits)	2632	1562	1537	1542	1894	2828	2835	1669	1827	1784
Return visits	1635	2740	2240	2372	2129	539	608	861	1332	1031
Total visits	**4267**	**4365**	**3777**	**3914**	**4023**	**3367**	**3443**	**2530**	**3159**	**2815**

1.14 Out of Hour Emergency Visits/Unbooked Attendances

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Emergency/ unbooked visits	485	432	270	392	398	372	352	433	268	308

SECTION 2: Mortality

2.1 All Deaths

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total number of deaths	46	46	48	52	47	44	50	52	50	50
Inborn deaths	44	43	43	45	41	42	46	45	48	46
Deaths in normally formed infants	28	26	30	33	32	20	24	30	35	34
Deaths in normally formed infants weighing ≤1500g	26	22	21	29	26	18	16	21	31	28
Deaths occurring in first 7 days of life	37	31	33	40	28	31	42	37	33	33
Deaths occurring in first 28 days of life	44	42	40	50	39	35	47	42	45	41
Deaths occurring in NMH	40	40	39	50	40	34	40	40	40	40

This table includes all deaths of liveborn infants irrespective of gestational age or birthweight. A liveborn infant is defined as any infant who breathes or has any evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles. Any death that is reported to the staff of the NICU, irrespective of the place or timing of death (i.e. the death may occur after discharge from the NICU), is also included in the above table. It should be noted that complete ascertainment of deaths that occur post-discharge from NMH, particularly after 28 days of age, cannot be guaranteed as NMH relies on other institutions/agencies to be notified of such deaths.

2.2: Inborn Deaths

Year	2018	2019	2020	2021	2022
Total number of deaths	42	46	45	48	46
Total number of deaths ≤1500g	21	24	26	33	31
Deaths in normally formed infants	18	22	24	33	31
Deaths in normally formed infants weighing ≤1500g	16	15	19	30	26
Deaths in infants with congenital anomalies	24	24	21	15	15
Deaths in infants with congenital anomalies weighing ≤1500g	5	9	7	3	5
Deaths in the Delivery Room	16	13	16	12	15
Deaths in the Delivery Room in normally formed infants	8	5	5	8	10
Deaths in the Delivery Room in normally formed infants weighing ≤1500g	8	5	5	8	10
Deaths in the Delivery Room in infants with congenital anomalies	8	8	11	4	5
Deaths in the Delivery Room in infants with congenital anomalies weighing ≤1500g	0	2	4	1	3
Deaths occurring in first 7 days of life	30	39	32	32	31
Deaths occurring in first 28 days of life	34	43	37	44	38
Deaths occurring in NMH	32	37	35	39	37

**Tables 2.1 and 2.2 updated in 2022*

2.3: Outborn Deaths

Year	2018	2019	2020	2021	2022
Total number of deaths	2	4	7	2	4
Total number of deaths ≤1500g	2	2	2	1	2
Deaths in normally formed infants.	2	2	6	2	3
Deaths in normally formed infants weighing ≤1500g	2	1	2	1	2
Deaths in infants with congenital anomalies	0	2	1	0	1
Deaths in infants with congenital anomalies weighing ≤1500g	0	1	0	0	0
Deaths occurring in first 7 days of life	1	3	5	1	2
Deaths occurring in first 28 days of life	2	4	5	1	3
Deaths occurring in NMH	2	3	5	1	3

Mortality Rate Calculations

(1) Early Neonatal Mortality Rate (ENMR) includes deaths up to 7 days and is calculated as follows

$$\frac{\text{Number of Early Neonatal Deaths (in first 7 days of life)} \times 1000}{\text{Total Number of Livebirths}}$$

The total number of livebirths includes all liveborn infants irrespective of birth weight and/or gestational age and excludes stillbirths (n=6948 - 28 + 7 = 6927).

(2) Late Neonatal Mortality Rate (LNMR) includes deaths up to 28 days of age.

(3) The rates can be adjusted to exclude those infants with lethal congenital malformations. The denominator for this calculation is the total number of livebirths (n=6927) less the number of livebirths who are born with lethal congenital malformations and who died (n=15) i.e. 6912.

(4) Please note, only inborn infants are included in the mortality rate calculations shown in Tables 2.4 & 2.5

2.4 Neonatal Mortality Rates for all liveborn inborn babies regardless of birthweight and gestation

Neonatal Mortality Rates	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Early neonatal mortality rate per 1000 births (n=31/6927)	4.0	3.1	3.4	3.8	2.9	3.9	4.9	4.3	4.1	4.5
Early neonatal mortality rate corrected for lethal congenital malformations (n=22/6912)	2.7	1.7	1.8	2.1	1.7	1.8	2.3	2.3	2.9	3.2
Late neonatal mortality rate per 1000 births (n=38/6927)	4.8	4.2	3.9	4.8	3.8	4.4	5.4	5.0	5.6	5.5
Late neonatal mortality rate corrected for lethal congenital malformations (n=26/6912)	2.9	2.4	2.3	2.8	2.4	2.1	2.8	2.9	4.0	3.8

2.5 Perinatal Mortality Rates for all babies born ≥500g and/or 24 wks gestation including stillbirths

Perinatal Mortality Rates	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Overall perinatal mortality rate per 1000 births	7.1	6.0	6.3	5.9	6.3	7.6	9.2	8.9	8.1	7.6
Perinatal mortality rate corrected for lethal congenital anomalies	4.7	3.6	4.1	3.3	4.1	4.3	5.3	6.4	5.7	5.1
Overall Perinatal mortality rate including late neonatal deaths	8.0	7.0	7.5	7.0	7.1	8.3	8.2	10.0	9.7	8.5
Overall Perinatal Mortality Rate excluding external referrals	n/a	n/a	n/a	n/a	n/a	n/a	6.7	7.3	6.6	5.1
Perinatal Mortality Rate corrected for lethal congenital anomalies and excluding early deaths and stillbirth external referrals	n/a	n/a	n/a	n/a	n/a	n/a	4.5	5.7	4.2	3.5

PMR excludes deaths of liveborn infants who are born <24 wks gestation, with a birth weight of<500g.

2.6: Inborn infants with congenital anomalies (15)

Case No.	EGA	BW (g)	Gender	Delivery Method	Apgars (1/5/10 mins)	Age at death (days)	Place of death	External Referral	IUGR	Placental Histology	Cause of death	PM
1	25+0	895	Female	Spontaneous Vaginal	5, 4	1	DR Death	No	No	Gross only	Multiple congenital anomalies; anhydramnios, pulmonary hypoplasia, spina bifida, pelvic mass, renal agenesis	No
2	25+3	590	Female	C-Section	7, 10	28	NICU	No	No	Severe MVM, velamentous cord with SUA.	Imperforate anus and colostomy formation, skeletal abnormalities, complications of extreme prematurity, ELBW, severe RDS	No
3	26+2	680	Male	C-Section	2, 1, 1	1	DR Death	Home	Yes	TCTA. DCH. Abnormal maturation.	Pulmonary hypoplasia, PPROM; multiple congenital anomalies (cardiac, skeletal, palate)	No
4	27+3	860	Male	C-Section	6, 4	1	DR Death	Yes	No	DCDA. Low grade FVM.	Genetic syndrome identified	No
5	27+3	1240	Male	C-Section	3, 5, 6	7	NICU	Yes	No	DCDA.	Pulmonary hypoplasia, pulmonary hypertension, urinary tract anomaly; bilateral hydroureteronephrosis, prematurity, VLBW	No
6	31+3	1560	Female	C-Section	2, 4	2	NICU	No	No	Hydrops	Pulmonary hypoplasia, PPROM (from 22 weeks), non-immune hydrops fetalis, bilateral chylothoraces, prematurity	No
7	34+2	1665	Male	C-Section	8, 8	46	Paediatric Hospital	No	No	Abnormal villous maturation	Genetic syndrome identified	No

Case No.	EGA	BW (g)	Gender	Delivery Method	Apgars (1/5/10 mins)	Age at death (days)	Place of death	External Referral	IUGR	Placental Histology	Cause of death	PM
8	35+1	2900	Male	Spontaneous Vaginal	1, 1	1	DR Death	No	No	Chorioamnionitis	Complex congenital heart abnormality	No
9	36+6	2760	Male	C-Section	2, 1, 1	1	DR Death	No	No	Gross only	Complex congenital heart abnormality	No
10	38+2	3055	Female	C-Section	4, 6, 8	186	Paediatric Hospital / Community	No	No	Not available	Congenital metabolic syndrome with a genetic cause identified	No
11	38+4	3220	Male	Spontaneous Vaginal	6, 8	21	Paediatric Hospital	No	No	Chorangiosis	Congenital heart lesion – truncus arteriosus, 22q11 deletion syndrome	No
12	38+5	2690	Male	C-Section	7, 9	2	Paediatric Hospital	Yes	No	Gross only, short cord.	Hypoplastic left heart; genetic abnormality identified	No
13	38+5	3565	Female	C-Section	4, 7	12	Paediatric Hospital	No	No	Gross only	Multiple congenital anomalies; diaphragmatic hernia, genetic abnormality identified	No
14	39+0	3120	Male	C-Section	7, 8	2	PNW	No	No	No abnormal histology reported	Severe congenital heart abnormality	No
15	39+2	3080	Male	C-Section	9, 8	97	Paediatric Hospital	No	no	Gross only	Multiple congenital anomalies; cardiac, renal, brain; genetic abnormality identified	No

2.7: Inborn infants normally formed ≤1500g (26)

Case No.	EGA	BW (g)	Gender	Delivery Method	Apgars (1/5/10 mins)	Age at death (days)	Place of death	External Referral	IUGR	Placental Histology	Cause of death	PM
1	18+1	225	Male	Spontaneous Vaginal	ND	1	DR Death	No	No	Chorioamnionitis	Extreme prematurity, preterm labour at a pre-viable gestation	No
2	19+3	290	Female	Spontaneous Vaginal	2, 2	1	DR Death	No	No	Mild chorionitis	Extreme prematurity, preterm labour at a pre-viable gestation	No
3	20+0	330	Male	Spontaneous Vaginal	4, 4, 4	1	DR Death	No	No	Gross only	Megacystis, oligohydramnios	No
4	21+0	435	Male	Spontaneous Vaginal	1, 1	1	DR Death	No	No	Chorioamnionitis with retroplacental haemorrhage	Extreme prematurity, preterm labour at a pre-viable gestation	No
5	22+0	455	Female	C-Section	ND	1	DR Death	No	No	High grade FVM	Extreme prematurity, PPROM, clinical chorioamnionitis; placenta accreta	No
6	22+5	465	Female	Spontaneous Vaginal	2, 2	1	DR Death	No	No	Chorioamnionitis	Extreme prematurity, preterm labour at a pre-viable gestation	No
7	23+0	535	Female	Spontaneous Vaginal	1, 1	1	DR Death	Yes	No	Chorioamnionitis	Extreme prematurity, intensive care measures not initiated	No
8	23+2	555	Female	Spontaneous Vaginal	5, 9	5	NICU	Yes	No	Decidual necrosis	E.Coli sepsis, extreme prematurity, severe RDS, clinical chorioamnionitis, PPROM x 2 days	No
9	23+2	615	Female	C-Section	5, 3	1	DR Death	No	No	Chorioamnionitis	Extreme prematurity, ELBW, resuscitative measures not initiated	No

Case No.	EGA	BW (g)	Gender	Delivery Method	Apgars (1/5/10 mins)	Age at death (days)	Place of death	External Referral	IUGR	Placental Histology	Cause of death	PM
10	23+4	510	Male	Spontaneous Vaginal	1, 1	1	DR Death	Yes	No	Chorioamnionitis	Extreme prematurity, clinical chorioamnionitis, PPROM x 3 days, intensive care measures not initiated	No
11	23+5	470	Female	Spontaneous Vaginal	4, 5, 6	32	NICU	No	No	High grade MVM. MIR,	Perforated NEC	No
12	23+6	560	Male	Spontaneous Vaginal	3, 4, 7	8	NICU	No	No	Chorioamnionitis	Intestinal perforation, suspected NEC, extreme prematurity, ELBW	No
13	24+6	800	Male	Spontaneous Vaginal	1, 3	1	DR Death	No	No	Chorioamnionitis	Extreme prematurity, intensive care measures not initiated	No
14	25+0	590	Male	Spontaneous Vaginal	ND	1	NICU	No	No	FVM. MIR and FIR. Severe chorioamnionitis.	Extreme prematurity, pulmonary hypoplasia, PPROM from 21 weeks'	No
15	25+0	735	Female	Spontaneous Vaginal	6, 8	47	NICU	Yes	No	MIR and FIR. Low grade MVM.	NEC, extreme prematurity, ELBW	No
16	25+0	900	Female	C-Section	3, 5, 6	1	NICU	No	No	DCH	Multiorgan failure, perinatal asphyxia, placental compromise and recurrent APH, extreme prematurity	No
17	25+3	700	Female	C-Section	1, 2, 3	1	NICU	No	No	Chorioamnionitis	Pulmonary hypoplasia, PPROM from 18 weeks, severe metabolic acidosis, extremely preterm twin	No
18	26+0	700	Male	C-Section	5, 5, 7	12	NICU	Yes	No	MCDA. No abnormal histology reported.	Severe RDS, extreme prematurity, gram negative sepsis	No

Case No.	EGA	BW (g)	Gender	Delivery Method	Apgars (1/5/10 mins)	Age at death (days)	Place of death	External Referral	IUGR	Placental Histology	Cause of death	PM
19	26+1	450	Female	C-Section	1, 9	10	NICU	Yes	Yes	High grade MVM and FVM	Gram negative sepsis, extreme prematurity, ELBW, severe RDS, seizures	No
20	26+2	660	Female	C-Section	3, 6, 6	15	NICU	Home	Yes	TCTA. DCH. Velamentous hypercoiled cord.	NEC, extreme prematurity, ELBW, IVH	No
21	26+2	935	Male	C-Section	8, 8	4	NICU	Home	No	TCTA. DCH.	Grade IV IVH, clinically suspected spontaneous GI perforation, extreme prematurity, triplet pregnancy	No
22	26+3	1010	Male	C-Section	0, 1	1	NICU	No	No	Chorioamnionitis, low grade FVM.	Pulmonary hypoplasia, oligohydramnios from 14 weeks, extreme prematurity, ELBW	Yes
23	26+4	580	Male	C-Section	1, 4, 6	3	NICU	No	Yes	Severe MVM	Severe RDS, ELBW, extreme prematurity	No

Case No.	EGA	BW (g)	Gender	Delivery Method	Apgars (1/5/10 mins)	Age at death (days)	Place of death	External Referral	IUGR	Placental Histology	Cause of death	PM
24	27+0	1310	Female	C-Section	2, 4, 5	2	NICU	No	No	Villous oedema	Severe pulmonary haemorrhage, feto-maternal haemorrhage and severe fetal anaemia, multi-organ dysfunction, extreme prematurity	No
25	27+2	770	Male	C-Section	6, 10	3	NICU	No	No	Severe MVM.	Pulmonary haemorrhage, extreme prematurity, ELBW	No
26	27+3	930	Male	Spontaneous breech with MSV	3, 4, 6	1	NICU	No	No	MCDA	Pulmonary hypoplasia, oligohydramnios, prematurity, MCDA twins with TTTS	No

2.8: Inborn infants normally formed >1500g (5)

Case No.	EGA	BW (g)	Gender	Delivery Method	Apgars (1, 5, 10 mins)	Age at death (days)	Place of death	External Referral	IUGR	Placental Histology	Cause of death	PM
1	31+6	2270	Male	C-Section	8, 9	10 months	Out of hospital death	No	No	Low grade MVM. High grade FVM.	Coroner's inquest	CC
2	34+6	2015	Male	Spontaneous Vaginal	9, 9	69	Out of hospital death	No	No	Low grade FVM.	Coroner's inquest	CC
3	38+0	3580	Male	C-Section	9, 9	36	Out of hospital death	No	No	Gross only	Coroner's inquest	CC
4	39+2	3715	Female	C-Section	3, 8	6	NICU	No	No	Retroplacental haemorrhage. High grade FVM.	Coroner's inquest	CC
5	41+0	3980	Male	Spontaneous Vaginal	0, 0, 1	5	NICU	No	No	Delayed villous maturation	Coroner's inquest	CC

2.9: Outborn infants with congenital anomalies (1)

Case No.	EGA	BW (g)	Gender	Delivery Method	Apgars (1, 5, 10 mins)	Age at death (days)	Place of death	Placental Histology	Cause of death	PM
1	39+4	3170	Male	C-Section	0, 0, 8	252	Local hospital/ home	Not available	Seizure disorder, abnormal brain on MRI, genetic condition identified	No

2.10: Outborn infants normally formed ≤1500g (2)

Case No.	EGA	BW (g)	Gender	Delivery Method	Apgars (1, 5, 10 mins)	Age at death (days)	Place of death	Placental Histology	Cause of death	PM
1	23+5	745	Male	C-Section	n/r	4	NICU	Not available	Grade IV IVH, complications of extreme prematurity	No
2	24+1	840	Male	Spon-taneous Vaginal	5, 7, 8	10	NICU	Not available	Extreme prematurity, ELBW, severe RDS	No

2.11: Outborn infants normally formed >1500g (1)

Case No.	EGA	BW (g)	Gender	Delivery Method	Apgars (1, 5, 10 mins)	Age at death (days)	Place of death	Placental Histology	Cause of death	PM
1	40+0	3800	Female	C-Section	1, 3	4	NICU	Not available	Severe neonatal encephalopathy, placental abruption	Yes

- *Age of Death (days) is calculated as the Date of Death minus the Date of Birth + 1,*
- *END: Early neonatal death (within first 7 days of life). If infant is listed as having died D7, it can be assumed it is an END.*
- *LND: Late neonatal death (within first 28 days of life). If infant is listed as having died D28, it can be assumed it is an LND.*
- *ID: Infant death (death after 28 days of life).*
- *Active Resus in DR: Defined as providing any form of respiratory support in the initial resuscitation area (ie CPAP or IPPV but does not include the administration of oxygen).*
- *Any liveborn infant who dies on the ANW (AntenatalWard), in the DR, in Theatre or on the PNW (PostnatalWard) within a few hours of birth without having been admitted to the NICU is considered a DR death.*
- *Any liveborn infant who dies on the PNW (PostnatalWard) after having been admitted to the NICU is considered to have died in the NICU.*
- *ND: Not documented.*

SECTION 3: Neonatal Encephalopathy

3.1 Definitions

Since 2013, NMH now reports on all infants **≥35 weeks gestation** who during the first week of life have:

- Either seizures alone

or

- Signs of Neonatal Encephalopathy which is defined as clinical findings in 3 or more of the following domains:
- Level of consciousness
- Spontaneous activity when either awake or aroused
- Posture
- Tone
- Primitive reflexes
- Automonic system

For a more detailed description of the findings in each domain, please refer to appendix 2. To be included in our annual figures, the signs of neonatal encephalopathy (whether mild, moderate or severe) must be present for at least 24 hrs.

Cases reported are reviewed and some are subsequently reclassified as Hypoxic-Ischaemic Encephalopathy if there is clinical evidence of encephalopathy (as defined above) associated with one or more of the following physiological criteria:

- Apgar score ≤5 at 10 mins of age
- Continued need for resuscitation (endotracheal intubation or PPV) at 10 mins after birth.
- Acidosis within 60 mins of birth (defined as a pH < 7.0 in an umbilical cord or any neonatal arterial, venous or capillary blood sample)
- Base deficit ≥16 mmol/L in an umbilical cord or any neonatal blood sample (arterial, venous or capillary) within 60 mins of birth

Reference is also made to which cases undergo therapeutic hypothermia. Please note that the physiological criteria which are now used to reclassify a case as HIE are broader than the criteria applied in previous years. If pertinent obstetric details surrounding the delivery are not available to allow a case to be catergorised as HIE according to the above definition, then, the case, by default, is reported as a case of Neonatal Encephalopathy. In all reported cases, it is assumed that there is no evidence of an infectious cause, a congenital malformation of the brain or an inborn error of metabolism that could explain the encephalopathy.

All cases (both neonatal encephalopathy cases and hypoxic-ischaemic encephalopathy cases) are further categorised according to severity of presentation. The most severe stage observed during the first 7 days following birth is recorded based on the infant's level of consciousness and response

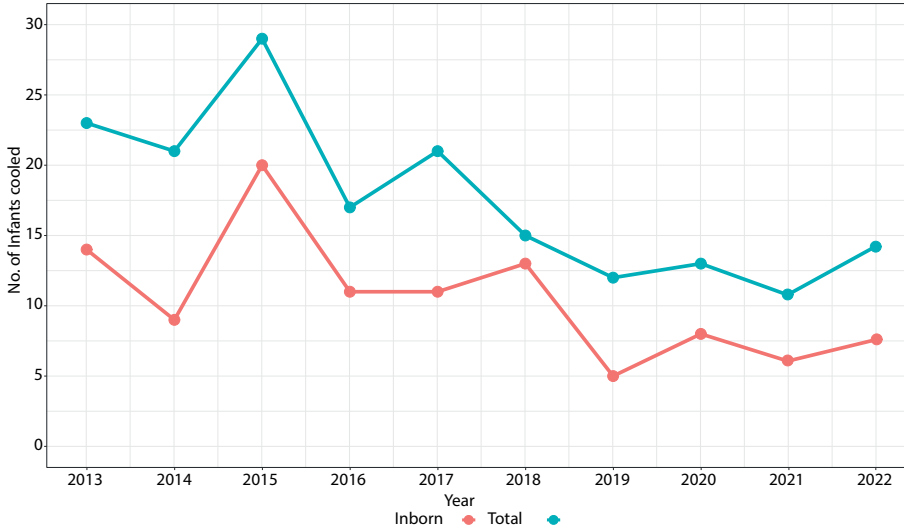
to arousal manoeuvres such as persistent gentle shaking, shining a light or ringing of a bell. Infants are considered to fall into the 'mild' category if they are alert or hyperalert with either a normal or exaggerated response to arousal, infants fall into the 'moderate' category if they are arousable but are lethargic and have a diminished response to arousal manoeuvres and infants fall into the 'severe' category if they are stuporous or comatosed and are difficult to arouse or are not arousable. If further clarification regarding any of these clinical terms or definitions is required, please refer to appendix 2.

Since 2017, infants who have seizures but who are not clinically encephalopathic are no longer included in the neonatal encephalopathy figures as before; they will now be listed separately.

3.2 Number of Cases 2022

	Inborns	Outborns
Neonatal Encephalopathy - with HIE	4	4
• Mild HIE (Grade 1)	0	0
• Moderate HIE (Grade 2)	1	2
• Severe HIE (Grade 3)	1	2
Neonatal Encephalopathy	3	3
Seizures – No Encephalopathy	3	0
Therapeutic Hypothermia	7	7

3.3 Infants undergoing Therapeutic Hypothermia in NMH



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Inborn										
HIE cases reported	12	9	19	9	9	9	5	8	6	4
Number cooled	*11*	*9*	*18*	*9*	*9*	*9*	*5*	*8*	*6*	*4*
NE cases reported	7	4	2	5	2	4	0	0	0	3
Number cooled	*3*	*0*	*2*	*2*	*2*	*4*	*0*	*0*	*0*	*3*
Total	**19**	**13**	**21**	**14**	**11**	**13**	**5**	**8**	**6**	**7**
Outborn										
HIE cases reported	8	13	8	6	10	2	6	4	2	4
Number cooled	*7*	*12*	*8*	*5*	*9*	*2*	*6*	*4*	*2*	*4*
NE cases reported	4	1	1	1	1	0	2	2	3	3
Number cooled	*2*	*0*	*1*	*1*	*1*	*0*	*1*	*1*	*3*	*3*
Total	**12**	**14**	**9**	**7**	**11**	**2**	**8**	**6**	**5**	**7**
Total Inborn and Outborn Cases	**31**	**27**	**30**	**21**	**22**	**15**	**13**	**14**	**11**	**14**
Total receiving Therapeutic Hypothermia										
Inborn infants cooled	14	9	20	11	11	13	5	8	6	7
Outborn infants cooled	9	12	9	6	10	2	7	5	5	7
Total	**23**	**21**	**29**	**17**	**21**	**15**	**12**	**13**	**11**	**14**

The above table excludes 5 additional infants who were cooled in our institution:
Two inborn infants were cooled in 2014 but were excluded as both of these infants were diagnosed with early onset neonatal sepsis.
One outborn infant was cooled in 2015 but was excluded as the infant was diagnosed with a congenitally acquired condition in the postnatal period.
One inborn infant was cooled in 2016 but was excluded at the infant was <35 wks gestation.
One inborn infant was cooled in 2019 but was excluded as the infant was diagnosed with early onset neonatal sepsis.
Since 2017, infants who have seizures but who are not clinically encephalopathic are excluded from the above table.

3.4 Hypoxic Ischaemic Encephalopathy: Inborn (4)

Case No.	EGA	BW (g)	Delivery Method	Delivery Method Indication	Apgars 1, 5, 10, 15, 20	PPV at 10 mins	Min pH within 60 min	Max BE within 60 min	Seizures Y/N	TH	Grade of NE	Summary of MRI brain	Organ Involvement	Outcome	Placental Histology	Classification
1	36+3	3950	SVD	PPROM, shoulder dystocia	0,0,3	Yes	7.27	-7.3	Yes	Yes	2	Normal	Ventilated	Discharged home D36	High grade FVM	1,2 HIE inborn
2	38+6	3840	Operative vaginal (Forceps)	Fetal tachycardia, NRCTG	1,1,4	Yes	7	-21.9	Yes	Yes	2	Abnormal: multiple small areas of infarction bilaterally, pattern suggestive of infection	Ventilated, acute kidney injury, raised LFTS, SIADH, coagulopathy, culture negative meningitis	Discharged home D18	Chorioamnionitis with fetal response. High grade villitis with stem vessel obliteration	1,2,4 HIE inborn
3	40+0	3450	Operative vaginal (Forceps)	Failure to advance, maternal pyrexia, failed ventouse	2,4,6	No	6.99	-16.4	No	Yes	2	Normal parenchyma, left extra-axial haemorrhage	AKI, increased LFTs, coagulopathy, SIADH	Discharged home D8	Mild chorionitis with mild fetal response	3,4 HIE inborn
4	41+0	3980	SVD	NRCTG	0,0,1	Yes	6.8	Incalculable	Yes	Yes	3	Abnormal: global pattern of ischaemia/infarction	Ventilated, acute kidney injury, raised liver function tests, coagulopathy	Died D5, Coroner's case	Delayed villous maturation	1,2,3,4 HIE inborn

3.5 Neonatal Encephalopathy: Inborn (3)

Case No.	EGA	BW (g)	Delivery Method	Delivery Method Indication	Apgars 1, 5, 10, 15, 20	PPV at 10 mins	Min pH within 60 min	Max BE within 60 min	Seizures Y/N	TH	Grade of NE	Summary of MRI brain	Organ Involvement	Outcome	Placental Histology	Classification
1	37+4	2600	Emergency C-Section (not in labour)	NRCTG	2,6,8	No	7	-12	Yes	Yes	2	Abnormal: large left intraparenchymal hemorrhage in tempero-occipital area	Ventilated, hyponatraemia, SIADH, coagulopathy, thromobytopenia,	Discharged home D15	High grade villitis with stem vessel obliteration. Moderate MVM.	NE inborn
2	39+2	3715	Emergency C-Section (not in labour)	Placental abruption, reduced fetal movements, NRCTG	3,8	No	7.11	-9.5	Yes	Yes	3	Abnormal: global pattern of ischaemia/ infarction	Ventilated, acute kidney injury, anaemia, thrombocytopenia, SIADH	Died D6, Coroner's case	Retroplacental haemorrhage. High grade FVM.	NE inborn
3	40+1	3475	Operative vaginal (Forceps)	NRCTG	4,6,8	No	7.12	-13.8	No	Yes	2	Normal	None	Discharged home D9	High grade FVM	NE inborn

3.6 Hypoxic Ischaemic Encephalopathy: Outborn (4)

Case No.	EGA	BW (g)	Delivery Method	Delivery Method Indication	Apgars 1, 5, 10, 15, 20	PPV at 10 mins	Min pH within 60 min	Max BE within 60 min	Seizures Y/N	TH	Grade of NE	Summary of MRI brain	Organ Involvement	Outcome	Placental Histology	Classification
1	37+4	2900	Emergency C-Section (in labour)	IOL for oligohydramnios, NRCTG	0,0,0	Yes	7	-8	Yes	Yes	3	Abnormal: global pattern of ischaemia/ infarction	Ventilated, coagulopathy	Transferred back to referring hospital D11	No placenta in NMH	1,2 HIE outborn
2	38+6	4060	SVD	IOL for GDM , shoulwder dystocia	2,1,4,6,8	Yes	7.18	-12	No	Yes	2	Normal	Ventilated	Discharged home D8	No placenta in NMH	1,2 HIE outborn
3	40+0	3800	Emergency C-Section (not in labour)	Placental abruption, fetal bradycardia	1,3,4	Yes	6.85	-17.8	Yes	Yes	3	Abnormal: global pattern of ischaemia/ infarction	Ventilated, myocardial dysfunction, acute kidney injury, SIADH, hyponatraemia, raised LFTS	Died D4: Severe neonatla encephalopathy, placental abruption	No placenta in NMH	1,2,3,4 HIE outborn
4	40+6	2955	Operative vaginal (Ventouse)	Fetal bradycardia	4,5,6	Yes	6.8	Incalculable	No	Yes	2	Abnormal: Unilateral, right sided, two small areas of focal ischaemic change. Parenchyma otherwise normal	Ventilated	Transferred back to referring hospital D6	No placenta in NMH	2,3,4 HIE outborn

3.7 Neonatal Encephalopathy: Outborn (3)

Case No.	EGA	BW (g)	Delivery Method	Delivery Method Indication	Apgars 1, 5, 10, 20 mins	PPV at 10 mins	Min pH within 60 mins	Max BE within 60 mins	Seizures Y/N	TH	Grade of NE	Summary of MRI brain	Organ Involvement	Outcome	Placental Histology	Classification
1	37+0	2750	Operative vaginal (Ventouse)	IOL reduced fetal movement, NRCTG	5,8	No	7.18	-7.9	No	Yes	2	Normal	Ventilated, SIADH, raised LFTs	Transferred back to referring hospital D7	No placenta in NMH	NE outborn
2	39+1	3550	SVD	Fetal bradycardia	4, 8, 10	No	7.09	-11	No	Yes	2	Normal parenchyma, isolated cortical vein thrombus	None	Transferred back to referring hospital D6	No placenta in NMH	NE outborn
3	39+2	3485	SVD	Spontaneous labour	9,10	No	7.03	-14	Yes	Yes	2	Normal	Ventilated, SIADH, raised LFTs	Transferred back to referring hospital DOL 6	No placenta in NMH	NE outborn

3.8 Seizures – No Encephalopathy: Inborn (3)

Case No.	EGA	BW (g)	Delivery Method	Delivery Method Indication	Apgars 1, 5, 10, 15, 20	PPV at 10 mins	Min pH within 60 min	Max BE within 60 min	Seizures Y/N	TH	Grade of NE	Summary of MRI brain	Organ Involvement	Outcome	Histology	Classification
1	36+5	4260	Emergency C- Section	Reduced fetal movements	5,8	No	7.08	-6.3	Yes	No	0	Bilateral IVH	Ventilated	Discharged home D43	High grade FVM and long cord	Seizure secondary to underlying genetic syndrome (under investigation)
2	40+5	4050	Emergency C-Section	Fetal bradycardia	8,9	No	7.29	Not recorded	Yes	No	0	Biilateral ischaemic changes periventricular regions	None	Transfer to tertiary paediatric centre D14	Long hypocoiled cord	Seizure secondary to hypoglycaemia and hyperinsulinism
3	41+2	4060	SVD	Spontaneous labour	8,9	No	7.11	-10	Yes	No	0	CRUSS: Normal	None	Discharged home D14	None	Seizure likely secondary to culture negative meningitis

3.9 Seizures – No Encephalopathy: Outborn (0)

No cases to report.

Classification:
1) Apgar score ≤5 at 10 mins of age
2) Continued need for resus at 10 mins after birth
3) pH <7.0 within 60 mins of birth
4) Base excess ≥ 16.0 within 60 mins of birth

Follow up of Neonatal Encephalopathy Cases

Since 2005, all infants who present in the newborn period with neonatal encephalopathy are followed in our out-patient clinic until they are 2 years of age. At that time, they undergo a full psychological evaluation (the Bayley Scales of Infant and Toddler Development-III) by our unit psychologist. Since 2020, and brought about as a response to the Covid-19 pandemic, the few infants who cannot attend for a Bayley Assessment, are offered an assessment using a combination of the PARCA-R (**P**arent **R**eport of **C**hildren's **A**bilities-**R**evised) Questionnaire and a telephone consultation with our clinical psychologist. Please see Section 8 for further details.

3.10 Yearly Neurodevelopmental Follow-up Rates (including infants who died)

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cases (%) followed up	27/32 (84%)	30/39 (77%)	27/31 (87%)	21/27 (78%)	25/30* (83%)	20/21* (95%)	26/30 (87%)	19/21* (90%)	12/17 (71%)	14/16 (88%)

** indicates an infant who could not be assessed on the day.*

3.11 Neurodevelopmental Outcome of the 2020 cohort at 2 years of age

2020 Cases (Neonatal Report)	Severity of Encephalopathy	Therapeutic Hypothermia (TH)	Assessment Tool	Cognitive Score	Language Score	Motor Score	Outcome
Inborn HIE 1	Moderate (Grade 2)	Yes	Bayley Assessment	70	74	49	Severe
Inborn HIE 2	Moderate (Grade 2)	Yes	Bayley Assessment	85	56	91	Normal
Inborn HIE 3	Severe (Grade 3)	Yes					Declined formal follow up. Infant demonstrating signs of significant global developmental delay.
Inborn HIE 4	Moderate (Grade 2)	Yes	Bayley Assessment	100	112	107	Normal
Inborn HIE 5	Severe (Grade 3)	Yes					Died D1
Inborn HIE 6	Severe (Grade 3)	Yes					Died D7
Inborn HIE 7	Moderate (Grade 2)	Yes	PARCA-R	100	120	Average	Normal
Inborn HIE 8	Severe (Grade 3)	Yes	Bayley Assessment	135	132	124	Normal
Outborn HIE 1	Severe (Grade 3)	Yes					Died D2
Outborn HIE 2	Moderate (Grade 2)	Yes					Died D4

Outborn HIE 3	Moderate (Grade 2)	Yes (but discontinued after 13 hrs due to severe PPHN)	Bayley Assessment	105	100	97	Normal
Outborn HIE 4	Moderate (Grade 2)	Yes	Bayley Assessment	90	77	88	Normal
Outborn NE 1	Severe (Grade 3)	Yes					Died at 5 months
Outborn NE 2	Severe (Grade 3)	No					Died D2
Inborn Seizures, No Encephalopathy 1	Not encephalopathic	No					Seizures due to an underlying brain malformation. Not due for follow-up in NMH
Inborn Seizures, No Encephalopathy 2	Not encephalopathic	No					Seizures due to a genetic disorder. Died in first year of life. Not due for follow-up in NMH
Inborn Seizures, No Encephalopathy 3	Not encephalopathic	No					Declined follow up. Normal assessment in OPD at 18 months apart from slight speech delay.
Inborn Seizures, No Encephalopathy 4	Not encephalopathic	No	Bayley Assessment	120	121	130	Normal
Outborn Seizures, No Encephalopathy 1	Not e ncephalopathic	No					Not listed for follow-up

**Cases listed in the order that they were reported in the 2020 Neonatal Clinical Report*

3.12 Composite Neurodevelopmental Outcome at 2 years of age for all cases of HIE born in 2020 and who were followed up in 2022 (n=11)

Grade	Normal Outcome	Mild/ Moderate Disability	Severe Disability	Death	Totals
Mild	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Moderate	5 (72%)	0 (0%)	1 (14%)	1 (14%)	7 (63%)
Severe	1 (25%)	0 (0%)	0 (0%)	3 (75%)	4 (37%)
Seizures<6 hours	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	**6 (55%)**	**0 (0%)**	**1 (9%)**	**4 (36%)**	**11 (100%)**

3.13 Composite Neurodevelopmental Outcome at 2 years of age for all cases of HIE born between the Years 2019-2020 and who were followed up during the Years 2021-2022 (n=22)

Grade	Normal Outcome	Mild/Moderate Disability	Severe Disability	Death	Totals
Mild	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Moderate	9 (65%)	2 (14%)	2 (14%)	1 (7%)	14 (64%)
Severe	1 (12%)	1 (12%)	0 (0%)	6 (75%)	8 (36%)
Seizures <6 hours	1 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)
Total	**10(45%)**	**3 (14%)**	**2 (9%)**	**7 (32%)**	**22 (100%)**

3.14 Composite Neurodevelopmental Outcome at 2 years of age for all cases of HIE born between the Years 2014-2018 and who were followed up during the 5 Year Epoch 2016-2020 (n=77)

Grade	Normal Outcome	Mild/Moderate Disability	Severe Disability	Death	Totals
Mild	9 (82%)	1 (9%)	1 (9%)	0 (0%)	11 (14%)
Moderate	37 (90%)	3 (7%)	1 (3%)	0 (0%)	41 (54%)
Severe	5 (21%)	2 (8%)	3 (13%)	14 (63%)	4 (31%)
Seizures/ Not encephalopathic	1 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)
Total	**52 (68%)**	**6 (8%)**	**5 (6%)**	**14 (18%)**	**77 (100%)**

3.15 Composite Neurodevelopmental Outcome at 2 years of age for all cases of HIE born between the Years 2009-2013 and who were followed up during the 5 year Epoch 2011-2015 (n=58)

Grade	Normal Outcome	Mild/Moderate Disability	Severe Disability	Death	Totals
Mild	7 (100%)	0 (0%)	0 (0%)	0 (0%)	7 (12%)
Moderate	35 (90%)	2 (5%)	2 (5%)	0 (0%)	39 (67%)
Severe	1 (8%)	0 (0%)	3 (25%)	8 (67%)	12 (21%)
Seizures/Not encephalopathic	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	**43 (74%)**	**2 (3%)**	**5 (9%)**	**8 (14%)**	**58 (100%)**

3.16 Composite Neurodevelopmental Outcome at 2 years of age for all cases of Neonatal Encephalopathy and/or Seizures without Encephalopathy born in 2020 and who were followed up in 2022 (n=3)

Grade	Normal Outcome	Mild/Moderate Disability	Severe Disability	Death	Totals
Mild	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Moderate	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Severe	0 (0%)	0 (0%)	0 (0%)	2 (0%)	2 (67%)
Seizures/Not encephalopathic	1 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (33%)
Total	**1 (33%)**	**0 (0%)**	**0 (0%)**	**2 (67%)**	**3 (100%)**

3.17 Composite Neurodevelopmental Outcome at 2 years of age for all cases of Neonatal Encephalopathy and/or Seizures without Encephalopathy born between the Years 2019-2020 and followed up during the Years 2021-2022 (n=4)

Grade	Normal Outcome	Mild/Moderate Disability	Severe Disability	Death	Totals
Mild	0 (0%)	1 (100%)	0 (0%)	0 (0%)	1 (25%)
Moderate	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Severe	0 (0%)	0 (0%)	0 (0%)	2 (0%)	2 (50%)
Seizures/ Not encephalopathic	1 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (25%)
Total	**1 (25%)**	**1 (25%)**	**0 (0%)**	**2 (50%)**	**4 (100%)**

3.18 Composite Neurodevelopmental Outcome at 2 years of age for all cases of Neonatal Encephalopathy and/or Seizures without Encephalopathy born between the Years 2014-2018 and followed up during the 5 Year Epoch 2016-2020 (n=31)

Grade	Normal Outcome	Mild/Moderate Disability	Severe Disability	Death	Totals
Mild	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Moderate	8 (73%)	2 (18%)	0 (0%)	1(9%)	11 (35%)
Severe	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Seizures/ Not encephalopathic	17 (85%)	2 (10%)	0 (0%)	1 (5%)	20 (65%)
Total	**25 (81%)**	**4 (13%)**	**0 (0%)**	**2 (6%)**	**31 (100%)**

3.19 Composite Neurodevelopmental Outcome at 2 years of age for all cases of Neonatal Encephalopathy and/or Seizures without Encephalopathy born between the Years 2009-2013 and followed up during the 5 Year Epoch 2011-2015 (n=59)

Grade	Normal Outcome	Mild/Moderate Disability	Severe Disability	Death	Totals
Mild	10 (100%)	0 (0%)	0 (0%)	0 (0%)	10 (17%)
Moderate	22 (73%)	3 (10%)	4 (13%)	1 (3%)	30(51%)
Severe	0 (0%)	0 (0%)	1 (50%)	1 (50%)	2 (3%)
Seizures/ Not encephalopathic	14 (82%)	1 (6%)	2 (12%)	0 (0%)	17(29%)
Total	**46 (78%)**	**4 (7%)**	**7 (12%)**	**2 (3%)**	**59 (100%)**

3.20 Neurodevelopmental Outcome at 2 years of age of infants who underwent therapeutic hypothermia 2009-2020 (n=172)

Year	Infants cooled	Cooled Infants followed up	Normal Outcome	Mild-Moderate Disability	Severe Disability	Death
2009	5	3	2	0	1	0
2010	10	8^	3	0	2	3
2011	17	14	10	0	1	3
2012	25	21	17	2	1	1
2013	23	20	18	1	0	1
2014	21	15	12	2	0	1
2015	29	23^	18	1	1	3
2016	17	16^	13	2	1	0
2017	21	17	10	0	2	5
2018	15	12^	6	2	2	2
2019	12	11	4	3	1	3
2020	13	12	6	0	1	5
Total	**208**	**172 (83%)**	**119 (69%)**	**13 (8%)**	**13 (8%)**	**27 (15%)**

^Excludes one infant who attended for assessment but could not be assessed on the day.

The above table excludes 5 additional infants who were cooled in our institution:

Two inborn infants were cooled in 2014 but were excluded as both of these infants were diagnosed with early onset neonatal sepsis. Both of these infants had normal Bayley Assessments at 2 yrs of age.

One outborn infant was cooled in 2015 but was excluded as the infant was diagnosed with a congenitally acquired condition in the postnatal period.

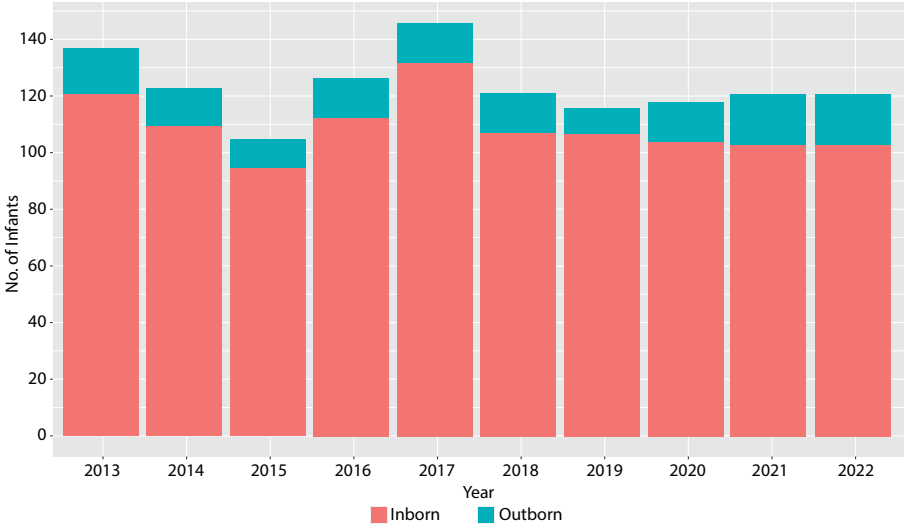
One inborn infant was cooled in 2016 but was excluded from the figures as the infant was <35 wks gestation.

One inborn infant was cooled in 2019 but was excluded as the infant was diagnosed with early onset neonatal sepsis

Section 4: Vermont Oxford Network (VON)

Our NICU is a member of Vermont Oxford Network (VON) allowing us to benchmark the outcomes of our very low birth weight (VLBW) infants nationally and internationally. All liveborn inborn infants and all outborn infants transferred to our unit within 28 days of birth are eligible for reporting to VON if their birthweight is between 401g and 1500g. Since 2005, infants of 22 wks to 29 wks gestation are also eligible for reporting, irrespective of their birthweight. As in previous report, graphs will include 10 years of data (if available) and tables will include 5 years of data. Please see earlier neonatal reports for information on previous years if required.

4.1 Number of VLBW infants reported to VON: 2013-2022

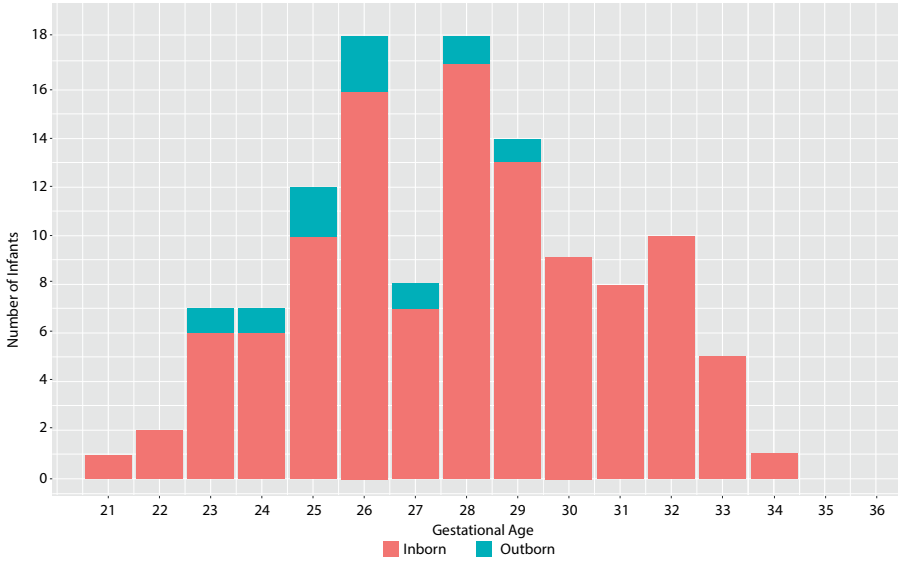


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Inborn	123	116	95	113	132	107	108	104	103	111
Outborn	14	8	10	14	14	14	8	14	18	9
Total	**137**	**124**	**105**	**127**	**146**	**121**	**116**	**118**	**121**	**120**

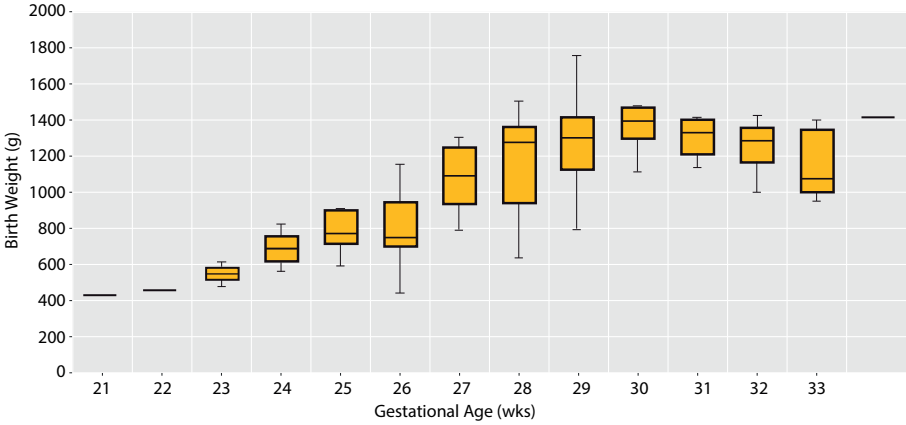
4.2 Summary of Infants reported to VON: 2022

Category	All Cases	Number of cases excluding congenital anomalies
Infants <401g but ≥22 wks gestation	0	0
Infants 401-500g	5	5
Infants 501-1500g	112	103
Infants >1500g but ≤29 wks gestation	3	3
Total	**120**	**111**

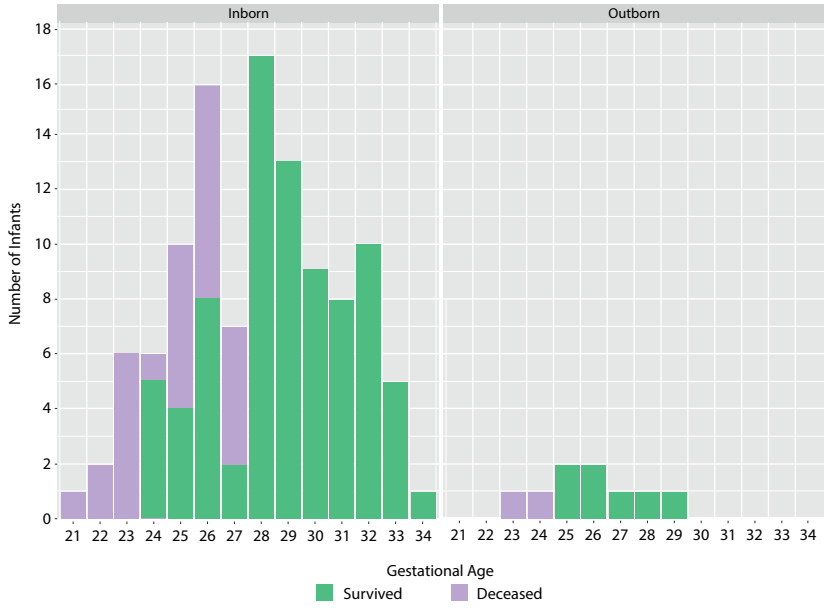
4.3 Vermont Infants showing distribution by Gestation (n=120)



4.4 Vermont Infants showing distribution of Birth Weights by Gestation (n=120)

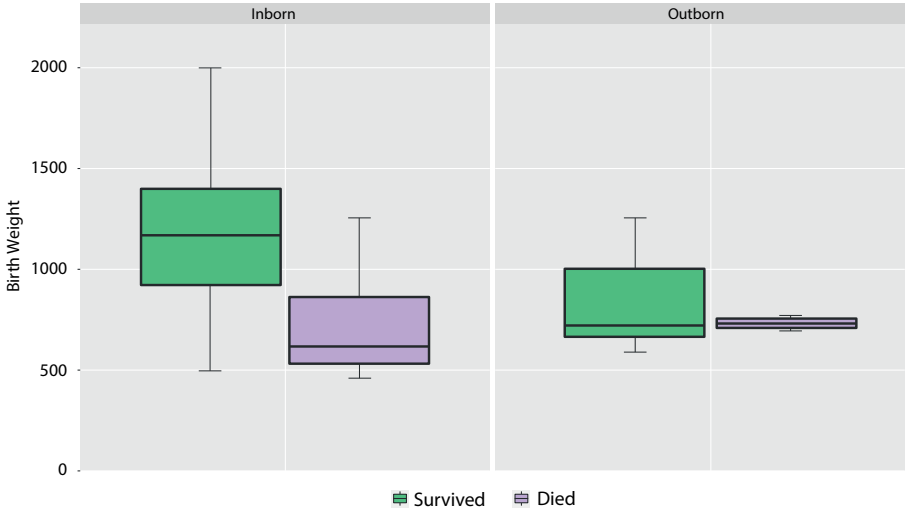


4.5 Survival Rate to Discharge of VLBW Infants reported to VON according to Gestational Age 2022 (n=120)



Gestational Age	Inborn Infants	Survival to Discharge	Outborn Infants	Survival to Discharge	Total Survival to Discharge
21 wks	1	0 (0%)	0	0 (0%)	0 (0%)
22 wks	2	0 (0%)	0	0 (0%)	0 (0%)
23 wks	6	0 (0%)	1	0 (0%)	0 (0%)
24 wks	6	5 (83%)	1	0 (0%)	5 (71%)
25 wks	10	4 (40%)	2	2 (100%)	6 (50%)
26 wks	16	8 (50%)	2	2 (100%)	10 (56%)
27 wks	7	2 (29%)	1	1 (100%)	3 (37%)
28 wks	17	17 (100%)	1	1 (100%)	18 (100%)
29 wks	13	13 (100%)	1	1 (100%)	14 (100%)
30 wks	9	9 (100%)	0	0 (100%)	9 (100%)
31 wks	8	8 (100%)	0	0 (0%)	8 (100%)
32 wks	10	10 (100%)	0	0 (0%)	10 (100%)
>32 wks	6	6 (100%)	0	0 (0%)	6 (100%)
Total	**111**	**82/111 (74%)**	**9**	**7/9 (78%)**	**89/120 (74%)**

4.6 Survival Rate to Discharge of VLBW Infants reported to VON according to Birthweight 2022 (n=120)



Birthweight	Inborn Infants	Survival to Discharge	Outborn Infants	Survival to Discharge	Total Survival to Discharge
<501g	5	0 (0%)	0	0 (0%)	0 (0%)
501-600g	10	2 (20%)	0	0 (0%)	2 (20%)
601-700g	10	5 (50%)	2	2 (100%)	7 (58%)
701-800g	6	3 (50%)	3	2 (67%)	5 (56%)
801-900g	11	8 (73%)	1	0 (0%)	8 (67%)
901-1000g	13	11 (85%)	1	1 (100%)	12 (86%)
1001-1100g	3	2 (67%)	1	1 (100%)	3 (75%)
1101-1200g	9	9 (100%)	0	0 (0%)	9 (100%)
1201-1300g	10	9 (90%)	1	1 (100%)	10 (91%)
1301-1400g	18	17 (94%)	0	0 (0%)	17 (94%)
1401-1500g	13	13 (100%)	0	0 (0%)	13 (100%)
>1500g	3	3 (100%)	0	0 (0%)	3 (100%)
Total	**111**	**82/111 (74%)**	**9**	**7/9 (78%)**	**89/120 (74%)**

Includes 10 DR deaths: one infant born at 21 wks (435g), two infants born at 22 wks (455g, 465g), 3 infants born at 23 wks (510g, 535g, 615g), one infant born at 24 wks (800g), one infant born at 25 wks (895g) with a bilateral renal agenesis and a myelomeningocoele, one infant born at 26 wks (680g) with pulmonary hypoplasia, PPROM, oligohydramnios and multiple congenital anomalies (cardiac, skeletal, cleft palate) and one infant born at 27 wks (860g) with Trisomy 13. Of the 10 DR deaths, only the infant born at 24 wks was offered intensive care in the DR but did not survive to admission to NICU.

- *Includes 9 cases of infants with congenital anomalies of whom 3 survived to discharge. Since 2022,VON now includes a diagnosis of "Twin to Twin Transfusion" on its list of congenital anomalies:*
  - *24wks, 520g, inborn, with multiple congenital intestinal atresias who survived to discharge*
  - *25wks, 590g, inborn, with imperforate anus and skeletal abnormalities who died prior to discharge*
  - *25wks, 895g, inborn, with bilateral renal agenesis and myelomeningocole who died in the DR.*
  - *26wks, 680g, inborn, with pulmonary hypoplasia, PPROM, oligohydramnios and multiple congenital anomalies (cardiac, skeletal, cleft palate), who died in the DR.*

- *27wks, 860g, inborn, with Trisomy 13 who died in the DR.*
- *27wks, 930g, inborn, with pulmonary hypoplasia, oligohydramnios, twin-to-twin transfusion syndrome (donor) with bilateral hydronephrosis and a dilated, thick-walled bladder consistent with posterior urethral valves, who died prior to discharge.*
- *27wks, 1160g, inborn, with twin to twin transfusion syndrome (recipient) who survived to discharge*
- *27wks, 1240g, inborn, with obstructive uropathy who died prior to discharge.*
- *34wks, 1400g, inborn, with congenital diaphragmatic hernia who survived to discharge.*

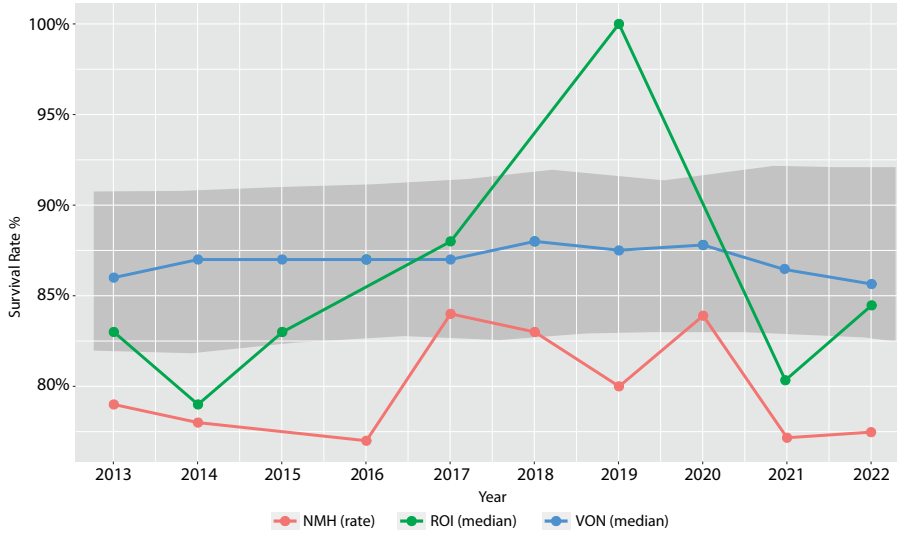
- *No infant was still hospitalized at 1 year of age*
- *There was no reported death post-discharge of any of the 2022 cohort.*

Comparing NMH outcomes to the VON Network and to the cohort of Infants born in the Republic of Ireland (ROI)

In this report, NMH data is compared to VON and ROI data by comparing NMH percentage rates for key performance indicators (KPIs) to the VON Network percentage rate and to the median percentage rates for the VON Network and ROI infants.

In 2019, VON commenced reporting the median percentages for the network and for the ROI cohort along with the 1st and 3rd quartile percentages (Q1 and Q3). All tables and figures in the annual report were updated to reflect this change to median percentages. When interpreting these values, 50% of units in VON will report a lower percentage than the median, 25% of units will report a lower percentage than Q1 and 75% of units will report a lower percentage than Q3. More recently, VON has re-introduced the reporting of VON Network and ROI percentage rates. Our report, this year, will now include a reference to the VON Network percentage rates in the table accompanying the graphs.

4.7 Survival rate to discharge for all infants (congenital anomalies Inc.) NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	79%	78%	83%	77%	84%	83%	80%	84%	74%	74%
VON (rate)	86%	86%	85%	85%	86%	85%	85%	86%	86%	84%
VON (median)	86%	87%	87%	87%	87%	88%	88%	88%	88%	86%
ROI (median)	83%	79%	83%	87%	88%	88%	100%	88%	81%	84%

4.8 Survival Rate to Discharge of VLBW Infants reported to VON according to AGA or SGA 2022 (n=120)

Gestational Age	Survival of AGA Infants	Survival of SGA Infants	Total Survival	VON Survival Rate %	VON Median IQR (Q1-Q3)
21 wks	0/1 (0%)	0/0 (0%)	0/1 (0%)	2%	0% (0%-0%)
22 wks	0/2 (0%)	0/0 (0%)	0/2 (0%)	21%	0% (0-33%)
23 wks	0/6 (0%)	0/1 (0%)	0/7 (0%)	46%	48% (0-71%)
24 wks	5/7 (71%)	0/0 (0%)	5/7 (71%)	63%	100% (33-100%)
25 wks	6/12 (50%)	0/0 (0%)	6/12 (50%)	75%	100% (57-100%)
26 wks	9/14 (64%)	1/4 (25%)	10/18 (56%)	82%	100% (67-100%)
27 wks	3/8 (37%)	0/0 (0%)	3/8 (37%)	88%	100% (83-100%)
28 wks	17/17 (100%)	1/1 (100%)	18/18 (100%)	92%	100% (90-100%)
29 wks	13/13 (100%)	1/1 (100%)	14/14 (100%)	95%	100% (94-100%)
30 wks	9/9 (100%)	0/0 (0%)	9/9 (100%)	95%	100% (100-100%)
31 wks	5/5 (100%)	3/3 (100%)	8/8 (100%)	96%	100% (100-100%)
32 wks	4/4 (100%)	6/6 (100%)	10/10 (100%)	97%	100% (100-100%)
>32 wks	0/0 (0%)	6/6 (100%)	6/6 (100%)	96%	100% (100-100%)
Total	**71/98 (72%)**	**18/22 (82%)**	**89/120 (74%)**	**84%**	**86% (80-92%)**

*Note: AGA: Appropriately Grown for Gestational Age. SGA: Small for Gestational Age.
*SGA defined as a birthweight <10th centile for GA as per VON criteria. Tenth percentile values are based on US Vital Statistics Natality datasets for 2007 and 2008

Shrunken Standardised Morbidity or Mortality Ratios (SMRs) for NMH

A 'shrunken standardised morbidity or mortality ratio' (SMR) and its upper and lower bounds indicate whether our centre has more or fewer infants with the outcome than would be expected given the characteristics of infants treated at our centre. It is calculated as observed/expected.

Shrunken estimates are a weighted average between the calculated SMR and the mean of all SMRs for the Network. For hospitals with a small number of infants, the Network mean value will be weighted more heavily, for larger hospitals, the calculated SMR will be weighted more heavily. Shrunken estimates are more stable over time than if the correction were not applied because they adjust for imprecision by filtering random variation.

If the upper bound of the shrunken SMR is less than 1, our centre has fewer infants with the outcome than would be expected.
If the lower bound of the shrunken SMR is greater than 1, our centre has more infants with the outcome than would be expected.
If the lower and upper bounds include 1, then the number of infants with the outcome is not significantly different from the numbers of infants expected, after adjusting for the characteristics of the infants treated.

Both the estimate of the shrunken SMR and the lower and upper bounds of the 95% confidence interval are based on multivariable adjustment models which considers the case mix at our centre. For example, the model for mortality includes the following predictors: gestational age, SGA (small for gestational age), Apgar score at 1 min, gender, vaginal birth, birth location (inborn or outborn) and birth defect severity. The models for other outcomes vary slightly to the one for mortality. Shrunken SMRs are reported only for infants 501-1500g. Composite shrunken SMRs are also quoted and look at the data over a three-year period.

4.9 Shrunken & Composite SMRs for All Deaths for NMH

Year	Shrunken SMR with 95% CI	Years	Composite Shrunken SMR with 95% CI
2018	1.1 (0.7-1.6)	**2016 - 2018**	1.4 (1.1-1.8)*
2019	1.2 (0.8-1.7)	**2017 - 2019**	1.3 (1.0-1.6)
2020	1.4 (0.8-2.0)	**2018 - 2020**	1.3 (1.0-1.7)
2021	1.5 (1.1-2.1)*	**2019 - 2021**	1.5 (1.1-1.8)*
2022	1.5 (1.0-2.1)	**2020 - 2022**	1.6 (1.3-2.0)*

* Lower and upper bounds of confidence interval (CI) does not include 1.0

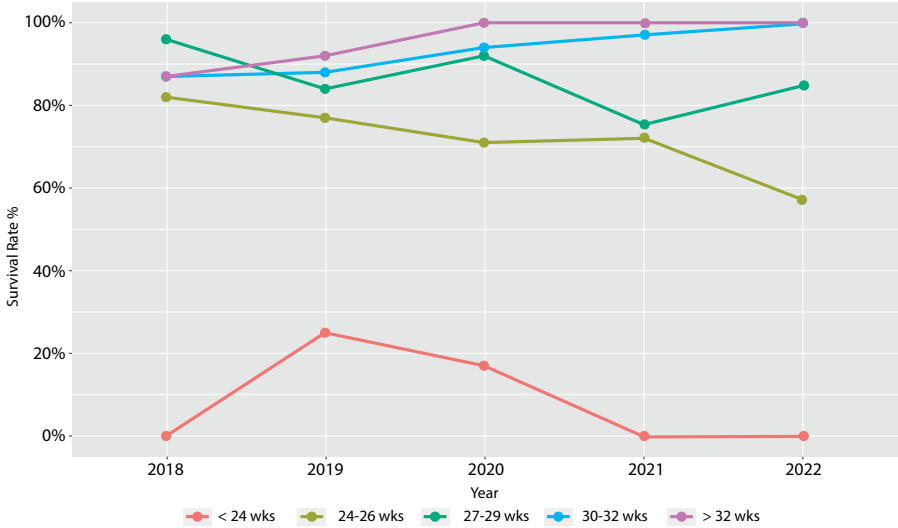
4.10 Cumulative 5-year Survival Rates to Discharge of VLBW Infants according to Gestational Age

Gestational Age (wks)	Survival to Discharge of 2006-2010 Cohort (n=697)	Survival to Discharge of 2011-2015 Cohort (n=612)	Survival to Discharge of 2016-2020 Cohort (n=628)	Survival to Discharge of the 2021-2022 Cohort (n=241)
20	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)
21	0/2 (0%)	0/6 (0%)	0/3 (0%)	0/2 (0%)
22	0/11 (0%)	0/12 (0%)	0/11 (0%)	0/3 (0%)
23	1/26 (4%)	7/22 (32%)	7/27 (26%)	0 /17 (0%)
24	17/35 (49%)	22/47 (47%)	15/35 (43%)	12/20 (60%)
25	26/49 (53%)	33/49 (67%)	38/55 (69%)	14 /24 (58%)
26	66/77 (86%)	28/48 (58%)	52/60 (87%)	24/33 (72%)
27	71/80 (89%)	59/66 (89%)	60/67 (90%)	9/18 (50%)
28	86/94 (91%)	75/83 (90%)	72/81 (89%)	25/29 (86%)
29	99/107 (93%)	86/90 (96%)	88/93 (95%)	25/25 (100%)
30	69/71 (97%)	60/61 (98%)	65/72 (90%)	22/22 (100%)
31	48/52 (92%)	41/44 (93%)	38/42 (91%)	15/15 (100%)
32	43/46 (93%)	41/45 (91%)	34/37 (92%)	20/21 (95%)
>32	45/47 (96%)	38/39 (97%)	43/45 (96%)	12/12 (100%)
Total	**571/697 (82%)**	**490/612 (80%)**	**512/628 (82%)**	**178/241 (74%)**

4.11 Cumulative 5-year Survival Rates to Discharge of VLBW Infants according to Birthweight

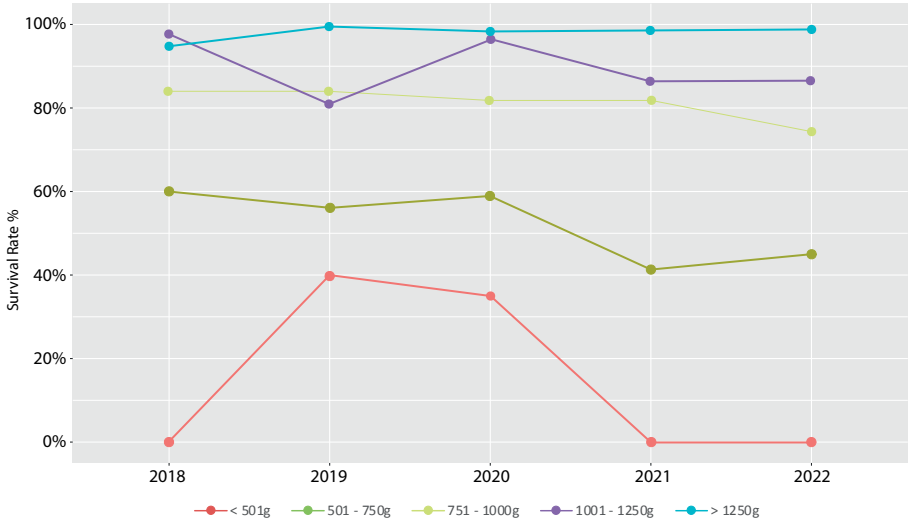
Birthweight (g)	Survival to Discharge of 2001–2010 Cohort	Survival to Discharge of 2011–2015 Cohort (n=612)	Survival to Discharge of 2016–2020 Cohort (n=628)	Survival to Discharge of the 2021-2022 Cohort (n=241)
<501	N/A	2/26 (8%)	5/19 (26%)	0/9 (0%)
501-600	N/A	9/27 (33%)	12/35 (34%)	3/21 (14%)
601-700	N/A	33/48 (69%)	28/48 (58%)	16 /27 (59%)
701-800	N/A	35/54 (65%)	35/48 (73%)	16/26 (62%)
801-900	N/A	35/49 (71%)	36/48 (75%)	11/16 (69%)
901-1000	N/A	42/50 (84%)	68/75 (91%)	21/23 (91%)
1001-1100	N/A	54/61 (89%)	47/51 (92%)	9/11 (82%)
1101-1200	N/A	58/64 (91%)	56/63 (89%)	18/20 (90%)
1201-1300	N/A	62/66 (94%)	59/64 (92%)	17/19 (89%)
1301-1400	N/A	68/69 (99%)	63/68 (93%)	34/35 (97%)
1401-1500	N/A	73/76 (96%)	84/87 (97%)	28/29 (97%)
>1500	N/A	19/22 (86%)	19/22 (86%)	5/5 (100%)
Total	**N/A**	**490/612 (80%)**	**512/628 (82%)**	**178/241 (74%)**

4.12 Survival Rates to Discharge by Gestational Age Category



Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=120)
<24 wks	0/9 (0%)	2/8 (25%)	1/6 (17%)	0/12 (0%)	0/10 (0%)
24-26 wks	28/34 (82%)	20/26 (77%)	20/28 (71%)	29/40 (73%)	21/37 (57%)
27-29 wks	45/47 (96%)	37/44 (84%)	44/48 (92%)	24/32 (75%)	35/40 (88%)
30-32 wks	20/23 (87%)	23/26 (88%)	29/31 (94%)	30/31 (97%)	27/27 (100%)
>32 wks	7/8 (87%)	11/12 (92%)	5/5 (100%)	6/6 (100%)	6/6 (100%)
Total	**100/121 (83%)**	**93/116 (80%)**	**99/118 (84%)**	**89/121 (74%)**	**89/120 (74%)**

4.13 Survival Rates to Discharge by Birthweight Category



Birthweight	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=120)
<501g	0/9 (0%)	2/5 (40%)	1/3 (33%)	0/4 (0%)	0/5 (0%)
501-750g	28/34 (82%)	12/22 (55%)	13/22 (59%)	14/33 (42%)	13/28 (46%)
751-1000g	45/47 (96%)	23/27 (85%)	20/24 (83%)	19/23 (83%)	21/29 (72%)
1001-1250g	20/23 (87%)	19/23 (83%)	29/31 (94%)	20/23 (87%)	16/18 (89%)
>1250g	7/8 (87%)	37/39 (95%)	36/38 (95%)	36/38 (95%)	39/40 (97%)
Total	**100/121 (83%)**	**93/116 (80%)**	**99/118 (84%)**	**89/121 (74%)**	**89/120 (74%)**

4.14 Survival Rates of Inborn Infants born at 23 wks Gestation

Year	2018	2019	2020	2021	2022	Total
No. of liveborn infants	3	3	4	9	6	**25**
No. offered active resuscitation in DR	3	3	4	8	3	**21**
No. admitted to NICU	3	3	4	6	3	**19**
No. survived to discharge	0	1	0	0	0	**1**
% of liveborn infants offered active resuscitation	100%	100%	100%	89%	50%	**84%**
% of liveborn infants admitted to NICU	100%	100%	100%	67%	50%	**76%**
% Survival to discharge	0%	33%	0%	0%	0%	**4%**
% Survival to discharge of those offered active resuscitation in DR	0%	33%	0%	0%	0%	**5%**

4.15 List of Denominators for VON Infants 2022

Gestational Age	Admissions to NICU	Inborn admissions to NICU	Outborn admissions to NICU	No. with cranial imaging	No. with at least one retinal examination	No. in NMH at 36 wks PMA
22 wks	0	0	0	0	0	0
23 wks	4	3	1	4	0	0
24 wks	6	5	1	6	4	2
25 wks	11	9	2	8	6	4
26 wks	17	15	2	16	8	4
27 wks	7	6	1	6	3	2
28 wks	18	17	1	18	17	9
29 wks	14	13	1	14	13	6
30 wks	9	9	0	9	9	0
31 wks	8	8	0	8	7	0
32 wks	10	10	0	10	10	7
> 32 wks	6	6	0	4	4	3
Total	**110**	**101**	**9**	**103**	**81**	**37**

4.16 List of Denominators 2018 – 2022

Year	2018	2019	2020	2021	2022
Total number of infants reported to VON	121	116	118	121	120
Normally formed infants reported to VON	114	102	110	115	115
Total number of delivery room deaths	6	8	1	7	10
Delivery room deaths of normally formed infants	6	1	0	6	8
Inborn admissions to NICU	101	99	103	96	101
Outborn admissions to NICU	14	9	14	18	9
Infants with cranial imaging on/before D28	109/115 (95%)	102/108 (94%)	111/117 (95%)	104/114 (91%)	103/110 (94%)
Infants with one retinal examination	101/115 (88%)	94/108 (87%)	98/117 (84%)	87/114 (76%)	81/110 (74%)
Infants still in NMH at 36 wks PMA	63	54	42	51	37

ANTENTAL FACTORS

Antenatal Corticosteroids

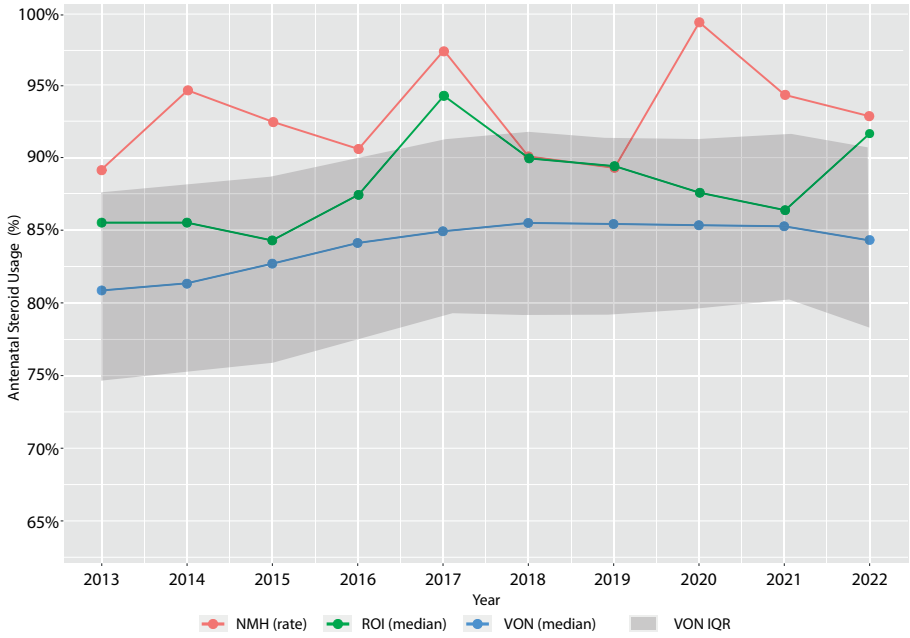
VON defines the use of antenatal steroids as follows: the infant is assumed to have received antenatal steroids if the mother received corticosteroids either IM or IV during the pregnancy at any time prior to delivery. Corticosteroids include betamethasone, dexamethasone and hydrocortisone. It does not define optimal steroid administration, nor does it look at timing of the doses or use of multiple courses of steroids. In our institution, the practice to date has been to administer steroids up to 33 completed weeks of gestation (i.e. <34 wks gestation). Antenatal steroid administration is offered from 23+0 wks gestation.

4.17 Use of Antenatal Steroids

Gestational Age	2018 (n=121)	2019 (n=116)	2020* (n=117)	2021 (n=121)	2022 (n=119)*
<24 wks	4/9 (44%)	4/8 (50%)	5/6 (83%)	9/12 (75%)	5/10 (50%)
24-26 wks	31/35 (89%)	22/26 (85%)	28/28 (100%)	38/40 (95%)	35/37 (95%)
27-29 wks	45/46 (98%)	43/44 (98%)	47/48 (98%)	32/32 (100%)	38/39 (97%)
30-32 wks	23/23 (100%)	25/26 (96%)	30/30 (100%)	29/31 (94%)	27/27 (100%)
>32 wks	6/8 (75%)	9/12 (75%)	5/5 (100%)	6/6 (100%)	6/6 (100%)
Total	**109/121 (90%)**	**103/116 (89%)**	**115/117 (98%)**	**114/121 (94%)**	**111/119 (93%)**

* Indicates an infant with missing data

4.18: Use of Antenatal Steroid: NMH vs. VON & ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	88%	94%	92%	91%	97%	90%	89%	98%	94%	93%
VON (rate)	80%	81%	81%	83%	84%	85%	84%	84%	84%	83%
VON (median)	81%	81%	82%	84%	85%	86%	86%	86%	86%	85%
ROI (median)	86%	86%	84%	88%	94%	90%	95%	88%	87%	92%

4.19 Timing of Antenatal Steroids (ANS) based on last dose received 2022 (n=111)

Time of Dose	1 dose of ANS administered	2 doses of ANS administered	≥3 doses of ANS administered
0-12 hrs prior to delivery	13	8	0
12-24 hrs prior to delivery	0	7	3
24-48 hrs prior to delivery	0	5	2
48 hrs to 7 days prior to deliv-ery	0	27	2
>7 days prior to delivery	0	43	0
Unknown	1	0	0
Total	14 (13%)	90 (81%)	7 (6%)

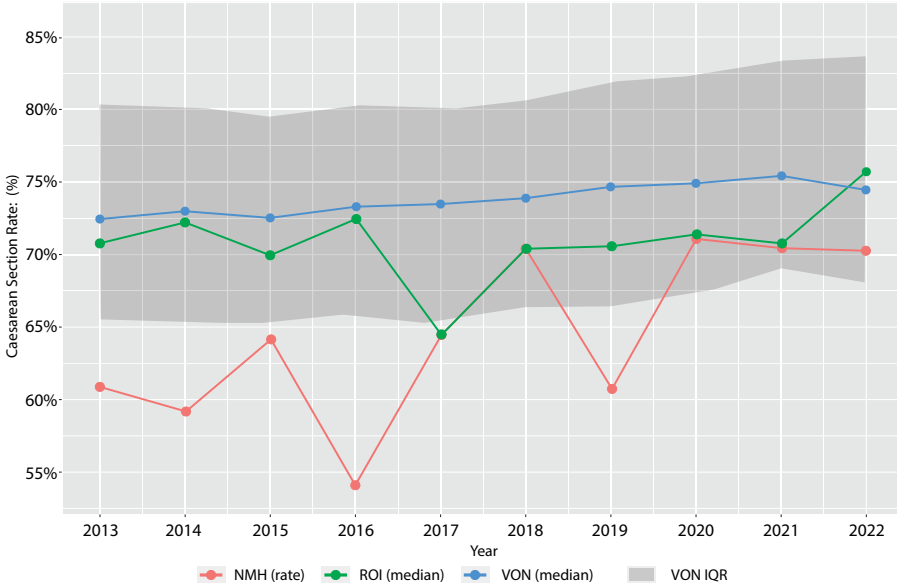
Delivery Method

VON does not distinguish between breech or vaginal delivery, between spontaneous or induced labour or between elective or emergency caesarean section. Hence, infants are either delivered 'vaginally' or by 'caesarean section'.

4.20 Delivery by Caesarean Section

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=120)
< 24 wks	0/9 (0%)	1/8 (13%)	2/6 (33%)	1/12 (8%)	2/10 (20%)
24-26 wks	19/34 (56%)	12/26 (46%)	19/28 (68%)	27/40 (68%)	24/37 (65%)
27-29 wks	40/47 (85%)	29/44 (66%)	33/48 (69%)	22/32 (69%)	29/40 (73%)
30-32 wks	19/23 (83%)	18/26 (69%)	26/31 (84%)	30/31 (97%)	24/27 (89%)
> 32wks	8/8 (100%)	11/12 (92%)	5/5 (100%)	6/6 (100%)	6/6 (100%)
Total	**86/121 (71%)**	**71/116 (61%)**	**85/118 (72%)**	**86/121 (71%)**	**85/120 (71%)**

4.21 Caesarean Section Rate: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	61%	58%	64%	54%	64%	71%	61%	72%	71%	71%
VON (rate)	72%	71%	72%	71%	72%	72%	73%	73%	75%	74%
VON (median)	72%	73%	73%	73%	73%	73%	75%	75%	76%	75%
ROI (median)	71%	72%	70%	72%	64%	71%	71%	72%	71%	77%

Antenatal Magnesium Sulphate

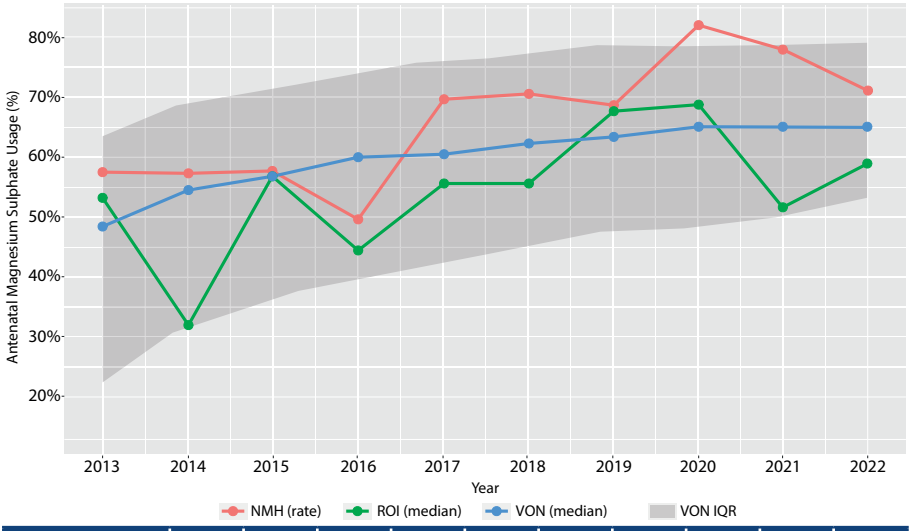
Since 2012, VON collects data on the antenatal administration of intravenous magnesium sulphate to the mother during pregnancy at any time prior to delivery. In Sept. 2012, our institution began administering magnesium sulphate routinely to all women <30 wks gestation (i.e. up to 29 6/7 weeks) in whom it was anticipated that delivery would occur within the next 12 hours. Based on national guidelines published in 2013 the indications for magnesium sulphate in our institution was extended to include infants delivering <32 wks gestation. Magnesium sulphate is prescribed for the neuroprotection of the fetus. Mothers may also receive magnesium sulphate for the management of PET.

4.22 Administration of Antenatal Magnesium Sulphate

Gestational Age	2018** (n=119)	2019* (n=115)	2020****** (n=112)	2021** (n=119)	2022*** (n=117)
< 24 wks	3/9 (33%)	4/8 (50%)	1/5 (20%)	8/12 (67%)	4/10 (40%)
24-26 wks	27/34 (79%)	20/26 (77%)	28/28 (100%)	37/38 (97%)	31/36 (86%)
27-29 wks	44/45 (98%)	36/43 (84%)	44/48 (92%)	27/32 (84%)	32/38 (84%)
30-32 wks	10/23 (44%)	18/26 (69%)	19/26 (73%)	21/31 (68%)	18/27 (67%)
> 32wks	0/8 (0%)	1/12 (8%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**84/119 (71%)**	**79/115 (69%)**	**92/112 (82%)**	**93/119 (78%)**	**85/117 (73%)**

**Indicates an infant with missing data*

4.23 Administration of Antenatal Magnesium Sulphate: NMH vs VON and ROI

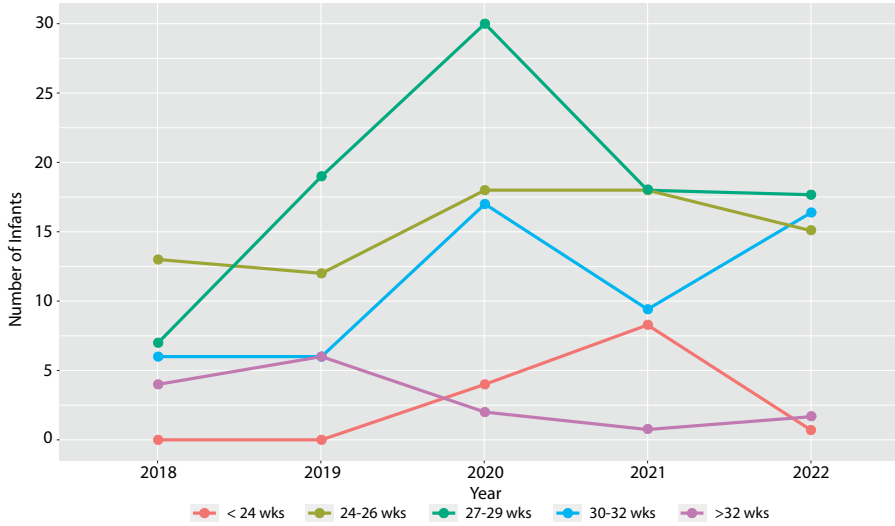


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	58%	57%	58%	50%	70%	71%	69%	82%	78%	73%
VON (rate)	48%	52%	55%	57%	59%	61%	62%	63%	64%	64%
VON (median)	48%	55%	57%	60%	61%	62%	63%	65%	65%	66%
ROI (median)	53%	32%	57%	44%	56%	56%	68%	72%	52%	58%

In Utero Transfers

Our hospital is a national tertiary referral centre and accepted referrals of high-risk pregnancies from all around the country. The number of inborn infants transferred to NMH antenatally for the purposes of delivering in our centre is recorded annually.

4.24: No. of In Utero Transfers



Gestational Age	2018	2019	2020	2021	2022
< 24 wks	0/8 (0%)	0/6 (0%)	4/6 (67%)	8/12 (67%)	2/10 (20%)
24-26 wks	13/32 (41%)	12/23 (52%)	18/28 (64%)	16/40 (40%)	15/37 (41%)
27-29 wks	7/38 (18%)	19/40 (48%)	30/48 (63%)	16/32 (50%)	17/40 (43%)
30-32 wks	6/21 (29%)	6/26 (23%)	17/31 (55%)	9/31 (29%)	16/27 (59%)
> 32wks	4/8 (50%)	6/12 (50%)	2/5 (40%)	1/6 (17%)	3/6 (50%)
Total	**30/107 (28%)**	**43/107 (40%)**	**71/118 (60%)**	**50/121 (41%)**	**53/120 (44%)**

4.25 Referral Source of In Utero transfers

Name of Hospital	2018	2019	2020	2021	2022
Cavan General Hospital	0	0	2	4	2
Coombe Women and Infants University Hospital	0	0	2	0	0
Cork University Maternity Hospital	0	0	0	0	0
Craigavon Area Hospital	0	1	2	0	0
Daisy Hill Hospital, Newry	0	0	1	0	0
Enniskillen	0	0	0	0	0
Altnagelvin	0	0	1	2	0
Kerry General Hospital	0	0	0	0	0
Letterkenny General Hospital	4	12	8	3	8
Limerick Regional Maternity Hospital	0	0	0	1	0
Mayo General Hospital	2	2	4	5	5
Midland Regional Hospital, Mullingar	9	14	14	9	16
Midland Regional Hospital, Portlaoise	0	0	1	0	1
Our Lady Of Lourdes' Hospital, Drogheda	2	0	0	2	6
Portiuncula Hospital, Ballinasloe	0	2	3	2	1
Rotunda Hospital	2	0	1	0	0
Royal Maternity Hospital, Belfast	0	0	2	0	1
Sligo Regional Hospital	3	1	5	3	3
South Tipperary General Hospital, Clonmel	0	0	0	0	0
St. Luke's General Hospital, Kilkenny	2	4	11	4	5
Ulster Hospital	0	0	0	0	1
University College Hospital Galway	1	0	1	4	2
Waterford Regional Hospital	2	0	4	2	1
Wexford General Hospital	3	7	9	9	1
Total	**30**	**43**	**71**	**50**	**53**

Conditions Pertaining to Pregnancy

VON reports on the presence of chorioamnionitis, maternal hypertension (chronic or pregnancy induced) and maternal diabetes. Chorioamnionitis is answered as "yes" if a diagnosis of chorioamnionitis is recorded in the maternal or infant medical record. Our institution routinely examines the placenta looking for evidence of chorioamnionitis and so it is on the basis of placental reports that our institution codes the question on chorioamnionitis for inborn infants. Data on outborn infants is derived solely from the medical record. Hence in many outborn cases, chorioamnionitis is coded as "unknown" as our institution does not have access to the placental histology of outborn babies and there may be no reference to this condition in the medical record. Maternal hypertension is answered as "yes" if maternal hypertension, chronic or pregnancy-induced, with or without oedema and proteinuria, is recorded in the maternal or infant medical record or if a maternal blood pressure above 140 systolic or 90 diastolic is recorded prior to or during the present pregnancy. Eclampsia and pre-eclampsia are considered forms of pregnancy-induced hypertension. Maternal diabetes is answered as "yes" if maternal diabetes of any type or severity is recorded in the maternal or infant medical record.

4.26 Reasons for Preterm Delivery According to Gestational Age Category 2022 (n=120)

Gestational Age	Preterm Labour	PPROM	Maternal Interest	Foetal Interest
< 24 wks	4/10 (40%)	3/10 (30%)	3/10 (30%)	0/10 (0%)
24-26 wks	9/37 (24%)	12/37 (32%)	6/37 (16%)	10/37 (27%)
27-29 wks	8/40 (20%)	9/40 (22%)	5/40 (13%)	18/40 (45%)
30-32 wks	2/27 (7%)	5/27 (19%)	6/27 (22%)	14/27 (52%)
> 32wks	1/6 (17%)	0/6 (0%)	0/6 (0%)	5/6 (83%)
Total	**24/120 (20%)**	**29/120 (24%)**	**20/120 (17%)**	**47/120 (39%)**

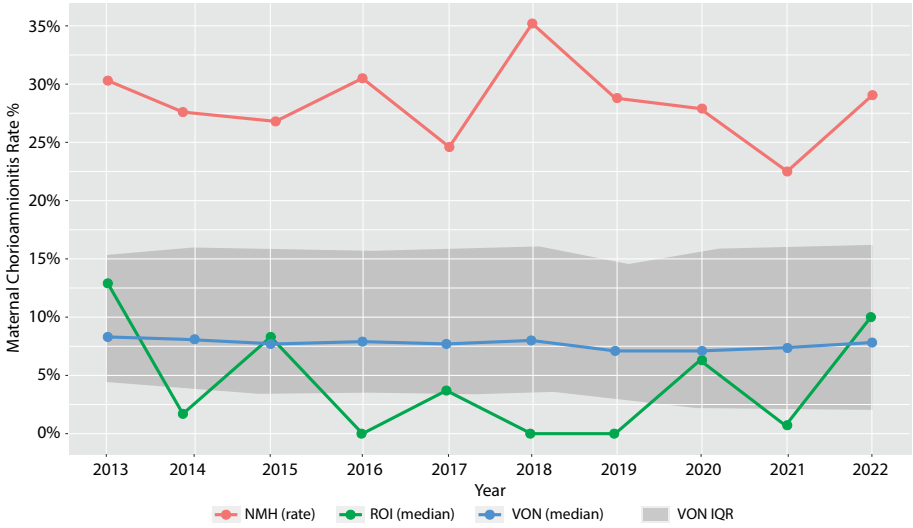
4.27 Reasons for Preterm Delivery

Year	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=120)
Preterm Labour	32/121 (26%)	23/116 (20%)	27/118 (23%)	20/121 (17%)	24/120 (20%)
PPROM	24/121 (20%)	39/116 (33%)	23/118 (19%)	15/121 (12%)	29/120 (24%)
Maternal Interest	23/121 (19%)	9/116 (8%)	13/118 (11%)	24/121 (20%)	20/120 (17%)
Fetal Interest	42/121 (35%)	45/116 (39%)	55/118 (47%)	62/121 (51%)	47/120 (39%)
Total	**121/121 (100%)**	**116/116 (100%)**	**118/118 (100%)**	**121/121 (100%)**	**120/120 (100%)**

4.28 Maternal Chorioamnionitis

Gestational Age	2018 (n=108)	2019 (n=104)	2020 (n=104)	2021 (n=102)	2022 (n=116)
< 24 wks	3/8 (36%)	4/4 (100%)	1/4 (25%)	9/11 (82%)	8/10 (80%)
24-26 wks	17/33 (52%)	6/22 (27%)	12/27 (44%)	7/34 (21%)	13/34 (38%)
27-29 wks	13/38 (34%)	11/40 (28%)	12/42 (29%)	4/29 (14%)	9/39 (23%)
30-32 wks	5/21 (24%)	8/26 (31%)	4/26 (15%)	3/23 (13%)	3/27 (11%)
> 32wks	0/8 (0%)	1/12 (8%)	0/5 (0%)	0/5 (0%)	0/6 (0%)
Total	**38/108 (35%)**	**30/104 (29%)**	**29/104 (28%)**	**23/102 (23%)**	**33/116 (28%)**

4.29 Maternal Chorioamnionitis: NMH vs VON and ROI



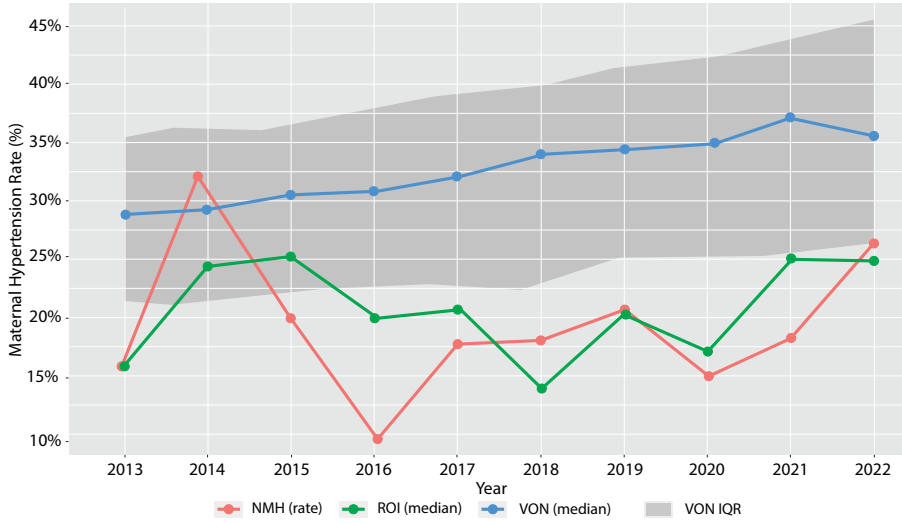
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	30%	28%	27%	31%	25%	35%	29%	28%	23%	28%
VON (rate)	13%	13%	13%	13%	13%	13%	13%	12%	12%	13%
VON (median)	8%	8%	8%	8%	8%	8%	7%	7%	7%	7%
ROI (median)	13%	2%	8%	0%	4%	0%	0%	6%	1%	10%

4.30 Maternal Hypertension (Chronic or Pregnancy Induced)

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=119*)
< 24 wks	0/9 (0%)	1/8 (13%)	0/6 (0%)	1/12 (8%)	0/10 (0%)
24-26 wks	6/34 (18%)	5/26 (19%)	3/28 (11%)	4/40 (10%)	8/37 (22%)
27-29 wks	7/47 (15%)	7/44 (16%)	8/48 (17%)	6/32 (19%)	10/39 (26%)
30-32 wks	8/23 (35%)	5/26 (19%)	6/31 (19%)	8/31 (26%)	12/27 (44%)
> 32wks	1/8 (13%)	6/12 (50%)	1/5 (20%)	3/6 (50%)	2/6 (33%)
Total	**22/121 (18%)**	**24/116 (21%)**	**18/118 (15%)**	**22/121 (18%)**	**32/119 (27%)**

**Indicates an infant with missing data*

4.31 Maternal Hypertension (Chronic or Pregnancy Induced): NMH vs VON and ROI



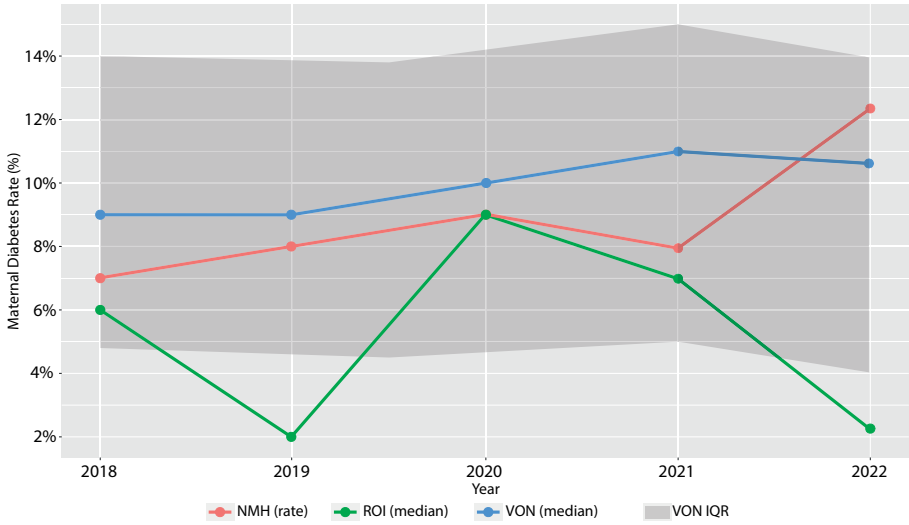
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	16%	32%	20%	10%	18%	18%	21%	15%	18%	27%
VON (rate)	29%	30%	31%	32%	32%	35%	35%	37%	37%	38%
VON (median)	28%	29%	30%	30%	32%	33%	34%	35%	37%	37%
ROI (median)	16%	24%	25%	20%	21%	14%	20%	17%	25%	25%

4.32 Maternal Diabetes (of any type or severity)

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=119*)
< 24 wks	0/9 (0%)	0/8 (0%)	0/6 (0%)	0/12 (0%)	0/10 (0%)
24–26 wks	2/34 (6%)	4/26 (15%)	0/28 (0%)	1/40 (3%)	5/37 (14%)
27–29 wks	1/47 (2%)	2/44 (5%)	4/48 (8%)	6/32 (19%)	5/39 (13%)
30–32 wks	3/23 (13%)	1/26 (4%)	6/31 (19%)	3/31 (10%)	4/27 (15%)
> 32wks	2/8 (25%)	2/12 (17%)	0/5 (0%)	0/6 (0%)	1/6 (17%)
Total	**8/121 (7%)**	**9/116 (8%)**	**10/118 (9%)**	**10/121 (8%)**	**15/119 (13%)**

**Indicates an infant with missing data*

4.33 Maternal Diabetes (of any type or severity): NMH vs VON and ROI



Year	2018	2019	2020	2021	2022
NMH (rate)	7%	8%	9%	8%	13%
VON (rate)	10%	10%	11%	12%	12%
VON (median)	9%	9%	10%	11%	11%
ROI (median)	6%	2%	9%	7%	3%

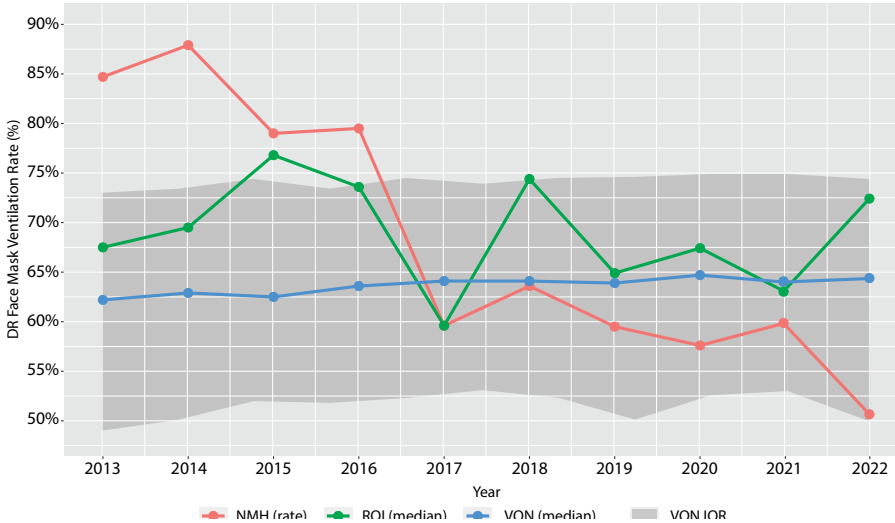
Delivery Room Interventions

4.34 Delivery Room Face Mask Ventilation

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=119*)
< 24 wks	3/9 (33%)	5/8 (63%)	5/6 (83%)	8/12 (67%)	4/10 (40%)
24–26 wks	31/34 (91%)	21/26 (81%	22/28 (79%)	24/40 (60%)	28/37 (76%)
27–29 wks	32/47 (68%)	29/44 (66%)	29/48 (60%)	22/32 (69%)	21/39 (54%)
30–32 wks	8/23 (35%)	10/26 (39%)	9/31 (29%)	18/31 (58%)	8/27 (30%)
> 32wks	3/8 (38%)	4/12 (33%)	3/5 (60%)	1/6 (17%)	0/6 (0%)
Total	**77/121 (64%)**	**69/116 (60%)**	**68/118 (58%)**	**73/121 (60%)**	**61/119 (51%)**

**Indicates an infant with missing data*

4.35 Delivery Room Face Mask Ventilation: NMH vs. VON and ROI

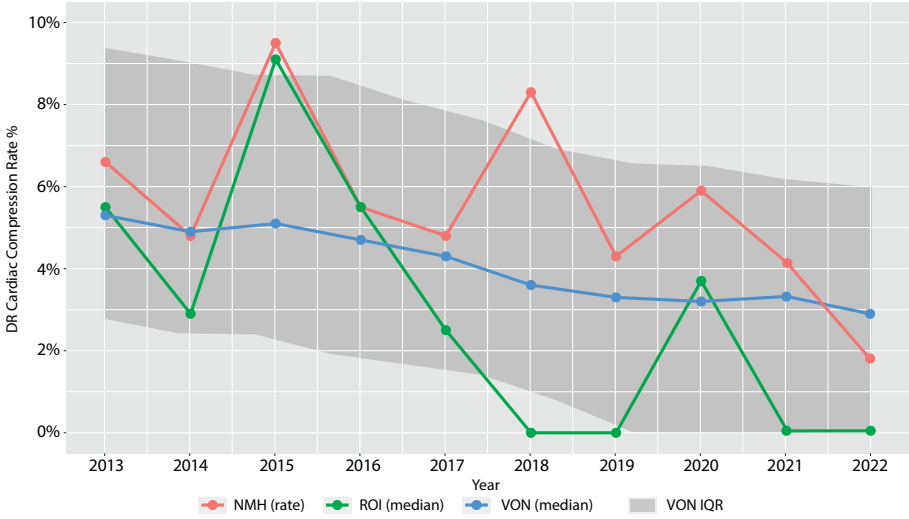


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	85%	88%	79%	80%	60%	64%	60%	58%	60%	51%
VON (rate)	61%	62%	62%	62%	62%	63%	63%	63%	64%	63%
VON (median)	62%	63%	63%	64%	64%	64%	64%	65%	64%	64%
ROI (median)	68%	70%	77%	74%	60%	74%	65%	68%	64%	72%

4.36 Delivery Room Cardiac Compressions

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=120)
< 24 wks	1/9 (11%)	1/8 (13%)	2/6 (33%)	1/12 (8%)	0/10 (0%)
24-26 wks	5/34 (15%)	3/26 (12%)	1/28 (4%)	2/40 (5%)	2/37 (5%)
27-29 wks	4/47 (9%)	0/44 (0%)	2/48 (4%)	0/32 (0%)	0/40 (0%)
30-32 wks	0/23 (0%)	1/26 (4%)	2/31 (7%)	2/31 (7%)	0/27 (0%)
> 32wks	0/8 (0%)	0/12 (0%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**10/121 (8%)**	**5/116 (4%)**	**7/118 (6%)**	**5/121 (4%)**	**2/120 (2%)**

4.37 Delivery Room Cardiac Compressions: NMH vs. VON and ROI

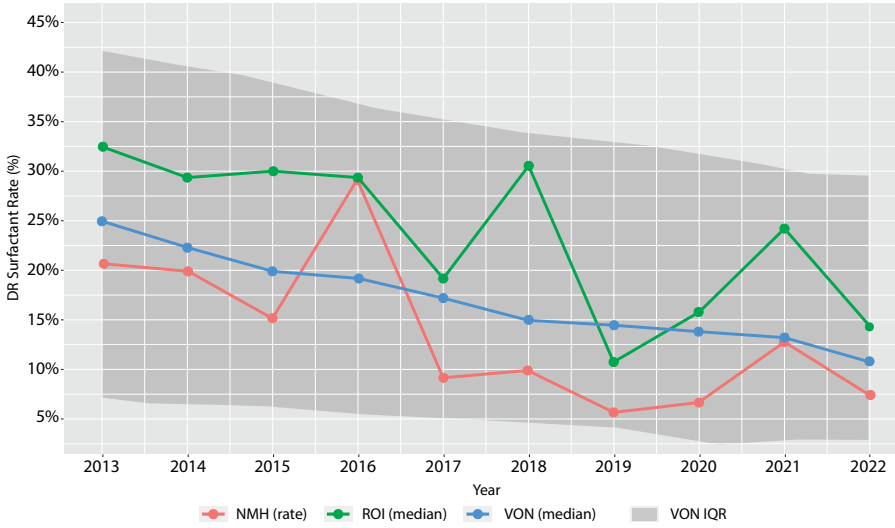


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	7%	5%	10%	6%	5%	8%	4%	6%	4%	2%
VON (rate)	6%	6%	6%	5%	5%	4%	4%	4%	4%	4%
VON (median)	5%	5%	5%	5%	4%	4%	3%	3%	3%	3%
ROI (median)	6%	3%	9%	6%	3%	0%	0%	3%	0%	0%

4.38 Delivery Room Surfactant

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=120)
< 24 wks	1/9 (11%)	2/8 (25%)	2/6 (33%)	2/12 (17%)	2/10 (20%)
24-26 wks	4/34 (12%)	2/26 (8%)	2/28 (7%)	6/40 (15%)	7/37 (19%)
27-29 wks	6/47 (13%)	3/44 (7%)	4/48 (8%)	4/32 (13%)	0/40 (0%)
30-32 wks	0/23 (0%)	0/26 (0%)	0/31 (0%)	2/31 (7%)	0/27 (0%)
> 32wks	0/8 (0%)	0/12 (0%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**11/121 (9%)**	**7/116 (6%)**	**8/118 (7%)**	**14/121 (12%)**	**9/120 (8%)**

4.39 Delivery Room Surfactant: NMH vs. VON and ROI

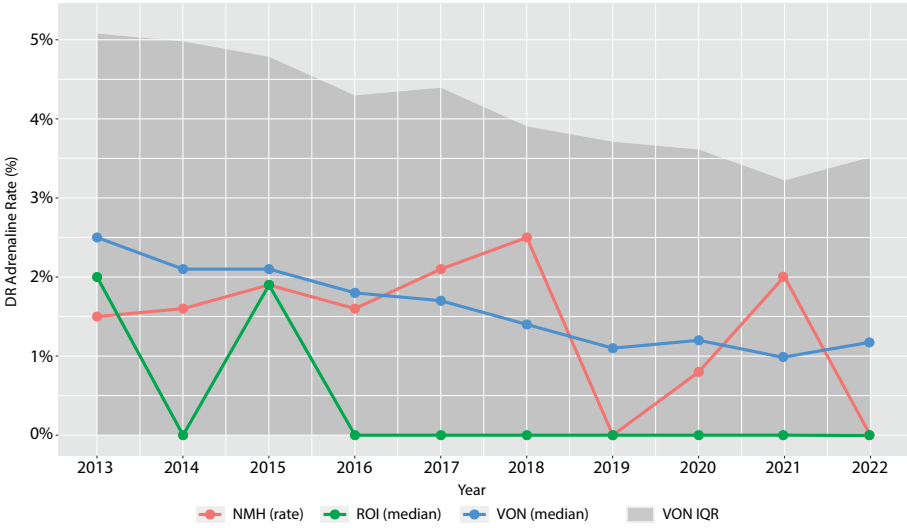


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	21%	20%	15%	29%	9%	9%	6%	7%	12%	8%
VON (rate)	29%	27%	25%	24%	22%	21%	20%	20%	19%	18%
VON (median)	24%	23%	20%	19%	17%	15%	14%	13%	12%	11%
ROI (median)	33%	29%	30%	29%	18%	30%	11%	17%	24%	13%

4.40 Delivery Room Adrenaline

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=120)
< 24 wks	0/9 (0%)	0/8 (0%)	0/6 (0%)	0/12 (0%)	0/10 (0%)
24–26 wks	1/34 (3%)	0/26 (0%)	0/28 (0%)	2/40 (5%)	0/37 (0%)
27–29 wks	1/47 (2%)	0/44 (0%)	0/48 (0%)	0/32 (0%)	0/40 (0%)
30–32 wks	1/23 (4%)	0/26 (0%)	1/31 (3%)	0/31 (0%)	0/27 (0%)
> 32wks	0/8 (0%)	0/12 (0%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**3/121 (2.5%)**	**0/116 (0%)**	**1/118 (0.8%)**	**2/121 (2%)**	**0/120 (0%)**

4.41 Delivery Room Adrenaline: NMH vs. VON and ROI

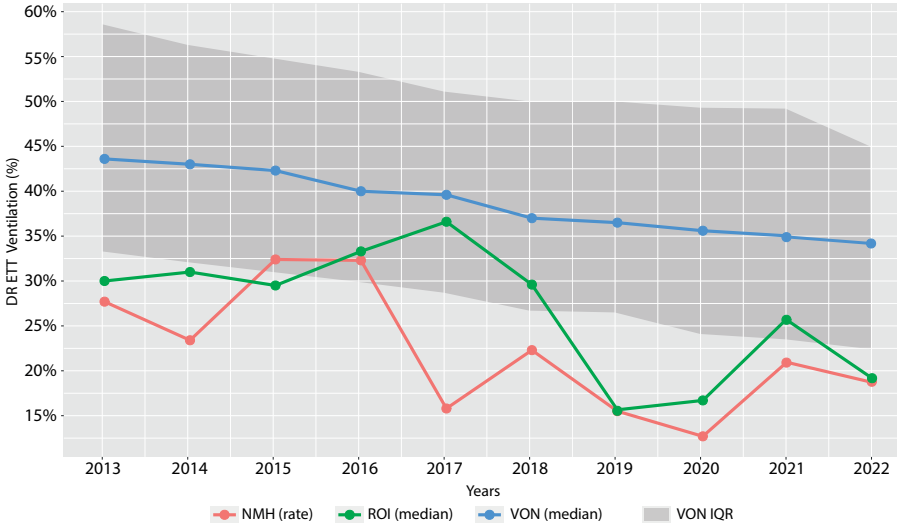


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	2%	2%	2%	2%	2%	3%	0%	1%	2%	0%
VON (rate)	3%	3%	3%	3%	2%	2%	2%	2%	2%	2%
VON (median)	3%	2%	2%	2%	2%	1%	1%	1%	1%	1%
ROI (median)	2%	0%	2%	0%	0%	0%	0%	0%	0%	0%

4.42 Delivery Room ETT Ventilation

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=120)
< 24 wks	3/9 (33%)	4/8 (50%)	3/6 (50%)	5/12 (42%)	3/10 (30%)
24-26 wks	14/34 (41%)	6/26 (23%)	2/28 (7%)	12/40 (30%)	15/37 (41%)
27-29 wks	10/47 (21%)	7/44 (16%)	8/48 (17%)	6/32 (19%)	3/40 (8%)
30-32 wks	0/23 (0%)	1/26 (4%)	2/31 (7%)	4/31 (13%)	0/27 (0%)
> 32wks	0/8 (0%)	0/12 (0%)	0/5 (0%)	0/6 (0%)	1/6 (17%)
Total	**27/121 (22%)**	**18/116 (16%)**	**15/118 (13%)**	**27/121 (22%)**	**22/120 (18%)**

4.43 Delivery Room ETT Ventilation: NMH vs. VON and ROI

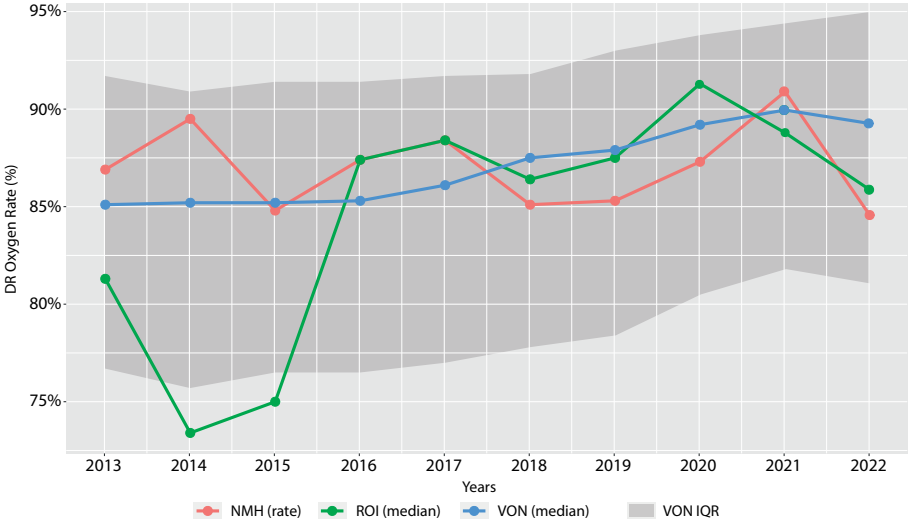


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	28%	23%	32%	32%	16%	22%	16%	13%	22%	18%
VON (rate)	46%	44%	43%	41%	40%	38%	37%	37%	37%	36%
VON (median)	44%	43%	42%	40%	40%	37%	36%	36%	35%	34%
ROI (median)	30%	31%	30%	33%	37%	30%	16%	18%	26%	19%

4.44 Delivery Room Oxygen

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=119)
< 24 wks	4/9 (44%)	5/8 (63%)	5/6 (83%)	9/12 (75%)	4/10 (40%)
24–26 wks	33/34 (97%)	25/26 (96%)	28/28 (100%)	40/40 (100%)	35/37 (95%)
27–29 wks	44/47 (94%)	42/44 (96%)	46/48 (96%)	30/32 (94%)	34/39 (87%)
30–32 wks	17/23 (74%)	22/26 (85%)	19/31 (61%)	28/31 (90%)	24/27 (89%)
> 32wks	5/8 (63%)	5/12 (42%)	5/5 (100%)	3/6 (50%)	3/6 (50%)
Total	**103/121 (85%)**	**99/116 (85%)**	**103/118 (87%)**	**110/121 (91%)**	**100/119 (84%)**

4.45 Delivery Room Oxygen: NMH vs. VON and ROI

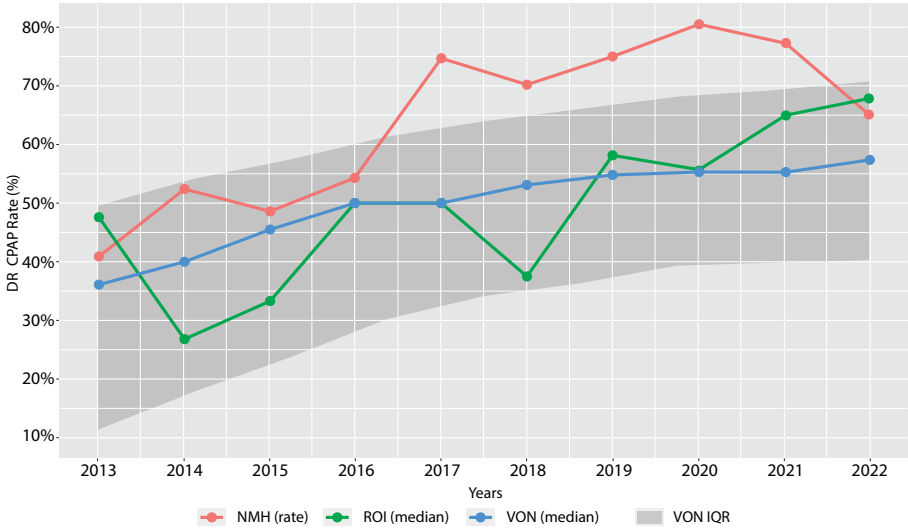


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	87%	90%	85%	87%	88%	85%	85%	87%	91%	84%
VON (rate)	83%	83%	83%	83%	83%	80%	85%	87%	88%	87%
VON (median)	85%	85%	85%	85%	86%	88%	88%	89%	90%	89%
ROI (median)	81%	73%	75%	87%	88%	86%	88%	93%	88%	86%

4.46 Delivery Room CPAP

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=120)
< 24 wks	1/9 (11%)	0/8 (0%)	2/6 (33%)	5/12 (42%)	1/10 (10%)
24-26 wks	24/34 (71%)	19/26 (73%)	27/28 (96%)	32/40 (80%)	25/37 (68%)
27-29 wks	40/47 (85%)	39/44 (89%)	40/48 (83%)	29/32 (91%)	31/40 (78%)
30-32 wks	16/23 (70%)	24/26 (92%)	21/31 (68%)	24/31 (77%)	19/27 (70%)
> 32wks	4/8 (50%)	5/12 (42%)	5/5 (100%)	3/6 (50%)	1/6 (17%)
Total	**85/121 (70%)**	**87/116 (75%)**	**95/118 (81%)**	**93/121 (77%)**	**77/120 (64%)**

4.47 Delivery Room CPAP: NMH vs. VON and ROI

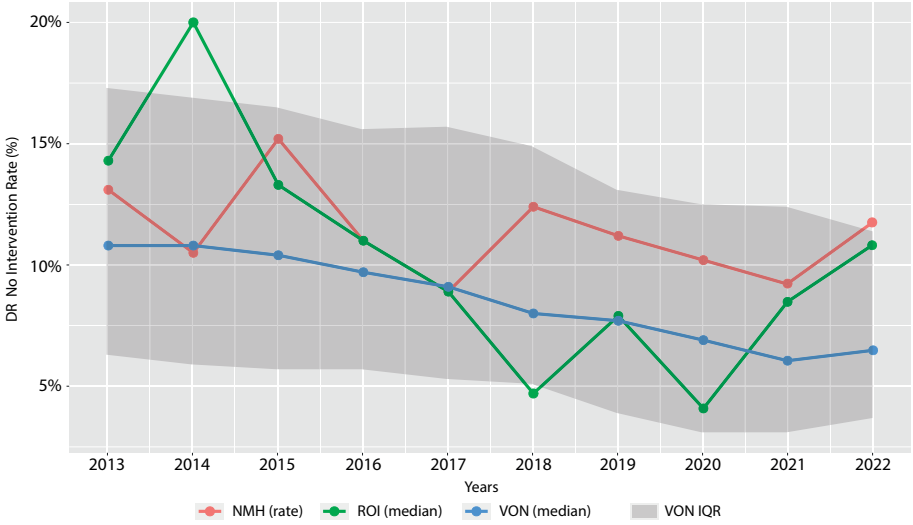


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	41%	52%	49%	54%	75%	70%	75%	81%	77%	64%
VON (rate)	36%	41%	44%	48%	51%	53%	53%	54%	56%	57%
VON (median)	36%	40%	46%	50%	50%	53%	55%	55%	57%	57%
ROI (median)	48%	27%	33%	50%	50%	38%	58%	56%	65%	67%

4.48 No Intervention required in Delivery Room

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=120)
< 24 wks	5/9 (56%)	3/8 (38%)	1/6 (17%)	3/12 (25%)	6/10 (60%)
24-26 wks	1/34 (3%)	1/26 (4%)	0/28 (0%)	0/40 (0%)	2/37 (5%)
27-29 wks	0/47 (0%)	2/44 (5%)	2/48 (4%)	2/32 (6%)	4/40 (10%)
30-32 wks	6/23 (26%)	1/26 (4%)	9/31 (29%)	3/31 (10%)	1/27 (4%)
> 32wks	3/8 (38%)	6/12 (50%)	0/5 (0%)	3/6 (50%)	3/6 (50%)
Total	15/121 (12%)	13/116 (11%)	12/118 (10%)	11/121 (9%)	16/120 (13%)

4.49 No intervention required in Delivery Room: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	13%	11%	15%	11%	9%	12%	11%	10%	9%	13%
VON (rate)	12%	12%	11%	11%	11%	10%	9%	9%	8%	9%
VON (median)	11%	11%	10%	10%	9%	8%	8%	7%	7%	7%
ROI (median)	14%	20%	13%	11%	9%	5%	8%	4%	8%	12%

Ventilation

VON reports on the use of nasal CPAP, nasal ventilation, HFNC (high flow nasal cannula), conventional ventilation and high frequency ventilation in the NICU (i.e. outside the initial resuscitation area).

Interventions in the initial resuscitation area refer to actions performed in the DR or in an initial resuscitation area immediately following birth and prior to admission to the NICU. Designating an area as an 'initial resuscitation area' acknowledges the fact that the birth may occur in places outside of a 'delivery room' i.e. at home, in a car, ambulance, emergency room etc. However, this section reports on events that happen to the infant AFTER leaving the 'delivery room' or 'initial resuscitation area'. The denominator is all infants admitted to the NICU and so excludes infants who die in the DR.

Nasal CPAP after initial resuscitation is defined as 'continuous positive airway pressure' applied via the nose. CPAP administered through a face mask covering the nose *without* the administration of intermittent breaths is considered nasal CPAP for the purpose of this definition. High flow nasal cannula oxygen is not considered nasal CPAP. Of note, since 2018, nasal IMV or SIMV is no longer considered nasal CPAP for the purpose of this definition.

Nasal ventilation after initial resuscitation is defined as non-invasive positive pressure ventilation via nasal prongs or other nasal device at any time after leaving the delivery room/initial resuscitation area. Since 2018, nasal ventilation is coded 'yes' if the infant received non-invasive positive pressure patterns that include two or more levels of positive pressure such as 'BiPAP' or 'SiPAP', synchronised or unsynchronised intermittent mandatory ventilation or non-invasive high-frequency oscillation.

High Flow Nasal Cannula (HFNC) after initial resuscitation has been removed as a data item in 2022. It has been replaced by two other data items, Nasal Cannula Flow after initial resuscitation and Flow Rate of Nasal Cannula greater than 2 litres per minute after initial resuscitation. Nasal Cannula Flow is defined as the administration of air or oxygen (any FiO2) via nasal cannula at any flow rate at any time after leaving the delivery room/initial resuscitation area. If this is answered "Yes", then it is qualified as to whether the infant received air or oxygen (any FiO2) via nasal cannula at a flow rate of more than two liters per minute (>2 L/min).

Conventional Ventilation after initial resuscitation is defined as the administration of intermittent positive pressure ventilation through an endotracheal tube with a conventional ventilator (IMV rate <240/min) at any time after leaving the delivery room/initial resuscitation area. The infant must be 'connected' to a ventilator for this definition to apply.

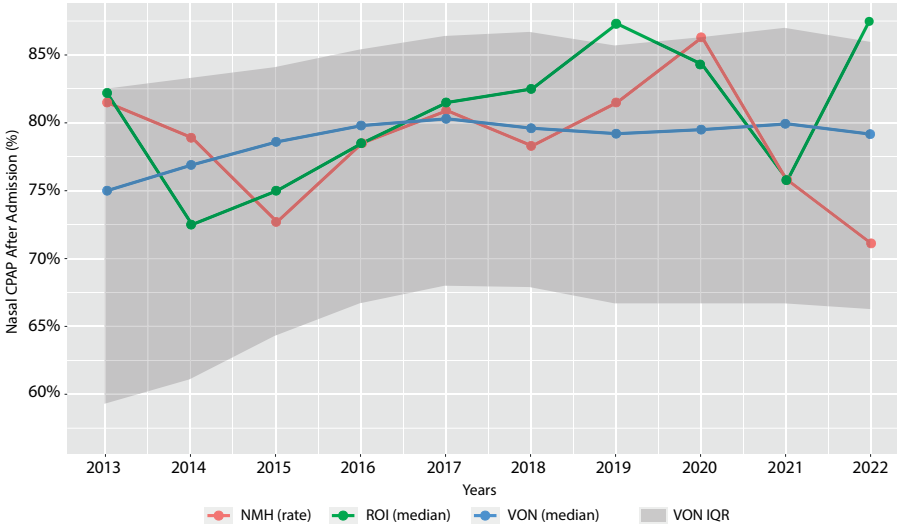
High Frequency Ventilation (HFV) after initial resuscitation is defined as the administration of high frequency ventilation (IMV rate ≥240/min) through an endotracheal tube at any time after leaving the delivery room/initial resuscitation area. High frequency ventilation via nasal prongs is not considered HFV.

4.50 Nasal CPAP after admission to the NICU

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	3/4 (75%)	3/5 (60%)	3/5 (60%)	1/7 (14%)	1/4 (25%)
24–26 wks	27/33 (82%)	21/25 (84%)	27/28 (96%)	34/39 (87%)	27/34 (79%)
27–29 wks	43/47 (92%)	41/42 (98%)	46/48 (96%)	28/31 (90%)	34/39 (87%)
30–32 wks	14/23 (61%)	20/25 (80%)	21/31 (68%)	23/31 (74%)	17/27 (63%)
> 32wks	3/8 (38%)	3/11 (27%)	4/5 (80%)	1/6 (17%)	0/6 (0%)
Total	**90/115 (78%)**	**88/108 (82%)**	**101/117 (86%)**	**87/114 (76%)**	**79/110 (72%)**

**Since 2018, nasal IMV or SIMV is longer considered nasal CPAP for the purpose of this definition.*

4.51 Nasal CPAP after admission to the NICU: NMH vs. VON and ROI



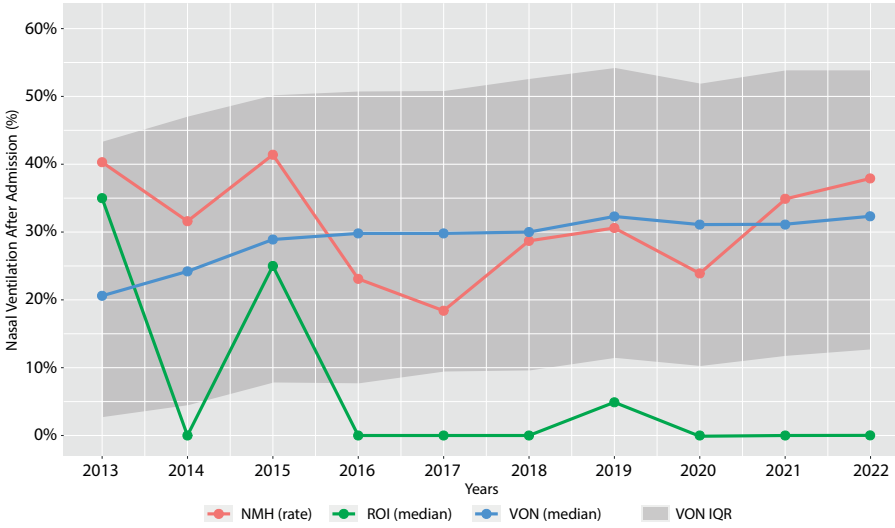
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	82%	79%	73%	79%	81%	78%	82%	86%	76%	72%
VON (rate)	74%	76%	78%	78%	79%	77%	77%	78%	78%	78%
VON (median)	75%	77%	79%	80%	80%	80%	79%	80%	80%	79%
ROI (median)	82%	73%	75%	79%	82%	83%	87%	84%	76%	88%

4.52 Nasal Ventilation after admission to the NICU

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24wks	3/4 (75%)	2/5 (40%)	1/5 (20%)	1/7 (14%)	1/4 (25%)
24-26wks	18/33 (55%)	17/25 (68%)	15/28 (54%)	29/39 (74%)	23/34 (68%)
27-29wks	11/47 (23%)	9/42 (21%)	11/48 (23%)	10/31 (32%)	16/39 (41%)
30-32wks	1/23 (4%)	4/25 (16%)	1/31 (3%)	0/31 (0%)	1/27 (4%)
>32wks	0/8 (0%)	1/11 (9%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**33/115 (29%)**	**33/108 (31%)**	**28/117 (24%)**	**40/114 (35%)**	**41/110 (37%)**

**Nasal Ventilation implies non-invasive positive pressure ventilation via nasal prongs or other nasal device including a nasal cannula*

4.53 Nasal Ventilation after admission to the NICU: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	40%	32%	41%	23%	18%	29%	31%	24%	35%	37%
VON (rate)	29%	31%	34%	35%	35%	35%	36%	36%	36%	37%
VON (median)	21%	24%	29%	30%	30%	30%	32%	31%	31%	32%
ROI (median)	35%	0%	25%	0%	0%	0%	6%	1%	0%	0%

4.54 Nasal Cannula Flow after admission to the NICU

Gestational Age	2022 (n=110)
< 24 wks	0/4 (0%)
24–26 wks	16/34 (47%)
27–29 wks	23/39 (59%)
30–32 wks	6/27 (22%)
> 32wks	0/6 (0%)
Total	**45/110 (41%)**

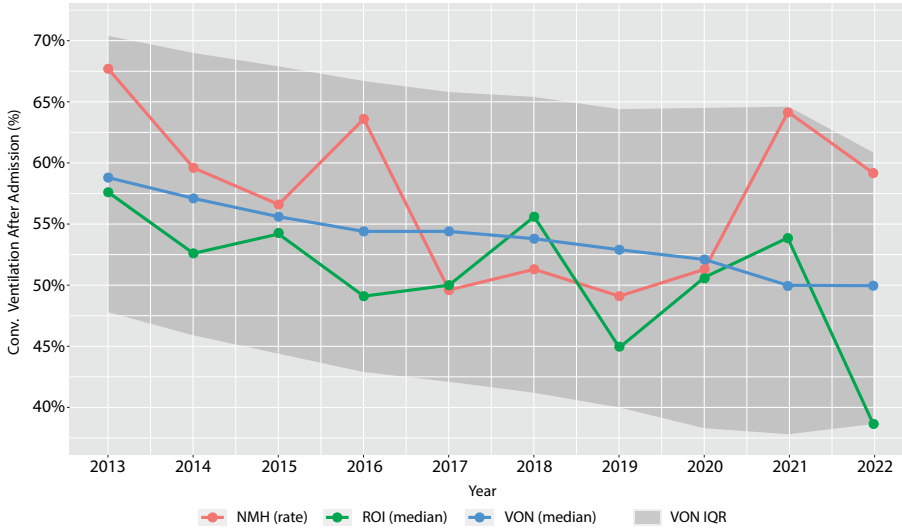
4.55 Flow Rate of Nasal Cannula >2litres/min after admission to the NICU

Gestational Age	2022 (n=45)
(n=45)	0/0 (0%)
< 24 wks	12/16 (75%)
24–26 wks	14/23 (61%)
27–29 wks	5/6 (83%)
30–32 wks	0/0 (0%)
> 32wks	31/45 (69%)
Total	**31/45 (69%)**

4.56 Conventional Ventilation after admission to the NICU

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	4/4 (100%)	4/5 (80%)	5/5 (100%)	7/7 (100%)	4/4 (100%)
24-26 wks	27/33 (82%)	21/25 (84%)	19/28 (68%)	37/39 (95%)	32/34 (94%)
27-29 wks	24/47 (51%)	22/42 (52%)	24/48 (50%)	21/31 (68%)	20/39 (51%)
30-32 wks	3/23 (13%)	5/25 (205)	11/31 (36%)	8/31 (26%)	8/27 (30%)
> 32wks	1/8 (13%)	1/11 (9%)	1/5 (20%)	0/6 (0%)	1/6 (17%)
Total	**59/115 (51%)**	**53/108 (49%)**	**60/117 (51%)**	**73/114 (64%)**	**65/110 (59%)**

4.57 Conventional Ventilation after admission to the NICU: NMH vs. VON and ROI

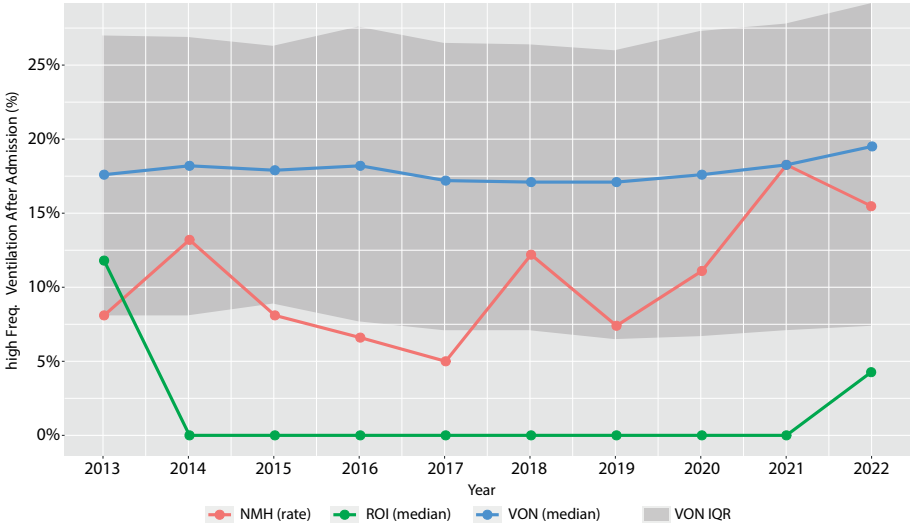


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	68%	60%	57%	64%	50%	51%	49%	51%	64%	59%
VON (rate)	58%	57%	56%	55%	54%	54%	53%	53%	51%	51%
VON (median)	59%	57%	56%	54%	54%	54%	53%	52%	50%	50%
ROI (median)	58%	53%	54%	49%	50%	56%	45%	51%	54%	37%

4.58 High Frequency Ventilation after admission to the NICU

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	3/4 (75%)	1/5 (20%)	3/5 (60%)	2/7 (29%)	2/4 (50%)
24–26 wks	7/33 (21%)	2/25 (8%)	5/28 (18%)	10/39 (26%)	12/34 (35%)
27–29 wks	4/47 (9%)	4/42 (10%)	5/48 (10%)	9/31 (29%)	3/39 (8%)
30–32 wks	0/23 (0%)	1/25 (4%)	0/31 (0%)	0/31 (0%)	0/27 (0%)
> 32wks	0/8 (0%)	0/11 (0%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**14/115 (12%)**	**8/108 (7%)**	**13/117 (11%)**	**21/114 (18%)**	**17/110 (15%)**

4.59 High Frequency Ventilation after admission to the NICU: NMH vs. VON and ROI

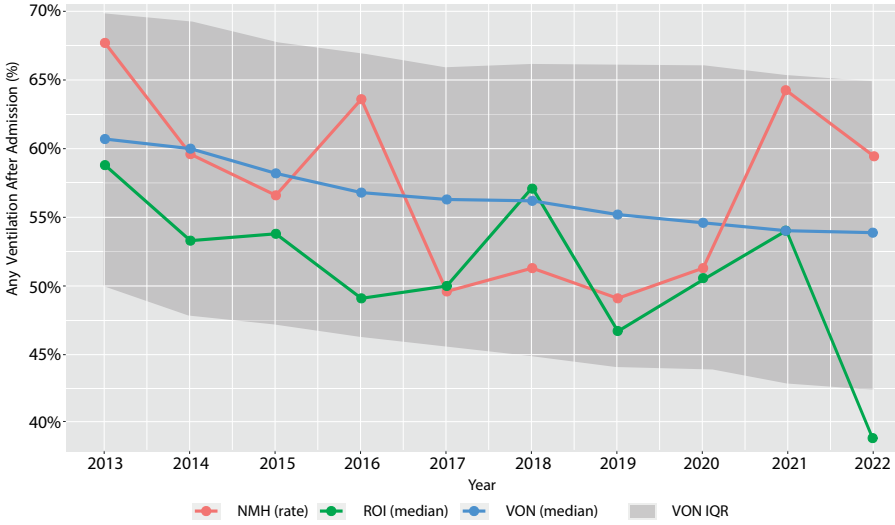


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	8%	13%	8%	7%	5%	12%	7%	11%	18%	16%
VON (rate)	21%	21%	21%	21%	21%	20%	21%	22%	22%	23%
VON (median)	18%	18%	18%	18%	17%	17%	17%	18%	18%	19%
ROI (median)	12%	0%	0%	0%	0%	0%	0%	0%	0%	4%

4.60 Any Ventilation after admission to the NICU

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	4/4 (100%)	4/5 (80%)	5/5 (100%)	7/7 (100%)	4/4 (100%)
24-26 wks	27/33 (82%)	21/25 (84%)	19/28 (68%)	37/39 (95%)	32/34 (94%)
27-29 wks	24/47 (51%)	22/42 (52%)	24/48 (50%)	21/31 (68%)	20/39 (51%)
30-32 wks	3/23 (13%)	5/25 (20%)	11/31 (36%)	8/31 (26%)	8/27 (30%)
> 32wks	1/8 (13%)	1/11 (9%)	1/5 (20%)	0/6 (0%)	1/6 (17%)
Total	**59/115 (51%)**	**53/108 (49%)**	**60/117 (51%)**	**73/114 (64%)**	**65/110 (59%)**

4.61 Any Ventilation (Conventional Ventilation or HFV) after admission to the NICU: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	68%	60%	57%	64%	50%	51%	49%	51%	64%	59%
VON (rate)	61%	60%	59%	57%	57%	56%	55%	56%	55%	55%
VON (median)	61%	60%	58%	57%	56%	56%	56%	55%	54%	53%
ROI (median)	59%	53%	54%	49%	50%	57%	47%	51%	54%	37%

4.62 Number of Infants never requiring ventilation (Conventional Ventilation or HFV) after admission to the NICU NICU

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24wks	0/4 (0%)	1/5 (20%)	0/5 (0%)	0/7 (0%)	0/4 (%)
24-26wks	6/33 (18%)	4/25 (16%)	9/28 (32%)	2/39 (5%)	2/34 (%)
27-29wks	23/47 (49%)	20/42 (48%)	24/48 (50%)	10/31(32%)	19/39 (%)
30-32wks	20/23 (87%)	20/25 (80%)	20/31 (64%)	23/31(74%)	19/27 (%)
>32wks	7/8 (87%)	10/11 (91%)	4/5 (80%)	6/6 (0%)	5/6 (%)
Total	**56/115 (49%)**	**55/108 (51%)**	**57/117 (49%)**	**41/114 (36%)**	**45/110 (41%)**

4.63 Number of Infants never requiring any additional respiratory support (Conventional Ventilation, HFV, CPAP, HFNC) apart from low flow oxygen after admission to the NICU

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24wks	0/4 (0%)	1/5 (20%)	0/5 (0%)	0/7 (0%)	0/4 (0%)
24-26wks	0/33 (0%)	0/25 (0%)	0/28 (0%)	0/39 (0%)	0/34 (0%)
27-29wks	1/47 (2%)	0/42 (0%)	0/48 (0%)	0/31 (0%)	4/39 (3%)
30-32wks	7/23 (30%)	2/25 (8%)	9/31 (29%)	6/31 (19%)	11/27 (41%)
>32wks	5/8 (62%)	8/11 (73%)	1/5 (20%)	5/6 (83%)	5/6 (83%)
Total	**13/115 (11%)**	**11/108 (10%)**	**10/117 (9%)**	**11/114 (10%)**	**20/110 (18%)**

**In 2022, 3 infants did not require additional oxygen in the NICU but all 3 of these infants required CPAP (28wks x 2, 31wks x 1)*

4.64 No. of Infants <28 wks gestation who are never ventilated after admission to the NICU

Year	2018	2019	2020	2021	2022
No. of infants <28 wks admitted to NICU	49	49	40	55	45
No. intubated within the first few hrs/days of life for the purposes of resuscitation and/ or surfactant administration	34 (69%)	32 (65%)	24 (60%)	49 (89%)	39 (87%)
No. not requiring intubation within the first few hrs/days of life	**15 (31%)** 23 wks (1) 25 wks (3) 26 wks (6) 27 wks (5)	**16 (33%)** 23 wks (1) 24 wks (1) 25 wks (1) 26 wks (2) 27 wks (11)	**16 (40%)** 24 wks (2) 25 wks (8) 26 wks (3) 27 wks (3)	**6 (11%)** 24 wks (2) 26 wks (2) 27 wks (2)	**6 (9%)** 24 wks (1) 26 wks (4) 27 wks (1)
No. of infants not initially intubated who subsequently required intubation for other reasons (ie sepsis etc)	**4/15 (27%)** 23 wks (1) 25 wks (2) 26 wks (1)	**0/16 (0%)**	**4/16 (27%)** 24 wks (1) 25 wks (1) 26 wks (2)	**3/6 (50%)** 24 wks (2) 27 wks (1)	**3/6 (50%)** 24 wks (1) 26 wks (2)
No. of infants < 28 wks who were never intubated during their NICU stay	**11/49(22%)**	**16/49(33%)**	**12/40*(30%)**	**3/55 (5%)** 26 wks (2) 27 wks (1)	**3/45* (7%)** 26 wks (2)* 27 wks (1)

** Implies an infant who had received surfactant via InSurE method.*

Ventilation Practices

This section reports on six specific ventilation practices:

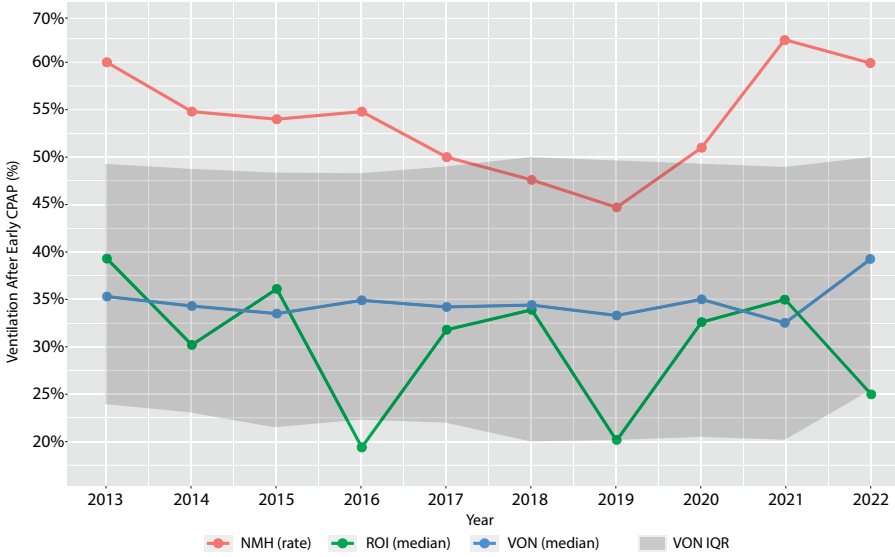
- Ventilation after early CPAP (the need for subsequent ETT ventilation after early CPAP)
- Timing of surfactant
- InSurE (**In**tubation, **Sur**factant administration, immediate **E**xtubation) method of administration of surfactant
- Inhaled Nitric Oxide
- Caffeine administration

Of note, since 2022, VON no longer reports on Nasal CPAP or Nasal Ventilation before or without ever having received ETT ventilation.

4.65 Ventilation after Early CPAP

Gestational Age	2018 (n=84)	2019 (n=85)	2020 (n=100)	2021 (n=90)	2022 (n=77)
< 24 wks	1/1 (100%)	0/0 (0%)	2/2 (100%)	4/4 (100%)	1/1 (100%)
24-26 wks	19/25 (76%)	15/19 (79%)	18/27 (67%)	29/31 (94%)	24/25 (96%)
27-29 wks	17/39 (44%)	18/38 (47%)	20/43 (47%)	19/29 (66%)	16/31 (52%)
30-32 wks	2/15 (13%)	4/23 (17%)	10/23 (44%)	5/25 (20%)	6/19 (32%)
> 32wks	1/4 (25%)	1/5 (20%)	1/5 (20%)	0/1 (0%)	0/1 (0%)
Total	**40/84 (48%)**	**38/85 (45%)**	**51/100 (51%)**	**57/90 (63%)**	**47/77 (61%)**

4.66 Ventilation after Early CPAP: NMH vs. VON and ROI

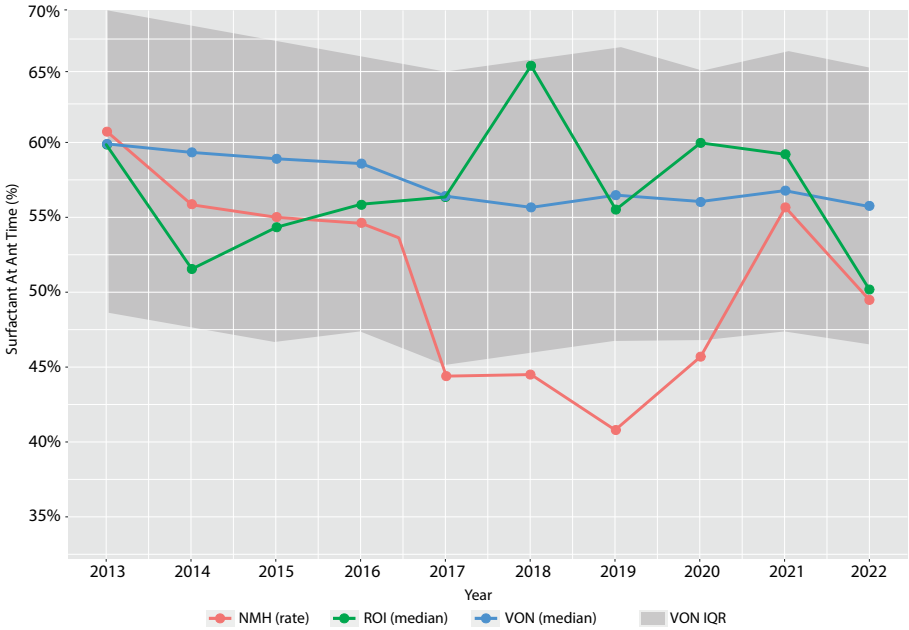


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	60%	55%	54%	55%	50%	48%	45%	51%	63%	61%
VON (rate)	37%	38%	37%	38%	37%	38%	37%	37%	36%	41%
VON (median)	35%	34%	34%	35%	34%	34%	34%	35%	33%	39%
ROI (median)	39%	30%	36%	19%	32%	34%	21%	33%	35%	25%

4.67 Surfactant administered at Any Time

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=120)
< 24 wks	3/9 (33%)	4/8 (50%)	5/6 (83%)	7/12 (58%)	4/10 (40%)
24-26 wks	23/34 (68%)	20/26 (77%)	15/28 (54%)	36/40 (90%)	31/37 (84%)
27-29 wks	23/47 (49%)	20/44 (46%)	25/48 (52%)	19/32 (59%)	17/40 (43%)
30-32 wks	3/23 (13%)	3/26 (12%)	8/31 (26%)	6/31 (19%)	7/27 (26%)
> 32wks	1/8 (13%)	0/12 (0%)	1/5 (20%)	0/6 (0%)	0/6 (0%)
Total	**53/121 (44%)**	**47/116 (41%)**	**54/118 (46%)**	**68/121 (56%)**	**59/120 (49%)**

4.68 Surfactant administered at Any Time: NMH vs. VON and ROI



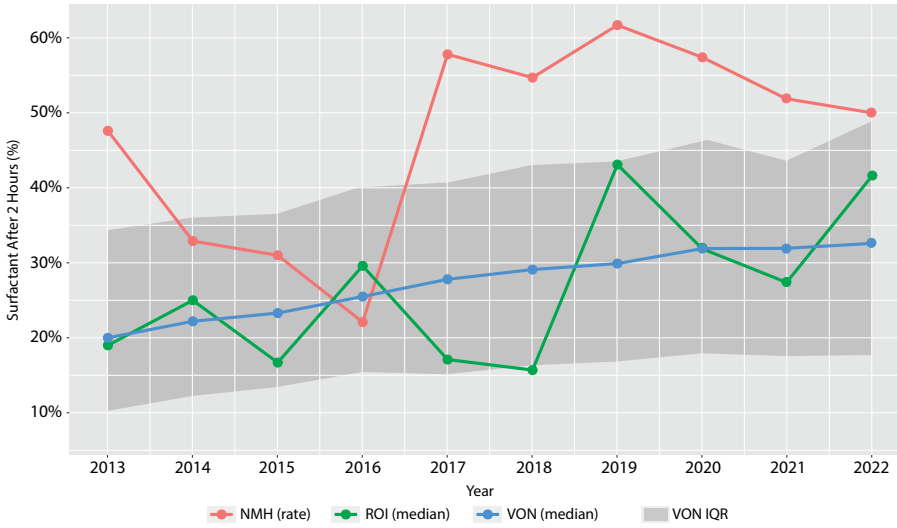
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	61%	57%	55%	54%	44%	44%	41%	46%	56%	49%
VON (rate)	59%	59%	57%	57%	56%	56%	56%	57%	57%	56%
VON (median)	60%	59%	58%	58%	56%	56%	57%	57%	58%	57%
ROI (median)	60%	52%	54%	56%	56%	66%	56%	60%	58%	50%

4.69 Surfactant administered after 2 Hours

Gestational Age	2018 (n=53)	2019 (n=47)	2020 (n=54)	2021 (n=68)	2022 (n=58)
< 24 wks	1/3 (33%)	1/4 (25%)	2/5 (40%)	3/7 (43%)	1/4 (25%)
24-26 wks	13/23 (57%)	13/20 (65%)	10/15 (67%)	18/36 (50%)	11/31 (35%)
27-29 wks	11/23 (48%)	14/20 (70%)	12/25 (48%)	11/19 (58%)	10/16 (63%)
30-32 wks	3/3 (100%)	1/3 (33%)	6/8 (75%)	3/6 (50%)	7/7 (100%)
> 32wks	1/1 (100%)	0/0 (0%)	1/1 (100%)	0/0 (0%)	0/0 (0%)
Total	**29/53 (55%)**	**29/47 (62%)**	**31/54 (57%)**	**35/68 (52%)**	**29/58 (50%)**

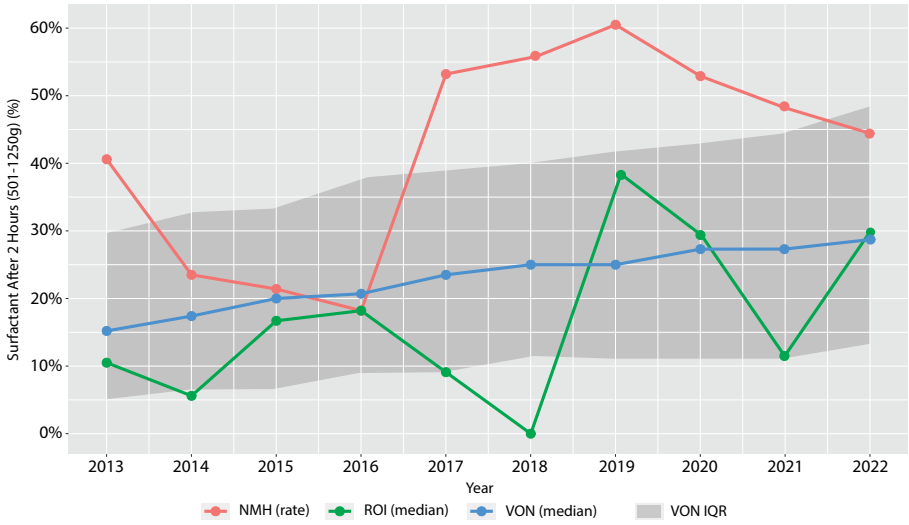
**indicates a case where the timing of administration of surfactant is unknown*

4.70 Surfactant administered after 2 Hours: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	48%	33%	31%	22%	58%	55%	63%	57%	52%	50%
VON (rate)	22%	24%	26%	28%	29%	31%	32%	33%	33%	34%
VON (median)	20%	22%	23%	26%	28%	29%	30%	32%	32%	33%
ROI (median)	19%	25%	17%	30%	17%	16%	46%	32%	27%	42%

4.71 Surfactant administered after 2 Hours in Infants with Birthweights of 501-1250g: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	41%	24%	21%	18%	53%	57%	62%	53%	49%	39%
VON (rate)	19%	21%	23%	25%	26%	28%	29%	30%	30%	31%
VON (median)	15%	17%	20%	21%	24%	25%	25%	27%	27%	29%
ROI (median)	11%	6%	17%	18%	9%	0%	39%	30%	11%	30%

InSurE

The definition of the InSurE method of surfactant administration (InSurE: **In**tubation, **Sur**factant administration, immediate Extubation) that is applied in our NICU includes any infant who is intubated for the sole purpose of administering surfactant and who is immediately extubated without having been connected to a conventional ventilator. The infant may receive some assisted positive pressure breaths via a resuscitation bag. The InSurE method of surfactant administration is considered successful if the infant remains extubated for 48 hours. This information is collected by our NICU independent of VON. If InSurE is successful, and the infant was not connected to a ventilator when the surfactant was administered, these infants are reported to VON as having received surfactant but as not having received conventional ventilation.

4.72 Surfactant Administration by InSurE Method

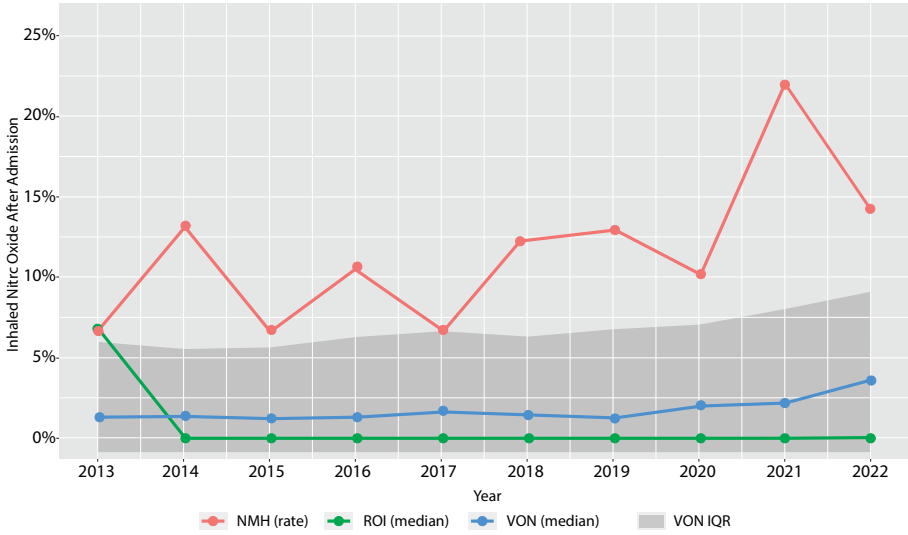
Year	2018		2019		2020		2021		2022	
Gestational Age	InSurE case	InSurE successful	InSurE case	InSurE successful	InSurE case	InSurE successful	InSurE case	InSurE successful	InSurE case	InSurE successful
< 24 wks	0/4 (0%)	N/A	0/5 (0%)	N/A	0/5 (0%)	N/A	0/7 (0%)	N/A	0/4 (0%)	N/A
24-26 wks	0/33 (0%)	N/A	0/25 (0%)	N/A	2/28(7%)	1/2**(50%)	0/39 (0%)	N/A	2/34(6%)	2/2** (100%)
27-29 wks	1/47 (2%)	1/1* (100%)	0/42 (0%)	N/A	2/48(4%)	2/2**(100%)	0/31 (0%)	N/A	0/39 (0%)	N/A
30-32 wks	0/23 (0%)	N/A	0/25 (0%)	N/A	0/31 (0%)	N/A	0/31 (0%)	N/A	0/27 (0%)	N/A
> 32wks	0/8 (0%)	N/A	0/11 (0%)	N/A	0/5 (0%)	N/A	0/6 (0%)	N/A	0/6 (0%)	N/A
Total	**1/115 (1%)**	**1/1 (100%)**	**0/108 (0%)**	**N/A**	**4/117 (3%)**	**N/A**	**0/114 (0%)**	**N/A**	**2/110(0%)**	**2/2 (100%)**

**Indicates an infant treated with InSurE in another centre*
N/A: not applicable

4.73 Inhaled Nitric Oxide after admission to the NICU

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	1/4 (25%)	2/5 (40%)	2/5 (40%)	3/7 (43%)	0/4 (0%)
24-26 wks	9/33 (27%)	4/25 (16%)	4/28 (14%)	10/39 (26%)	8/34 (24%)
27-29 wks	4/47 (9%)	5/42 (12%)	5/48 (10%)	9/31 (29%)	6/39 (15%)
30-32 wks	0/23 (0%)	2/25 (8%)	1/31 (3%)	2/31 (7%)	1/27 (4%)
> 32wks	0/8 (0%)	1/11 (9%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**14/115 (12%)**	**14/108 (13%)**	**12/117 (10%)**	**24/114 (21%)**	**15/110 (14%)**

4.74 Inhaled Nitric Oxide after admission to the NICU: NMH vs. VON and ROI

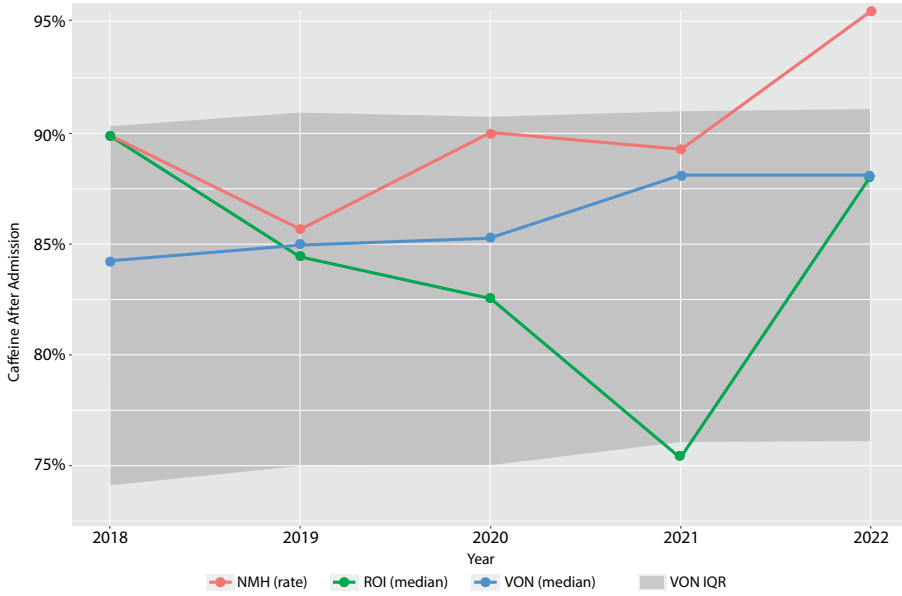


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	7%	13%	7%	11%	7%	12%	13%	10%	21%	14%
VON (rate)	5%	5%	5%	5%	6%	5%	6%	6%	6%	7%
VON (median)	2%	2%	2%	2%	2%	2%	2%	3%	3%	4%
ROI (median)	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%

4.75 Caffeine Administration after admission to the NICU

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	4/4 (100%)	4/5 (80%)	4/5 (80%)	7/7 (100%)	4/4 (100%)
24-26 wks	32/33 (97%)	23/25 (90%)	28/28 (100%)	38/39 (97%)	34/34 (100%)
27-29 wks	45/47 (96%)	42/42 (100%)	48/48 (100%)	30/31 (97%)	39/39 (100%)
30-32 wks	20/23 (87%)	21/25 (84%)	23/31 (74%)	26/31 (84%)	27/27 (100%)
> 32wks	2/8 (25%)	3/11 (27%)	2/5 (40%)	0/6 (0%)	1/6 (17%)
Total	**103/115 (90%)**	**93/108 (86%)**	**105/117 (90%)**	**101/114 (89%)**	**105/110 (95%)**

4.76 Caffeine Administration after admission to the NICU: NMH vs. VON and ROI



Year	2018	2019	2020	2021	2022
NMH (rate)	90%	86%	90%	89%	96%
VON (rate)	83%	84%	85%	86%	86%
VON (median)	84%	85%	85%	87%	87%
ROI (median)	90%	84%	82%	76%	87%

Respiratory Outcomes

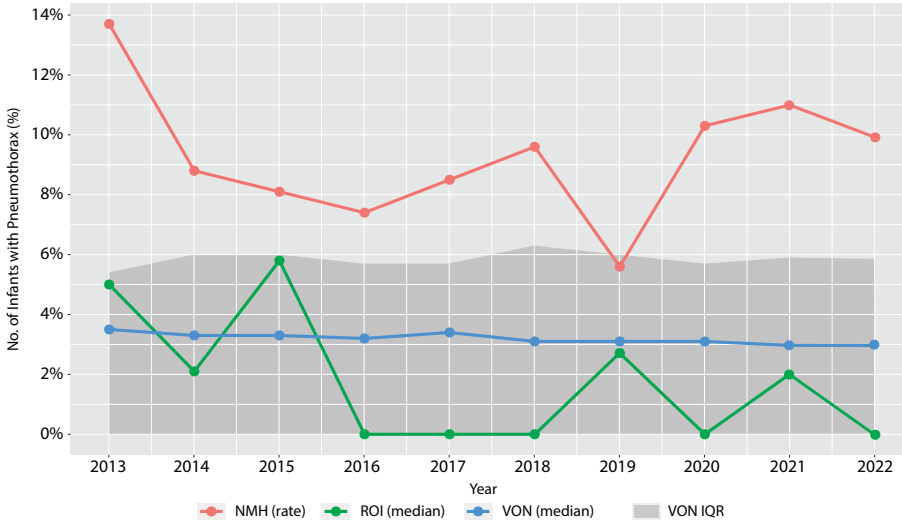
4.77 Pneumothorax

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24wks	0/4 (0%)	0/5 (0%)	4/5 (80%)	2/7 (29%)	1/4 (25%)
24-26wks	8/33 (24%)	2/25 (8%)	3/28 (11%)	7/39 (18%)	6/34 (18%)
27-29wks	2/47 (4%)	3/42 (7%)	5/48 (10%)	3/31 (10%)	3/39 (8%)
30-32wks	1/23 (4%)	1/25 (4%)	0/31 (0%)	0/31 (0%)	1/27 (4%)
>32wks	0/8 (0%)	0/11 (0%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**11/115 (10%)**	**6/108 (6%)**	**12/117 (10%)**	**12/114 (11%)**	**11/110 (10%)**

4.78 Pneumothorax requiring the placement of a chest drain and/or a pig-tail catheter.

Gestational Age	2018 (n=11)	2019 (n=6)	2020 (n=12)	2021 (n=12)	2022 (n=11)
< 24wks	0/0 (0%)	0/0 (0%)	2/4 (50%)	1/2 (50%)	1/1 (100%)
24-26wks	5/8 (71%)	2/2 (100%)	3/3 (100%)	3/7 (43%)	5/6 (83%)
27-29wks	0/2/ (0%)	2/3 (66%)	3/5 (60%)	3/3 (100%)	3/3 (100%)
30-32wks	0/1 (40%)	0/1 (0%)	0/0 (0%)	0/0 (0%)	1/1 (100%)
>32wks	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)
Total	**5/11 (45%)**	**4/6 (66%)**	**8/12 (67%)**	**7/12 (58%)**	**10/11 (91%)**

4.79 Number of Infants with Pneumothorax: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	14%	9%	8%	7%	9%	10%	6%	10%	11%	10%
VON (rate)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
VON (median)	4%	3%	3%	3%	3%	3%	3%	3%	3%	3%
ROI (median)	5%	2%	6%	0%	0%	0%	3%	0%	2%	0%

4.80 Shrunken and Composite Shrunken SMRs for Pneumothorax for NMH

Year	Shrunken SMR with 95% CI	Years	Composite Shrunken SMR with 95% CI
2018	1.5 (0.9-2.2)	2016-2018	1.7 (1.2-2.3)*
2019	1.2 (0.7-1.8)	2017-2019	1.8 (1.2-2.4)*
2020	1.7 (1.0-2.5)	2018-2020	1.8 (1.3-2.4)*
2021	1.6 (0.9-2.4)	2019-2021	1.8 (1.3-2.4)*
2022	1.6 (1.0-2.5)	2020-2022	2.0 (1.4-2.7)*

**Lower and upper bounds of Confidence Interval (CI) does not include 1.0*

4.81 Clinical Details of VLBW Infants with Pneumothorax

Cases	GA	B/ Weight	ANS Doses	Intubated in DR	Surfactant in DR	Intubated for surfactant in NICU	CPAP prior to intubation	Timing of first surfactant dose	PTX needled initially	Chest drain required	Length of ROM	GA at time of ROM	Survived to Discharge
1	23	555	2	No	No	Yes	Yes	2 hrs	Yes	Yes	<24hrs	23+1 wks	Died D5 of E. Coli sep-sis, extreme prematurity, severe RDS, clinical cho-rioamni-onitis, PPROM x 2 days.
2	25	590	2	Yes	Yes	No	No	8 mins	Yes	Yes	3 wks 4 days	21+3 wks	Died D1 of Extreme prematurity, pulmonary hypoplasia, PPROM form 21 weeks.
3	25	700	2	Yes	Yes	No	No	10 mins	Yes	Yes	6 wks 3 days	19+0 wks	Died D1 of Pulmonary hypoplasia, PPROM from 18 weeks, se-vere meta-bolic acido-sis, extreme-ly preterm twin
4	26	550	2	No	No	Yes	Yes	16 hrs	Yes	No	<24 hrs	26+1 wks	Home D98
5	26	930	2	Yes	No	No	No	1 hr 30 mins	Yes	Yes	3 wks 1 day	22+6 wks	Home D87
6	26	935	2	No	No	Yes	Yes	2 hrs	No	No	At time of C/S	26+4 wks	Died D4 of Grade IV IVH, ex-treme prem-aturity, tri-plet preg-nancy

Cases	GA	B/ Weight	ANS Doses	Intubated in DR	Surfactant in DR	Intubated for surfactant in NICU	CPAP prior to intubation	Timing of first surfactant dose	PTX needled initially	Chest drain required	Length of ROM	GA at time of ROM	Survived to Discharge
7	26	1010	2	Yes	Yes	No	No	18 mins	Yes	No	5 wks 2 days	21+1 wks	Died D1 of Pulmonary hypoplasia, oligohy-dramnios from 14 weeks, ex-treme prem-aturity, ELBW.
8	28	990	2	No	No	Yes	Yes	15 hrs 30 mins	Yes	Yes	54 hrs	27+5 wks	Home D79
9	28	1270	2	No	No	Yes	Yes	38 hrs	Yes	Yes	At time of C/S	28+3 wks	Home D58
10	28	1340	2	No	No	Yes	Yes	17 hrs	Yes	Yes	34 hrs	28+4 wks	Home D55
11	30	1425	2	No	No	Yes	Yes	8 hrs 30 mins	Yes	Yes	4 wks 5 daus	25+3 wks	Home D51

**indicates an outborn infant*

Chronic Lung Disease (CLD) of Prematurity

VON defines CLD of prematurity based on an algorithm which has been tested with actual hospital data and found to be more accurate than the oxygen at 36 weeks measure alone.

Prior to 2015, members used a rounded gestational age to calculate the Date of Week 36 and infants with unknown initial disposition, initial length of stay or an unknown age at admission for outborn infants were included in the CLD calculation. Starting in 2015, members use actual gestational age to calculate the Date of Week 36 and the CLD calculation excludes infants with unknown gestational age, initial disposition, initial length of stay or age at admission for outborn infants.

CLD is coded "Yes" if the infant is in our centre at 36 weeks postmenstrual age based on the actual gestational age i.e. not a rounded gestational age and Oxygen at 36 Weeks is answered "Yes" (including infants who were transferred before the Date of Week 36 and are readmitted). Infants are considered to 'be in our centre' if they have not been discharged home on that date or if they have been transferred from our centre to another centre prior to the date of week 36 but have been readmitted to our centre before discharge home, death or first birthday or are not transferred a second time before the 'date of week 36'.

If the infant is discharged home on or after 34 weeks postmenstrual age but before 36 weeks post-menstrual age, then CLD is equal to the 'value of oxygen at discharge'. The latter is recorded as 'yes' for infants who went home and were on oxygen at the time of discharge. If the infant was transferred to another hospital on or after 34 weeks postmenstrual age but before 36 weeks post-menstrual age, then CLD is equal to the value of oxygen at the time of discharge from our institution. Again, the latter is recorded as 'yes' for infants who were transferred and were on oxygen at the time of discharge from our centre.

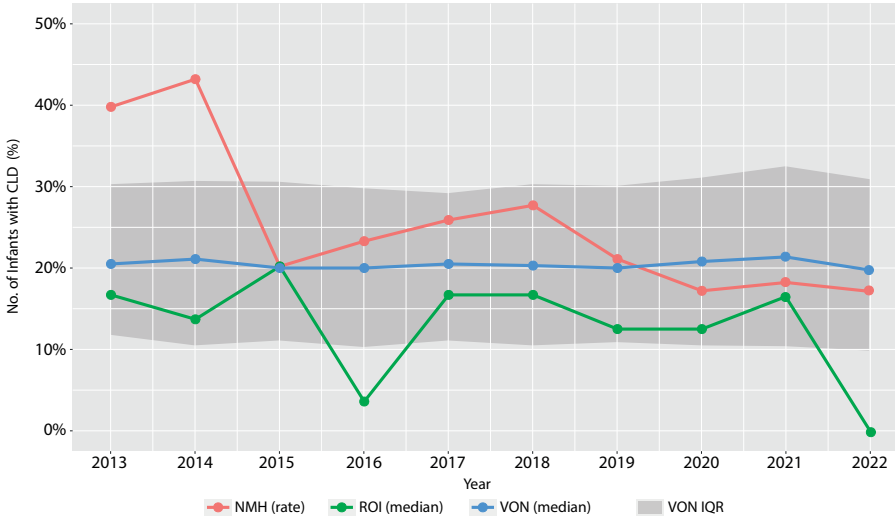
If the infant is discharged home before 34 weeks postmenstrual and is not on oxygen at the time of discharge, then CLD is coded as 'no'. If the infant is transferred before 34 weeks postmenstrual age and the infant is not on oxygen at discharge, then CLD is coded as 'no'. However, if the infant is discharged home or transferred to another hospital before 34 weeks postmenstrual age, and the infant is on oxygen at the time of discharge from our centre, then CLD is coded as 'Unknown'.

If the infant's gestational age is greater than 36 weeks, CLD is coded as 'not applicable'.

4.82 Chronic Lung Disease at 36 wks Gestational Age

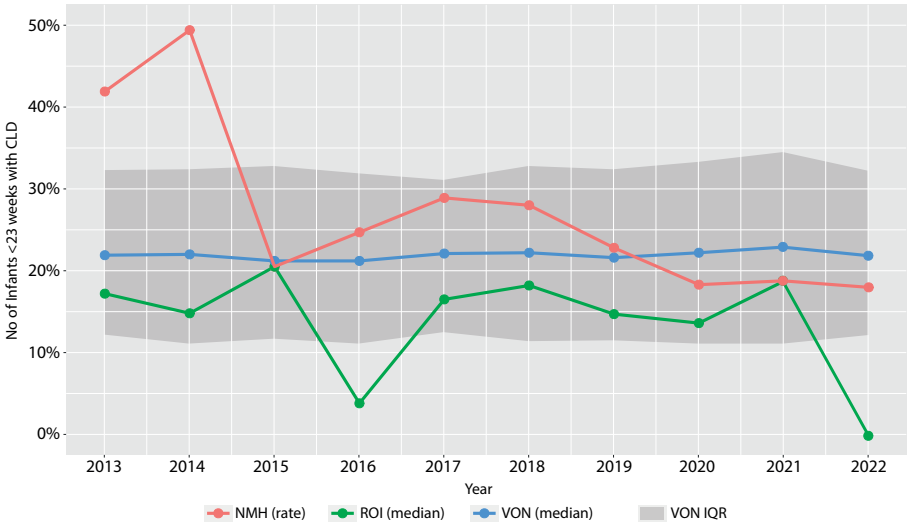
Gestational Age	2018 (n=101)	2019 (n=90)	2020 (n=87)	2021 (n=84)	2022 (n=82)
< 24 wks	1/1 (100%)	0/2 (0%)	1/1 (100%)	0/0 (0%)	0/0 (0%)
24-26 wks	10/28 (36%)	7/20 (35%)	5/14 (36%)	8/27 (30%)	7/18 (39%)
27-29 wks	13/44 (30%)	10/34 (29%)	9/38 (24%)	4/22 (18%)	6/31 (19%)
30-32 wks	2/20 (10%)	1/23 (4%)	0/29 (0%)	2/29 (7%)	0/27 (0%)
> 32wks	2/8 (25%)	1/11 (9%)	0/5 (0%)	0/6 (0%)	1/6 (17%)
Total	**28/101 (28%)**	**19/90 (21%)**	**15/87 (17%)**	**14/84 (17%)**	**14/82 (17%)**

4.83 Chronic Lung Disease: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	39%	43%	20%	23%	26%	28%	21%	17%	18%	17%
VON (rate)	25%	25%	24%	24%	25%	25%	25%	26%	26%	27%
VON (median)	21%	21%	20%	20%	21%	20%	20%	21%	21%	20%
ROI (median)	17%	14%	20%	4%	17%	17%	13%	15%	17%	0%

4.84 Chronic Lung Disease in Infants <33 weeks: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	41%	49%	21%	25%	29%	28%	23%	18%	19%	17%
VON (rate)	26%	27%	26%	26%	27%	27%	27%	28%	28%	29%
VON (median)	22%	22%	21%	21%	22%	22%	21%	23%	23%	22%
ROI (median)	17%	15%	21%	4%	17%	18%	15%	15%	19%	0%

4.85 Shrunken and Composite Shrunken SMRs for CLD for NMH

Year	Shrunken SMR for CLD with 95% CI	Years	Composite Shrunken SMR for CLD with 95% CI	Year	Shrunken SMR for CLD <33 wks with 95% CI	Years	Composite Shrunken SMR for CLD <33 wks with 95% CI
2018	1.1 (0.7-1.5)	2016-2018	1.2 (1.0-1.5)	2018	1.0 (0.7-1.4)	2016-2018	1.2 (0.9-1.4)
2019	1.0 (0.6-1.4)	2017-2019	1.1 (0.9-1.4)	2019	1.0 (0.6-1.4)	2017-2019	1.1 (0.9-1.4)
2020	0.9 (0.5-1.3)	2018-2020	1.0 (0.8-1.2)	2020	0.9 (0.6-1.3)	2018-2020	1.0 (0.7-1.2)
2021	0.8 (0.5-1.1)	2019-2021	0.9 (0.6-1.1)	2021	0.8 (0.5-1.2)	2019-2021	0.9 (0.6-1.1)
2022	0.8 (0.5-1.3)	2020-2022	0.8 (0.6-1.0)	2022	0.8 (0.5-1.2)	2020-2022	0.8 (0.6-1.0)

**Lower and upper bounds of Confidence Interval (CI) does not include 1.0*

Respiratory Support at 36 weeks

VON reports on the number of infants requiring additional respiratory support at 36 weeks gestational age. From 2022, VON will report on the number of infants receiving supplemental oxygen, nasal cannula flow, a flow rate of >2 litres/min via nasal cannula, nasal CPAP, nasal ventilation, conventional ventilation or HFV (high frequency ventilation) at any time after leaving the delivery room/initial resuscitation area on the date of week 36. This information is only collected on infants with a gestational age of 36+6 wks or more. The denominator is all infants who are still in NMH on the 'date of week 36' or who have been readmitted for the first time to NMH and in whom the events in the hospital to which the infant was transferred have been checked.

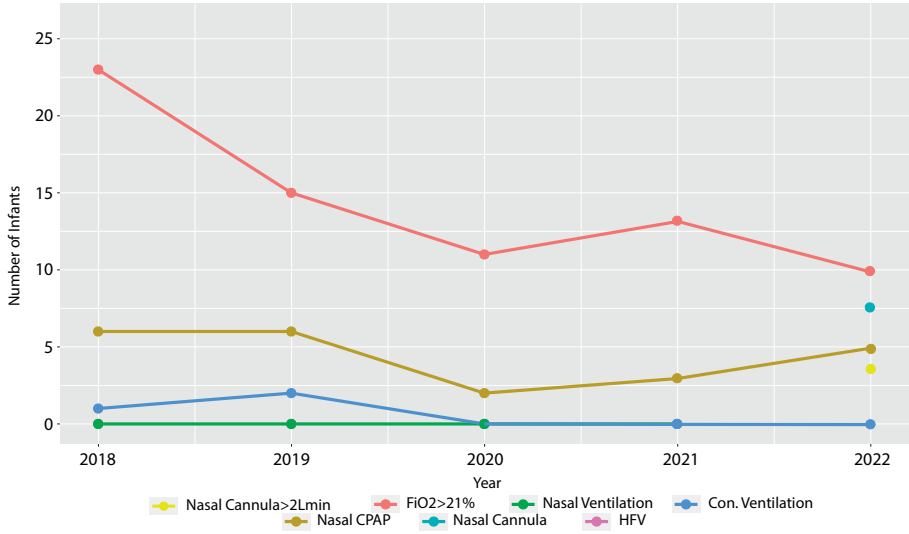
It applies to all infants whose gestational age at birth is ≤ 36+6 wks. If the infant's gestational age is 36+0-36+6 wks, the date of week 36 is the infant's date of birth. If the infant's gestational age is 35+6 wks or less, the gestational age at birth in weeks is subtracted from 36, this number is multiplied by 7, then the infant's gestational age at birth in days is subtracted to calculate the number of days to week 36. The latter number is added to the infant's date of birth.

In 2022, VON commenced reporting the National Institute of Child Health and Human Development (NICHD) BPD grade as determined by the highest mode of respiratory support administered on the Date of Week 36 regardless of prior or current oxygen therapy. If the infant was discharged home between 30+0/7 and 35+6/7, the NICHD BPD grade is determined by the highest mode of respiratory support at discharge.

- Grade 3 is defined as support with invasive mechanical ventilation (conventional or high frequency)
- Grade 2 is defined as support with nasal cannula >2L/min or non-invasive positive airway pressure (CPAP or NIMV)
- Grade 1 is defined as support with nasal cannula ≤2L/min
- None is no support

Only infants whose Gestational Age is equal to 31 wks or less and who are in our centre on the Date of Week 36 or who have been discharged home from our centre between 30+0 and 35+6 wks are included.

4.86 Number of Infants on various modes of Respiratory Support at 36 weeks

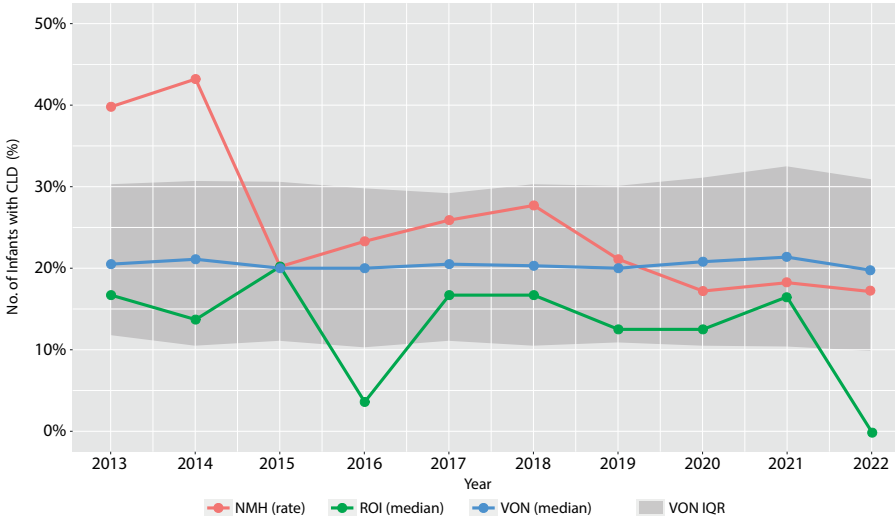


Modes of Respiratory Support	2018	2019	2020	2021	2022
FiO2 > 21%	23	15	11	13	10
Nasal CPAP	6	6	2	3	5
Nasal Ventilation	0	0	0	0	0
Nasal Cannula	N/A	N/A	N/A	N/A	7
Nasal Cannula Flow Rate > 2 L/min	N/A	N/A	N/A	N/A	4
Conventional Ventilation	1	2	0	0	0
HFV	0	0	0	0	0

4.87 Supplemental Oxygen at 36 wks

Gestational Age	2018 (n=63)	2019 (n=54)	2020 (n=42)	2021 (n=51)	2022 (n=37)
< 24 wks	1/1 (100%)	0/2 (0%)	1/1 (100%)	0/0 (0%)	0/0 (0%)
24-26 wks	10/23 (44%)	5/11 (46%)	3/6 (50%)	7/22 (32%)	5/10 (50%)
27-29 wks	8/21 (38%)	8/18 (44%)	7/17 (41%)	4/11 (36%)	5/17 (29%)
30-32 wks	2/12 (17%)	1/13 (8%)	0/13 (0%)	2/13 (15%)	0/7 (0%)
> 32wks	2/6 (33%)	1/10 (10%)	0/5 (0%)	0/5 (0%)	0/3 (0%)
Total	**23/63 (37%)**	**15/54 (28%)**	**11/42 (26%)**	**13/51 (26%)**	**10/37 (27%)**

4.88 Supplemental Oxygen at 36 wks: NMH vs. VON and ROI



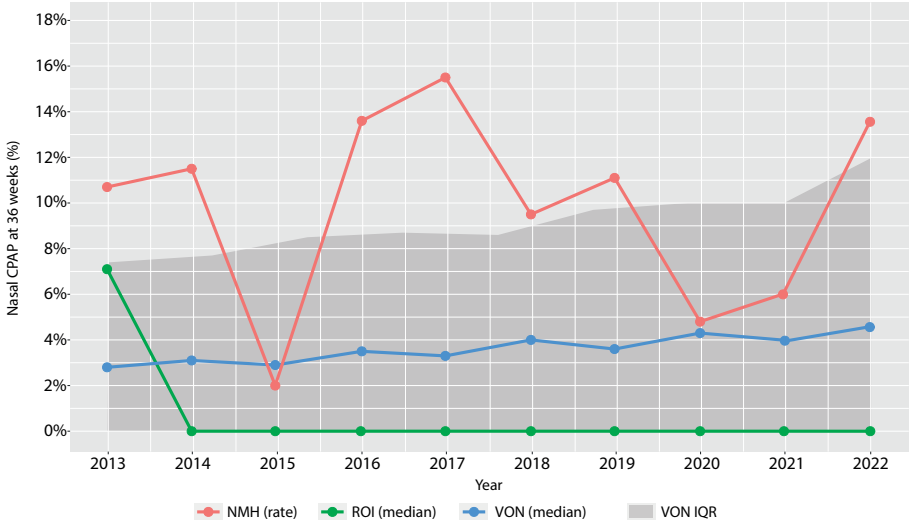
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	61%	56%	31%	39%	45%	37%	28%	26%	26%	27%
VON (rate)	30%	30%	30%	30%	31%	30%	31%	31%	32%	32%
VON (median)	25%	25%	25%	25%	25%	25%	25%	26%	26%	25%
ROI (median)	27%	6%	23%	6%	22%	21%	20%	19%	24%	0%

4.89 Nasal CPAP at 36 wks

Gestational Age	2018 (n=63)	2019 (n=54)	2020 (n=42)	2021 (n=51)	2022 (n=37)
< 24 wks	0/1 (0%)	1/2 (50%)*	0/1 (0%)	0/0 (0%)	0/0 (0%)
24-26 wks	4/23 (17%)*	1/11 (9%)	0/6 (0%)	1/22 (5%)	5/10 (50%)
27-29 wks	2/21 (10%)*	3/18 (17%)*	2/17 (12%)	2/11 (18%)	0/17 (0%)
30-32 wks	0/12 (0%)	1/13 (8%)	0/13 (0%)	0/13 (0%)	0/7 (0%)
> 32wks	0/6 (0%)	0/10 (0%)	0/5 (0%)	0/5 (0%)	0/3 (0%)
Total	**6/63 (10%)**	**6/54 (11%)**	**2/42 (5%)**	**3/51 (6%)**	**5/37 (14%)**

**Implies an infant not on supplementary oxygen at the time*

4.90 Nasal CPAP at 36 wks: NMH vs. VON and ROI



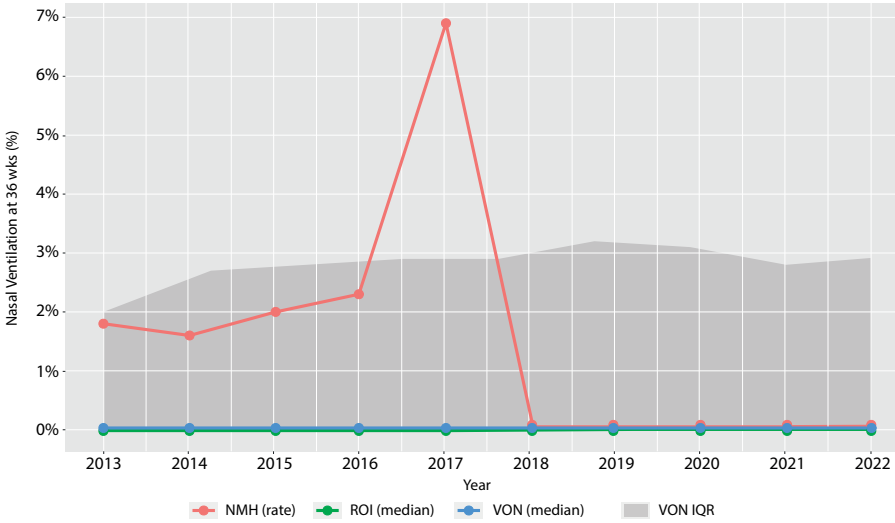
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	11%	12%	2%	14%	16%	10%	11%	5%	6%	14%
VON (rate)	6%	7%	7%	7%	8%	8%	8%	9%	9%	10%
VON (median)	3%	3%	3%	4%	3%	4%	4%	4%	4%	5%
ROI (median)	7%	0%	0%	0%	0%	0%	0%	0%	0%	0%

4.91 Nasal Ventilation at 36 wks

Gestational Age	2018 (n=63)	2019 (n=54)	2020 (n=42)	2021 (n=51)	2022 (n=37)
< 24 wks	0/1 (0%)	0/2 (0%)	0/1 (0%)	0/0 (0%)	0/0 (0%)
24-26 wks	0/23 (0%)	0/11 (0%)	0/6 (0%)	0/22 (0%)	0/10 (0%)
27-29 wks	0/21 (0%)	0/18 (0%)	0/17 (0%)	0/11 (0%)	0/17 (0%)
30-32 wks	0/12 (0%)	0/13 (0%)	0/13 (0%)	0/13 (0%)	0/7 (0%)
> 32wks	0/6 (0%)	0/10 (0%)	0/5 (0%)	0/5 (0%)	0/3 (0%)
Total	**0/63 (0%)**	**0/54 (0%)**	**0/42 (0%)**	**0/51 (0%)**	**0/37 (0%)**

**Implies an infant not on supplementary oxygen at the time*

4.92 Nasal Ventilation at 36 wks: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	2%	2%	2%	2%	7%	0%	0%	0%	0%	0%
VON (rate)	2%	2%	2%	2%	2%	3%	3%	3%	3%	3%
VON (median)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROI (median)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

4.93 Nasal Cannula Flow at 36 wks.

Gestational Age	2022 (n=37)
< 24 wks	0/0 (0%)
24-26 wks	2/10 (20%)
27-29 wks	5/17 (29%)
30-32 wks	0/7 (0%)
> 32wks	0/3 (0%)
Total	**7/37 (19%)**

4.94 Flow Rate of Nasal Cannula > 2L/min at 36 wkss

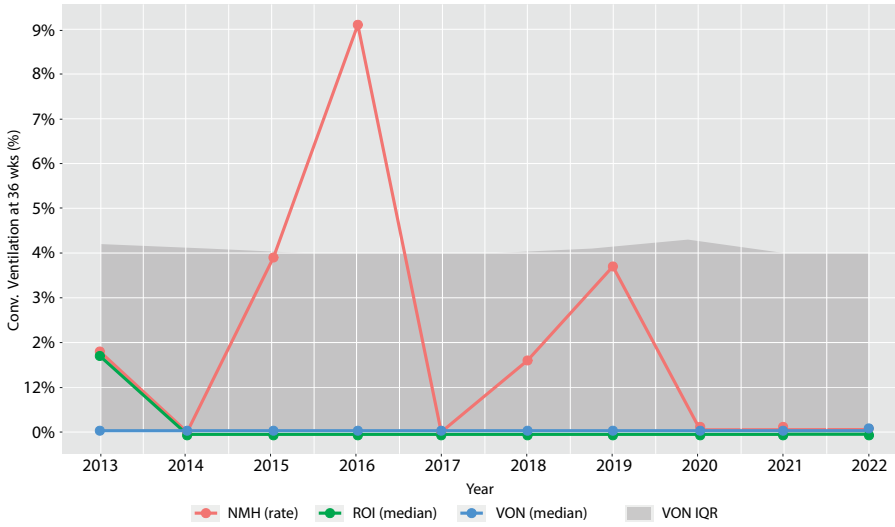
Gestational Age	2022 (n=7)
< 24 wks	0/0 (0%)
24-26 wks	1/2 (50%)
27-29 wks	3/5 (60%)
30-32 wks	0/0 (0%)
> 32wks	0/0 (0%)
Total	**4/7 (57%)**

4.95 Conventional Ventilation at 36 wks

Gestational Age	2018 (n=63)	2019 (n=54)	2020 (n=42)	2021 (n=51)	2022 (n=37)
< 24 wks	0/1 (0%)	0/2 (0%)	0/1 (0%)	0/0 (0%)	0/0 (0%)
24-26 wks	0/23 (0%)	1/11 (9%)	0/6 (0%)	0/22 (0%)	0/10 (0%)
27-29 wks	1/21 (5%)	0/18 (0%)	0/17 (0%)	0/11 (0%)	0/17 (0%)
30-32 wks	0/12 (0%)	0/13 (0%)	0/13 (0%)	0/13 (0%)	0/7 (0%)
> 32wks	0/6 (0%)	1/10 (10%)	0/5 (0%)	0/5 (0%)	0/3 (0%)
Total	**1/63 (2%)**	**2/54 (0%)**	**0/42 (0%)**	**0/51 (0%)**	**0/37 (0%)**

**Implies an infant not on supplementary oxygen at the time*

4.96 Conventional Ventilation at 36 wks: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	2%	0%	4%	9%	0%	2%	4%	0%	0%	0%
VON (rate)	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
VON (median)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROI (median)	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%

4.97 High Frequency Ventilation at 36 wks

Gestational Age	2018 (n=63)	2019 (n=54)	2020 (n=42)	2021 (n=51)	2022 (n=37)
< 24 wks	0/1 (0%)	0/2 (0%)	0/1 (0%)	0/0 (0%)	0/0 (0%)
24-26 wks	0/23 (0%)	0/11 (0%)	0/6 (0%)	0/22 (0%)	0/10 (0%)
27-29 wks	0/21 (0%)	0/18 (0%)	0/17 (0%)	0/11 (0%)	0/17 (0%)
30-32 wks	0/12 (0%)	0/13 (0%)	0/13 (0%)	0/13 (0%)	0/7 (0%)
> 32wks	0/6 (0%)	0/10 (0%)	0/5 (0%)	0/5 (0%)	0/3 (0%)
Total	**0/63 (0%)**	**0/54 (0%)**	**0/42 (0%)**	**0/51 (0%)**	**0/37 (0%)**

**Implies an infant not on supplementary oxygen at the time*

4.98 High Frequency Ventilation at 36 wks: NMH vs. VON and ROI

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
VON (rate)	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
VON (median)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROI (median)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

4.99 NICHD BPD Grade

Gestational Age	No. Of Infants	None	BPD Grade	BPD Grade	BPD Grade	Any Grade of BPD
< 24wks	0	0	0	0	0	0 (0%)
24 wks	1	0	1	0	0	1 (100%)
25 wks	4	2	0	2	0	2 (50%)
26 wks	6	4	0	2	0	2 (33%)
27 wks	2	2	0	0	0	0 (0%)
28 wks	11	7	1	3	0	4 (36%)
29 wks	10	9	1	0	0	1 (10%)
30 wks	4	4	0	0	0	0 (0%)
31 wks	3	3	0	0	0	0 (0%)
Total	**41**	**31 (76%)**	**3 (7%)**	**7 (17%)**	**0 (0%)**	**10 (24%)**

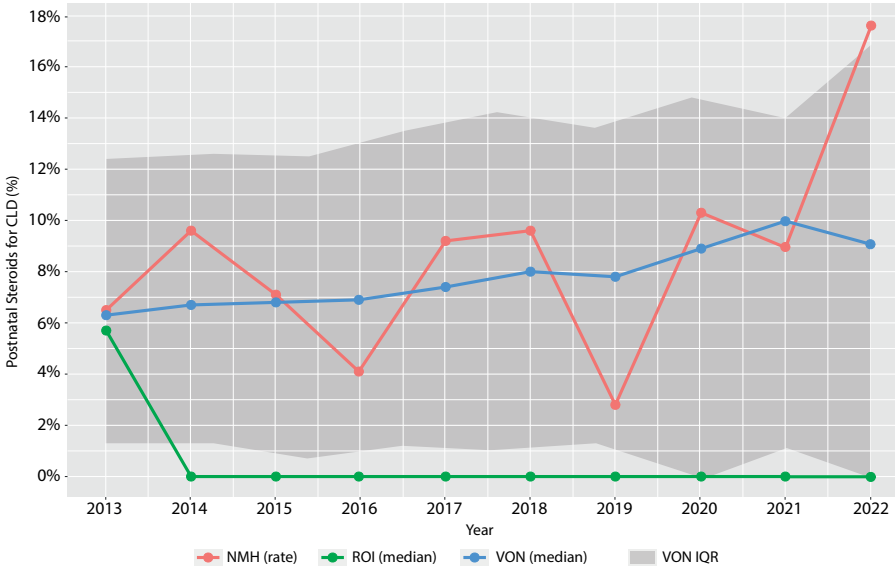
Postnatal Steroids for CLD

VON documents if infants receive systemic corticosteroids after birth to treat or prevent bronchopulmonary dysplasia or chronic lung disease. Inhaled corticosteroids are not considered systemic corticosteroids.

4.100 Postnatal Steroids for Chronic Lung Disease

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	2/4 (50%)	0/5 (0%)	1/5 (20%)	0/7 (0%)	1/4 (25%)
24-26 wks	6/33 (18%)	2/25 (8%)	7/28 (25%)	10/39 (26%)	16/34 (47%)
27-29 wks	3/47 (6%)	1/42 (2%)	4/48 (8%)	1/31 (3%)	2/39 (5%)
30-32 wks	0/23 (0%)	0/25 (0%)	0/31 (0%)	0/31 (0%)	0/27 (0%)
> 32wks	0/8 (0%)	0/11 (0%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**11/115 (10%)**	**3/108 (3%)**	**12/117 (10%)**	**11/114 (10%)**	**19/110 (17%)**

4.101 Postnatal Steroids for CLD: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	7%	10%	8%	4%	9%	10%	3%	10%	9%	17%
VON (rate)	9%	9%	10%	10%	11%	12%	12%	13%	13%	13%
VON (median)	6%	7%	7%	7%	8%	8%	8%	9%	10%	9%
ROI (median)	6%	0%	0%	0%	0%	0%	0%	0%	0%	0%

4.102 Clinical Details of VLBW Infants receiving PNS for CLD

Cases	GA	BW	Day of Life commenced PNS	Day of life completed Postnatal Steroids	Day of life successfully extubated (ie > 48 hrs)	Total length of first course of PNS	DART or other PNS protocol	Subsequent retreatment with PNS required	CLD	Survived to Discharge
1	23	470	D17	D28	D29	11 days	DXM 60mcg/kg x 9 doses, 40mcg/kg x 6 doses, 20mcg/kg x 4 doses, 8mcg/kg x 4 doses.	No	No	Died D32 of Perforated NEC
2	24	610	D18	D25	Infant not ventilated at the time of commencing PNS. On nasal IMV.	7 days	DXM 20mcg/kg x 9 doses, 10mcg/kg x 4 doses	No	Yes	Home D96
3	24	660	D22	D34	D46	12 days	DXM 60mcg/kg x 10 doses, 40mcg/kg x 6 doses, 20mcg/kg x 6 doses, 8mcg/kg x 4 doses	Yes. D44-D49: DXM 60mcg/kg x 6 doses, 40mcg/kg x 6 doses. D/C as transferred to tertariy surgical centre. D58-D66: DXM 60mcg/kg x 6 doses, 40mcg/kg x 6 doses, 20mcg/kg x 4 doses.	Yes	Home D134
4	24	700	D11	D21	D14	10 Days	DXM 60mcg/kg x 6 doses, 40mcg/kg x 6 doses, 20mcg/kg x 4 doses, 8mcg/kg x 4 doses	Yes: D26-D36: DXM 40mcg/kg x 6 doses, 24mcg/kg x 6 doses, 12mcg/kg x 4 doses, 6mcg/kg x 4 doses.	Yes	Home D106
5	24	710	D29	D39	D33	10 days	DXM 25mcg/kg x7 doses, 15mcg/kg x7 doses, 10mcg/kg x 6 doses	No	No	Home D98

Cases	GA	BW	Day of Life commenced PNS	Day of life completed Postnatal Steroids	Day of life successfully extubated (ie > 48 hrs)	Total length of first course of PNS	DART or other PNS protocol	Subsequent retreatment with PNS required	CLD	Survived to Discharge
6	25	590	D26	D28	Infant not ventilated at the time of commencing PNS. On nasal IMV. Died D28.	2 Days	DXM 50mcg/kg x 2 doses. 40mcg/kg x 1 dose	No	No	Died D28 of Imperforate anus with colostomy formation, skeletal abnormalities, complications of extreme prematurity, ELBW, severe RDS.
7*	25	745	D29	D29	Infant not ventilated at the time of commencing PNS. On nasal IMV.	1 day	DXM 25mcg/kg x 2 doses. D/C because of very significant hyperbilirubinaemia	No	Not known	Home D159
8	25	900	D16	D25	Infant not ventilated at time of commencing PNS. Intubated briefly on D17 but extubated on D19.	10 days	DXM 60mcg/kg x 6 doses, 40mcg/kg x 6 doses, 20mcg/kg x 4 doses, 8mcg/kg x 4 doses	No	Yes	Home D108
9	25	900	D19	D33	D24	14 Days	DXM 60mcg/kg x 6 doses, 40mcg/kg x 6 doses, 20mcg x 4 doses, 8mcg/kg x 4 doses, then 20mcg/kg x 4 doses and 8mcg/kg x 4 doses.	Yes. D36-D42: DXM 40mcg/kg x 7 doses, 20mcg/kg x 4 doses, 8mcg/kg x 4 doses.	Yes	Home D117

Cases	GA	BW	Day of Life commenced PNS	Day of life completed Postnatal Steroids	Day of life successfully extubated (ie > 48 hrs)	Total length of first course of PNS	DART or other PNS protocol	Subsequent retreatment with PNS required	CLD	Survived to Discharge
10	25	675	D28	D39	Infant not ventilated at the time of commencing PNS. On nasal IMV.	11 days	DXM 60mcg/kg x 6 doses, 40mcg/kg x 6 doses, 20mcg/kg x 6 doses, 8mcg/kg x 4 doses	No	No	Home D101
11	26	550	D17	D24	Infant not ventilated at the time of commencing PNS. On nasal IMV.	7 Days	DXM 25mcg/kg x 10 doses, 12.5mcg/kg x 5 doses	No	No	Home D98
12	26	590	D7	D10	Remained ventilated until time of death on D55	3 days. DXM discontinued due to perforated NEC	DXM 60mcg/kg x 6 doses, 40mcg/kg X 1 dose.	No	No	Died D55 of severe respiratory failure, NEC, liver dysfunction, extreme prematurity, ELBW, Twin 2, MCDA.
13	26	660	D14	D15	Died D15. Remained ventilated until time of death	1 day	DXM 60mcg/kg x 2 doses	No	No	Died D15 of NEC, extreme prematurity, ELBW, IVH

Cases	GA	BW	Day of Life commenced PNS	Day of life completed Postnatal Steroids	Day of life successfully extubated (ie > 48 hrs)	Total length of first course of PNS	DART or other PNS protocol	Subsequent retreatment with PNS required	CLD	Survived to Discharge
14	26	700	D7	D10	Died D12. Remained ventilated until time of death	3 days. DXM discontinued due to sepsis	Dex 60mcq/kg x 6 doses, 40 mcq/kg x1 dose	No	No	Died D12 of severe RDS, extreme pre-maturity, gram negative sepsis
15	26	705	D12	D26	D22	14 Days	DXM 60mcg/kg x 6 doses, 40mcg/kg x 6 doses, 20mcg x 4 doses, 8mcg/kg x 4 doses, then 50mcg/kg x 2 doses, 25mcg/kg x 3 doses, 20mcg/kg x 4 doses.	Yes. D34 to D44: DXM 60mcg/kg x 6 doses, 40mcg/kg x 6 doses, 20mcg/kg x 4 doses, 8mcg/kg x 4 doses.	Yes	Home D117
16	26	930	D33	D37	Infant not ventilated at the time of commencing PNS. On nasal IMV.	5 days	DXM 25mcg/kg x 7 doses, 12.5 mcg/kg x 4 doses	No	No	Home D87
17	26	945	D13	D23	Infant not ventilated at the time of commencing PNS. On CPAP.	10 Days	DXM 60mcg/kg x 6 doses, 40mcg/kg x 6 doses, 20mcg/kg x 4 doses, 8mcq/kg x 4 doses	Yes. D36-D46. DXM 60mcg/kg x 6 doses, 40 mcg/kg x 6 doses, 20mcg/kg x 4 doses, 8mcg/kg x 4 doses.	No	Home D82

Cases	GA	BW	Day of Life commenced PNS	Day of life completed Postnatal Steroids	Day of life successfully extubated (ie > 48 hrs)	Total length of first course of PNS	DART or other PNS protocol	Subsequent retreatment with PNS required	CLD	Survived to Discharge
18	27	1240	D5	D7	Died D7. Remained ventilated until time of death	2 days	DXM 100mcg/kg x 2 doses, 80mcg/kg x 2 doses	No	No	Died D7 of Pulmonary hypoplasia, pumonary hypertension, urinary tract anomaly, bilateral hydroureteronephrosis, prematurity, VLBW.
19	28	990	D13	D24	Infant not ventilated at the time of commencing PNS. On CPAP.	11 days	DXM 60mcg/kg x 8 doses, 40mcg/kg x 6 doses, 20mcg/kg x 4 doses, 8mcg/kg x 4 doses	No	Yes	Home D79

**Indicates an outborn infant*

**Note: the DART protocol used in NMH in 2022 was DXM base 60mcg/kg for 6 doses, 40 mcg/kg for 6 doses, 20mcg/kg for 4 doses and 8mcg/kg for 4 doses giving a cumulative dose of 0.75mg/kg of DXM Base*

Other Important Outcomes

Persistent Ductus Arteriosus (PDA)

A PDA is defined by VON as:

A. At least one of the following is present:
- Left to right or bidirectional ductal shunt on Doppler ECHO
- Systolic or continuous murmur

and

B. At least two of the following are present:
- Hyperdynamic precordium
- Bounding pulses
- Wide pulse pressure
- Pulmonary vascular congestion, cardiomegaly or both.

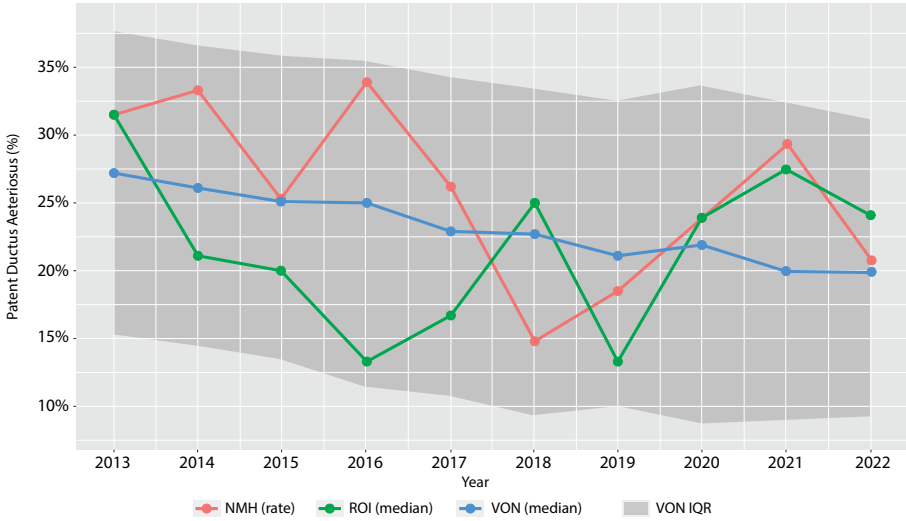
The denominator is all infants admitted to the NICU and so DR deaths are excluded.

VON has collected information on the use of ibuprofen either for the prevention or treatment of a PDA since 2008. Ibuprofen use other than for the prevention or treatment of a PDA is not included. From 2018, VON now collects data on the use of acetaminophen for the prevention or treatment of a PDA. Our NICU switched to prescribing Ibuprofen (which is a licensed product in Europe) for the treatment of a PDA in 2005. More recently, our NICU has prescribed acetaminophen. Both drugs are generally used as treatment agents and not as preventative agents. Indomethacin is rarely used in our unit either as a prophylactic agent to prevent severe IVH or as a treatment for a PDA.

4.103 PDA

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	1/4 (25%)	3/5 (60%)	1/5 (20%)	0/7 (0%)	2/4 (50%)
24-26 wks	11/33 (33%)	12/25 (48%)	13/28 (46%)	19/39 (49%)	14/34 (41%)
27-29 wks	3/47 (6%)	5/42 (12%)	13/48 (27%)	12/31 (39%)	5/39 (13%)
30-32 wks	2/23 (9%)	0/25 (0%)	0/31 (0%)	1/31 (3%)	0/27 (0%)
> 32wks	0/8 (0%)	0/11 (0%)	1/5 (20%)	1/6 (17%)	2/6 (33%)
Total	**17/115 (15%)**	**20/108 (19%)**	**28/117 (24%)**	**33/114 (29%)**	**23/110 (21%)**

4.104 Patent Ductus Arteriosus: NMH vs. VON and ROI

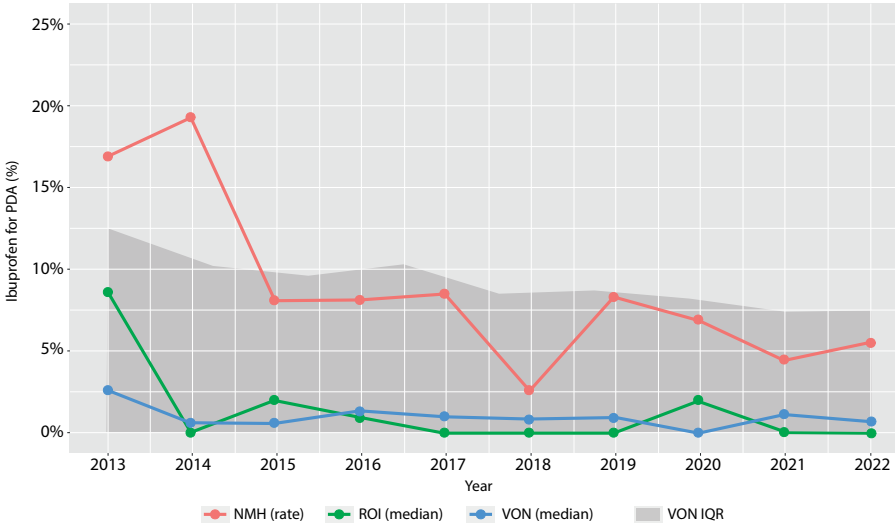


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	32%	33%	25%	34%	26%	15%	19%	24%	29%	21%
VON (rate)	29%	29%	29%	27%	26%	25%	24%	25%	24%	24%
VON (median)	27%	26%	25%	25%	23%	23%	21%	22%	20%	20%
ROI (median)	32%	21%	20%	13%	17%	25%	13%	24%	27%	23%

4.105 Ibuprofen for a PDA

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	1/4 (25%)	2/5 (40%)	0/5 (0%)	0/7 (0%)	1/4 (25%)
24-26 wks	1/33 (3%)	6/25 (24%)	4/28 (14%)	4/39 (10%)	5/34 (15%)
27-29 wks	1/47 (2%)	1/42 (2%)	4/48 (8%)	1/31 (3%)	0/39 (0%)
30-32 wks	0/23 (0%)	0/25 (0%)	0/31 (0%)	0/31 (0%)	0/27 (0%)
> 32wks	0/8 (0%)	0/11 (0%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**3/115 (3%)**	**9/108 (8%)**	**8/117 (7%)**	**5/114 (4%)**	**6/110 (5%)**

4.106 Use of Ibuprofen in VLBW Infants: NMH vs. VON and ROI

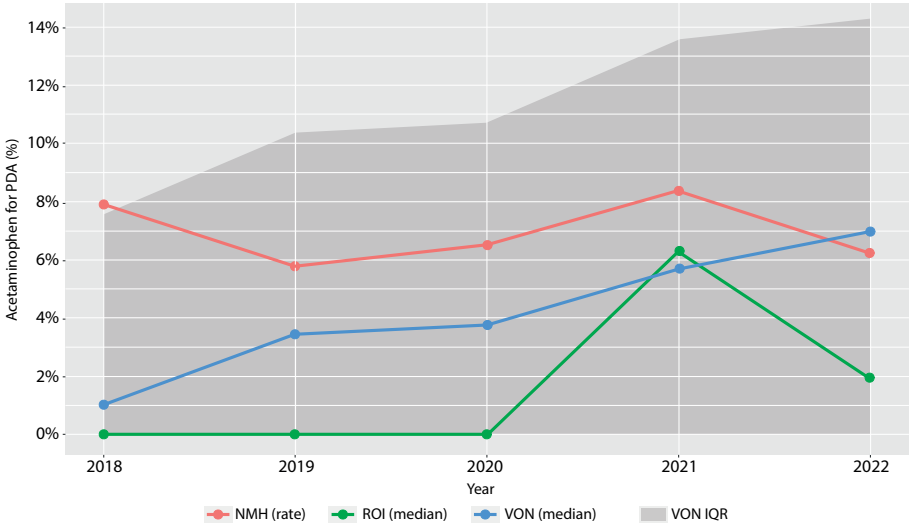


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	17%	19%	8%	8%	9%	3%	8%	7%	4%	6%
VON (rate)	8%	7%	7%	7%	6%	6%	6%	6%	6%	6%
VON (median)	3%	1%	1%	1%	1%	1%	1%	1%	1%	1%
ROI (median)	9%	0%	2%	1%	0%	0%	0%	2%	0%	0%

4.107 Acetaminophen for a PDA

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24wks	1 / 4 (25%)	1/5 (20%)	0/5 (0%)	0/7 (0%)	1/4 (25%)
24-26wks	7/33 (21%)	5/25 (20%)	3/28 (11%)	8/39 (21%)	6/34 (18%)
27-29wks	1/47 (2%)	0/42 (0%)	5/48 (10%)	2/31 (7%)	0/39 (0%)
30-32wks	0/23 (0%)	0/25 (0%)	0/31 (0%)	0/31 (0%)	0/27 (0%)
>32wks	0/8 (0%)	0/11 90%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**9/115 (8%)**	**6/108 (6%)**	**8/117 (7%)**	**10/114 (9%)**	**7/110 (6%)**

4.108 Use of Acetaminophen in VLBW Infants: NMH vs. VON and ROI



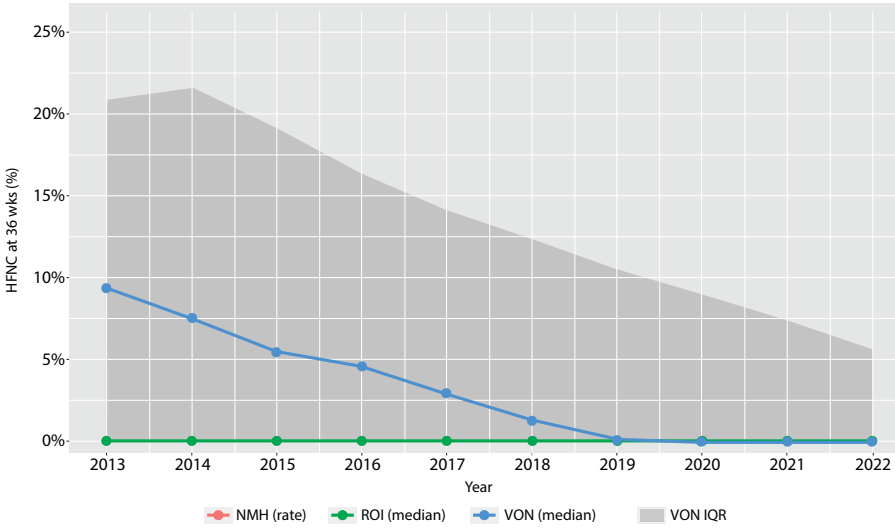
Year	2018	2019	2020	2021	2022
NMH (rate)	8%	6%	7%	9%	6%
VON (rate)	6%	7%	8%	9%	11%
VON (median)	1%	3%	3%	6%	7%
ROI (median)	0%	0%	0%	6%	2%

4.109 Ibuprofen or Acetaminophen for a PDA based on a Diagnosis of a PDA

Gestational Age	2018 (n=17)	2019 (n=20)	2020 (n=28)	2021 (n=33)	2022 (n=23)
< 24wks	1/1 (100%)*	2/3 (66%)*	0/1 (0%)	0/0 (0%)	2/2 (100%)
24-26wks	8/11 (73%)	9/12 (75%)**	7/13 (54%)	11/19 (58%)*	8/14 (57%)***
27-29wks	2/3 (67%)	1/5 (20%)	8/13 (62%)*	3/12 (25%)	0/5 (0%)
30-32wks	0/2 (0%)	0/0 (0%)	0/0 (0%)	0/1 (0%)	0/0 (0%)
>32wks	0/0 (0%)	0/0 (0%)	0/1 (0%)	0/1 (0%)	0/2 (0%)
Total	**11/17 (65%)**	**12/20 (60%)**	**15/28 (54%)**	**14/33 (42%)**	**10/23 (43%)**

**Implies an infant who received both ibuprofen and acetaminophen for treatment of a PDA.*

4.110 Use of Indomethacin in VLBW Infants: NMH vs. VON and ROI

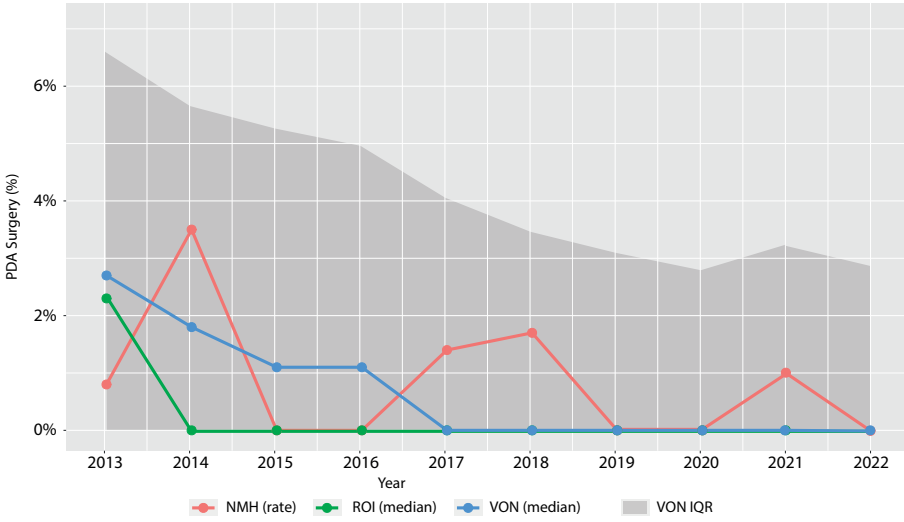


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
VON (rate)	15%	15%	14%	13%	11%	10%	9%	8%	8%	6%
VON (median)	9%	7%	6%	5%	3%	1%	0%	0%	0%	0%
ROI (median)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

4.111 Surgical Intervention for a PDA

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	0/4 (0%)	0/5 (0%)	0/5 (0%)	0/7 (0%)	0/4 (0%)
24-26 wks	1/33 (3%)	0/25 (0%)	0/28 (0%)	0/39 (0%)	0/34 (0%)
27-29 wks	1/47 (2%)	0/42 (0%)	0/48 (0%)	1/31 (3%)	0/39 (0%)
30-32 wks	0/23 (0%)	0/25 (0%)	0/31 (0%)	0/31 (0%)	0/27 (0%)
> 32wks	0/8 (0%)	0/11 (0%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**2/115 (2%)**	**0/108 (0%)**	**0/117 (0%)**	**1/114 (1%)**	**0/110 (0%)**

4.112 Surgical Intervention for a PDA: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	1%	4%	0%	0%	1%	2%	0%	0%	1%	0%
VON (rate)	5%	5%	4%	4%	3%	3%	3%	3%	3%	3%
VON (median)	3%	2%	1%	1%	0%	0%	0%	0%	0%	0%
ROI (median)	2%	0%	0%	0%	0%	0%	0%	0%	0%	0%

4.113 Clinical Details of VLBW Infants undergoing a PDA ligation

Cases	GA	BW	Day of life at time of PDA ligation	Still requiring ventilation at time of PDA ligation	Day of life successfully extubated (i.e. extubated >48 hrs) post PDA ligation	Received Postnatal Steroids for CLD	Timing of PNS course	Pertinent Clinical Details	Survived to discharge
No cases to report									

Necrotising Enterocolitis (NEC)

VON defines an infant as having NEC if there is surgical or post-mortem evidence of NEC or if the following criteria are met clinically and radiologically.

A. One or more of the following clinical signs present:
1. Bilious gastric aspirate or emesis
2. Abdominal distension
3. Occult or gross blood in stool (no fissure)

and

B. One or more of the following radiographic findings present:
1. Pneumatosis intestinalis
2. Hepato-bilary gas
3. Pneumoperitoneum

The denominator only includes infants admitted to the unit. Consultant paediatric surgeons attend our NICU, if required, to place an intraperitoneal drain. However, any definitive surgical procedure such as a laparotomy and/or a bowel resection cannot be performed on site and requires the infant to be transferred to one of two nearby tertiary neonatal surgical centres.

4.114 NEC

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	2/4 (50%)	0/5 (0%)	0/5 (0%)	0/7 (0%)	2/4 (50%)
24-26 wks	2/33 (6%)	0/25 (0%)	2/28 (7%)	5/39 (13%)	3/34 (9%)
27-29 wks	1/47 (2%)	0/42 (0%)	0/48 (0%)	3/31 (10%)	1/39 (3%)
30-32 wks	1/23 (4%)	0/25 (0%)	2/31 (7%)	1/31 (3%)	1/27 (4%)
> 32wks	0/8 (0%)	0/11 (0%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**6/115 (5%)**	**0/108 (0%)**	**4/117 (3%)**	**9/114 (8%)**	**7/110 (6%)**

4.115 NEC requiring surgical intervention (to include bowel resection, laparotomy, intraperitoneal drain)

Gestational Age	2018 (n=6)	2019 (n=0)	2020 (n=4)	2021 (n=9)	2022 (n=7)
< 24wks	1/2 (50%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	1/2 (50%)
24-26wks	0/2 (0%)	0/0 (0%)	2/2 (100%)	5/5 (100%)	2/3 (67%)
27-29wks	1/1 (100%)	0/0 (0%)	0/0 (0%)	2/3 (67%)	1/1 (100%)
30-32wks	0/1 (0%)	0/0 (0%)	2/2 (100%)	1/1 (100%)	1/1 (100%)
>32wks	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)
Total	**2/6 (33%)**	**0/0 (0%)**	**4/4 (100%)**	**8/9 (89%)**	**5/7 (71%)**

**Please note: this table only includes cases of NEC reported by NMH toVON. However, all surgical interventions are included even if the surgical procedure is not reported by NMH toVON*

4.116 Clinical Details of VLBW Infants with NEC

Cases	GA	BW	Multiple	Day of life at time of diagnosis of NEC	Grade of NEC	Surgical Intervention	Date of Intervention	Place of Intervention	Pertinent Clinical Details
1	23	470	Singleton	D32	Advanced (perforation). Extubated to CPAP on D29 after a course of postnatal steroids. The infant had been tolerating full feeds for over 2 weeks. Acute deterioration on D32 requiring reintubation. PFA confirmed diffuse pneumatosis and pneumoperitoneum. Both sides of abdomen needled and free air obtained. Unable to ventilate. Abdomen becoming more distended and discoloured. Died D32 of fulminant NEC.	No			Died D32 of Perforated NEC
2	23	560	Singleton	D8	Advanced (perforated). Abdominal distention noted D5 but abdomen was soft to palpation. PFA: non-specific bowel gas pattern with a paucity of bowel loops seen. Feeds were continued. Worsening abdominal distension noted D7. PFA confirmed pneumoperitoneum. NPO. Already on IV antibiotics but coverage broadened. Penrose drained placed D7. Became progressively unwell with high ventilatory requirements and severe hypotension unresponsive to multiple inotropes. Palliative care provided. Died D8.	Yes (reported to VON)	Penrose Drain placed D7	NICU	Died D8 of intestinal perforation, suspected NEC, extreme prematurity, ELBW

Cases	GA	BW	Multiple	Day of life at time of diagnosis of NEC	Grade of NEC	Surgical Intervention	Date of Intervention	Place of Intervention	Pertinent Clinical Details
3	24	660	Singleton	D7	Advanced (perforated). CXR on D7 (to confirm placement of a PICC line) noted a pneumoperitoneum. NPO. IV antibiotics. Transferred to tertiary surgical centre on D7. Findings at surgery confirmed a small area of NEC. Bowel resection (4cms in all) with loop Ileostomy performed on D8. Readmitted to NMH on D13. Worked back up to full feeds. Neonatal course complicated on D50 by prolapse of the stoma requiring transfer back to the tertiary surgical centre. The infant underwent a resection of the ischaemic loop with refashioning of the ileostomy and the mucous fistula. Readmitted to NMH on D54 but subsequently transferred back to the tertiary surgical centre on D97 because of a further bowel prolapse at the ileostomy site. The infant underwent a re-anastomosis in the tertiary surgical centre on D99 and was discharged home from there on D134.	Yes (reported to VON)	Bowel resection (4cms) and ileostomy on D8.	Tertiary Paediatric Centre	Discharged home D134

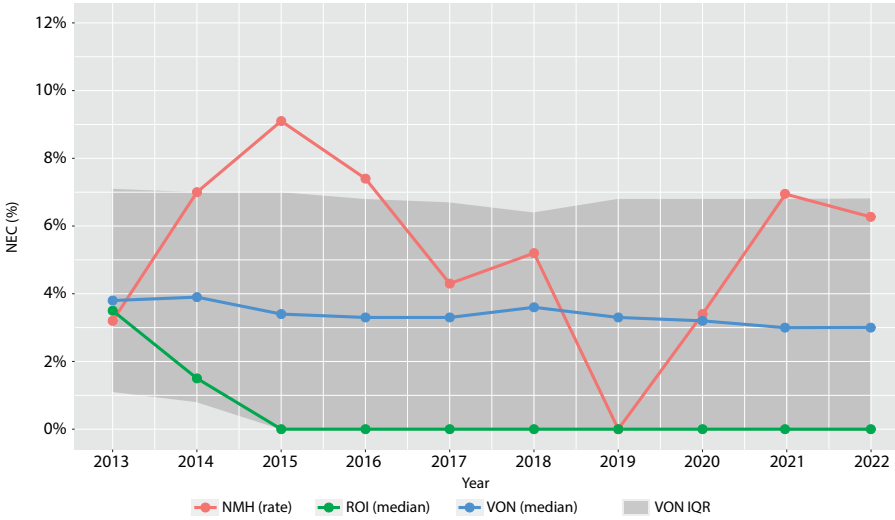
Cases	GA	BW	Multiple	Day of life at time of diagnosis of NEC	Grade of NEC	Surgical Intervention	Date of Intervention	Place of Intervention	Pertinent Clinical Details
4*	25	700	Singleton	D42	Pneumatosis. No perforation. Developed abdominal distention with bilious aspirates on D42. NPO. IV antibiotics x 7 days. PFA with pneumatosis. Feeds reintroduced but the infant developed further bilious aspirates and abdominal distention. Feeds held again on D54. PFA: interval development of marked bowel distension and some areas suspicious for pneumatosis. NPO and IV antibiotics for a further 10 days. PFA repeated prior to restarting feeds reported a few markedly dilated loops of bowel in the upper abdomen raising a concern for obstruction. Infant transferred on D67 for a surgical opinion. Managed conservatively in the tertiary surgical centre. A contrast enema noted diffusely mild-moderately dilated large bowel without a mucosal abnormality or transition point. Appearances were suggestive of dysmotility or a functional dilatation of the colon. There was no mechanical bowel obstruction or stricture noted. The infant was commenced on regular bowel washouts and feeds were reintroduced and tolerated. A rectal suction biospy for Hirshsprung's disease was negative. He was discharged home directly for the tertiary surgical centre on D104	No			Discharged home D142

Cases	GA	BW	Multiple	Day of life at time of diagnosis of NEC	Grade of NEC	Surgical Intervention	Date of Intervention	Place of Intervention	Pertinent Clinical Details
5	26	590	Twin 2	D11	Advanced (perforated). Ventilated from birth. E. coli sepsis on D9. NPO and IV antibiotics. Acute deterioration on D11 with abdominal distention. PFA with pneumoperitoneum. Penrose drain placed. Subsequent PFAs with non-specific lucencies in right lower quadrant suspicious of but not definitive for pneumatosis. No clinical improvement over the next 48 hours and so infant was transferred to tertiary surgical centre on D13. Exploratory laparotomy on D14 confirmed a NEC mass. Resection of 7 cms of proximal small bowel and an enterostomy/mucous fistula was created. Readmitted to NMH on D15. Unable to work up on oral feeds due to recurrent abdominal distention, poor stoma output and persistent thrombocytopaenia. Progressive deterioration in respiratory status. Too unstable to be transferred back to tertiary surgical centre for further assessment. Died D51 of severe respiratory failure.	Yes (reported to VON)	Penrose Drain D11. Bowel resection with enterostomy on D14	NICU and Tertiary Paediatric Centre	Died D55 of severe respiratory failure, NEC, liver dysfunction, extreme prematurity, ELBW, Twin 2, MCDA.
6	28	1470	Twin 1	D26	Pneumatosis. No perforation. Tolerating full feeds on D26. Developed abdominal distention with bilious aspirates. NPO. IV antibiotics. Intubated. PFA with pneumatosis. Despite medical management, the infant remained unwell. Ventilated with persistent bilious aspirates, abdominal distention and thrombocytoapaenia. Transferred D32 to tertiary surgical centre for ongoing care. NEC confirmed at surgery on D33. Bowel resection (50cms) and ileostomy.	Yes (not reported to VON)	Bowel resection (50cms) and ileostomy on D33	Tertiary Paediatric Centre	Discharged home D99

Cases	GA	BW	Multiple	Day of life at time of diagnosis of NEC	Grade of NEC	Surgical Intervention	Date of Intervention	Place of Intervention	Pertinent Clinical Details
7	32	1440	Twin 2	D8	Pneumatosis. Abdominal distension with bilious aspirates on D8. Feeds held and reintroduced 36 hrs later. Still with persistent aspirates. PFA suggestive of pneumatosis. Made NPO and treated with IV antibiotics for 10 days. Feeds reintroduced but abdomen remained distended with dilated loops of bowel visible on PFA. Contrast enema on D25 with no colonic stricture but dilated loops of small bowel seen. Upper GI contrast study on D27 with multiple dilated gas-filled bowel loops raising the possibility of a distal small bowel stricture. Transferred to tertiary surgical centre on D28. Underwent 2 stricturoplasties (D30 and D61) but then required a resection of a post-NEC stricture and an ileostomy on D85. Discharged home from tertiary surgical centre.	Yes (not reported to VON)	Two stricturoplasty operations on D30 and D61 initially followed by a resection of the post-NEC stricture and an ileostomy on D85	Tertiary Paediatric Centre	Discharged home D145

**Indicates outborn baby*

4.117 NEC: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	3%	7%	9%	7%	4%	5%	0%	3%	8%	6%
VON (rate)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
VON (median)	4%	4%	3%	3%	3%	4%	3%	3%	3%	3%
ROI (median)	4%	2%	0%	0%	0%	0%	0%	0%	0%	0%

4.118 Shrunken and Composite Shrunken SMRs for NEC for NMH

Year	Shrunken SMR with 95% CI	Years	Composite Shrunken SMR with 95% CI
2018	1.0 (0.5-1.7)	2016-2018	1.1 (0.7-1.6)
2019	0.3 (0.1-0.9)*	2017-2019	0.7 (0.4-1.1)
2020	0.8 (0.3-1.5)	2018-2020	0.7 (0.4-1.1)
2021	1.3 (0.6-2.1)	2019-2021	0.8 (0.4-1.2)
2022	0.9 (0.4-1.7)	2020-2022	1.0 (0.6-1.5)

**Lower and upper bounds of Confidence Interval (CI) does not include 1.0*

4.119 NEC Associated Mortality Rates

Year	2018	2019	2020	2021	2022
Overall Mortality Rate for NEC	2/6 (33%)	0/0 (0%)	3/4 (75%)	3/9 (33%)	3/7 (43%)
Mortality Rate for medically treated NEC	1 /4 (25%)	0/0 (0%)	0/0 (0%)	1/1 (100%)	1/2 (50%)
Mortality Rate for surgically treated NEC	1 /2 (50%)	0/0 (0%)	3/4 (75%)	2/8 (25%)	2/5 (40%)

Please note: this table only includes cases of NEC reported by NMH to VON. However, all surgical interventions are included even if the surgical procedure is not reported by NMH to VON.

Spontaneous GI Perforation

VON reports cases of spontaneous GI perforation. Prior to 2022, the diagnosis was based on a visual inspection of the bowel at the time of surgery or post-mortem examination that demonstrates a single focal perforation with the remainder of the bowel appearing normal. To satisfy this criterion, the infant must have undergone surgery or post-mortem examination. In 2022, VON introduced a new data item of "Surgically Confirmed or Clinically Diagnosed Focal Intestinal Perforation". There are 2 possible options, namely "surgically confirmed" or "clinically diagnosed". For a case to meet the surgically confirmed diagnosis, the infant must have a focal intestinal perforation separate from necrotising enterocolitis. The diagnosis is based on visual inspection of the bowel at the time of surgery or post-mortem examination that demonstrates a single focal perforation with the remainder of the bowel appearing normal. For a case to meet the clinical diagnosis, the answer to the Necrotising Enterocolitis data item must be "No", the bowel was not visualised at surgery or post-mortem and a diagnosis of focal intestinal perforation is recorded in the infant's medical record. It should be noted that if the infant satisfies the definition of NEC for that episode, the infant should be coded as having NEC and not a focal intestinal perforation.

4.120 Spontaneous GI Perforation

No.of Cases	2014	2015	2016	2017	2018	2019	2020	2021	2022
Surgical Confirmed Cases	0	0	1	0	1	0	0	2	0
Clinically Suspected Cases	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1

4.121 Clinical Details of VLBW Infants with Spontaneous GI perforation

Cases	GA	BW	Multiple	Day of life at time of diagnosis of GI perforation	Clinical course	Surgical Intervention	Date of Intervention	Place of Intervention	Pertinent Clinical Details
1	26	935	Triplet 1	D4	Advanced (perforated). Remained ventilated on D3. Cranial ultrasound that day confirmed bilateral Grade 4 IVHs. Oral feeds advancing. Abdomen noted to be distended on D4. PFA confirmed a pneumoperitoneum. Clinical impression was of a spontaneous GI perforation. Palliative care provided. Died D4.	No			Died D4 of grade IV IVH, clincially suspected spontaneous GI perforation, exteme prematurity, triplet pregnancy.

Intraventricular Haemorrhage (IVH)

All infants ≤1500g and ≤32 wks gestation in our NICU undergo routine ultrasound screening for IVH. This generally occurs between D1 and D3, again at D7-D10, and pre-discharge. If an abnormality is found, screening occurs more frequently, often once or twice weekly. The denominator for these tables is the number of infants who had cranial imaging (ultrasound, CT or MRI) performed on or before day 28 of life.

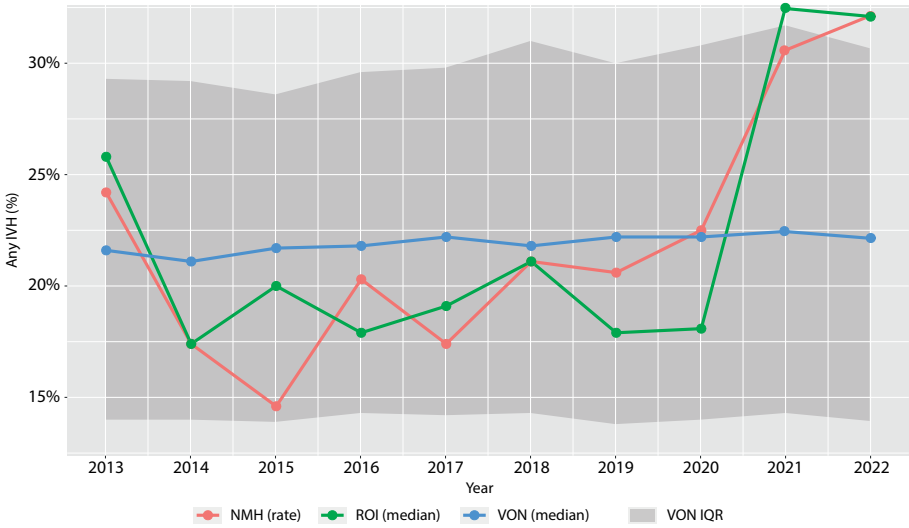
4.122 IVH

Gestational Age	Admissions	No IVH	Grade 1	Grade 2	Grade 3	Grade 4	Unknown (no cranial imaging performed)
< 24wks	4	0	1	0	1	2	0
24-26wks	34	15	12	0	0	3	4
27-29wks	39	27	5	3	1	2	1
30-32wks	27	23	1	3	0	0	0
>32wks	6	4	0	0	0	0	2
Total	**110**	**69**	**19**	**6**	**2**	**7**	**7**

4.123 Intraventricular Haemorrhage (Any Degree)

Gestational Age	2018 (n=109)	2019 (n=102)	2020 (n=111)	2021 (n=103)	2022 (n=103)
< 24 wks	3/4 (75%)	2/4 (50%)	1/3 (33%)	4/6 (67%)	4/4 (100%)
24–26 wks	11/31 (36%)	7/25 (28%)	11/27 (41%)	19/36 (53%)	15/30 (50%)
27–29 wks	7/46 (15%)	6/41 (15%)	12/47 (26%)	8/31 (26%)	11/38 (29%)
30–32 wks	2/22 (9%)	4/22 (18%)	1/29 (3%)	1/25 (4%)	4/27 (15%)
> 32wks	0/6 (0%)	2/10 (20%)	0/5 (0%)	0/5 (0%)	0/4 (0%)
Total	**23/109 (21%)**	**21/102 (21%)**	**25/111 (23%)**	**32/103 (31%)**	**34/103 (33%)**

4.124 IVH (Any Degree): NMH vs. VON and ROI

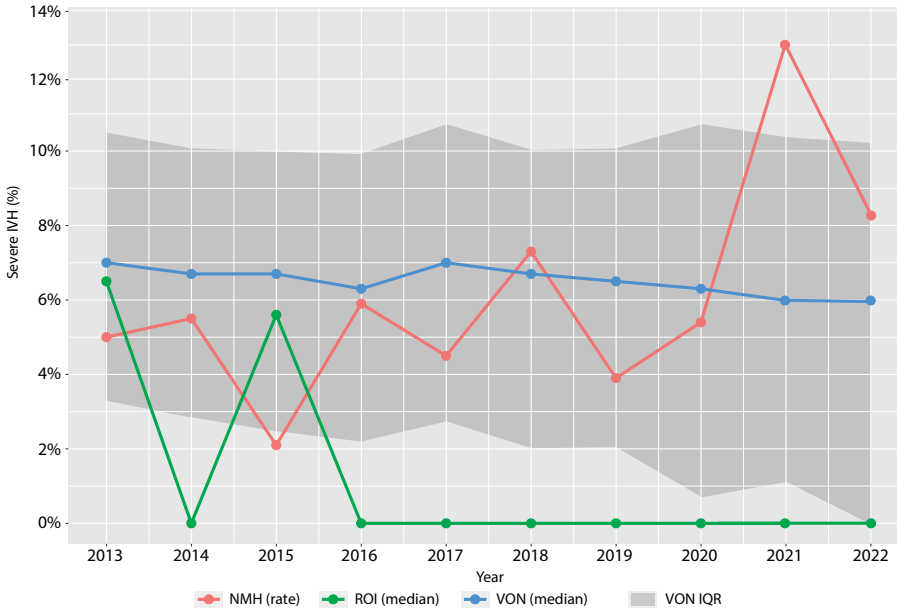


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	24%	17%	15%	20%	17%	21%	21%	23%	31%	33%
VON (rate)	24%	24%	25%	25%	26%	26%	26%	27%	27%	27%
VON (median)	22%	21%	22%	22%	22%	22%	22%	22%	23%	22%
ROI (median)	26%	17%	20%	18%	19%	21%	18%	18%	33%	33%

4.125 Severe Intraventricular Haemorrhage (Grade 3 IVH or more)

Gestational Age	2018 (n=109)	2019 (n=102)	2020 (n=111)	2021 (n=103)	2022 (n=103)
< 24 wks	2/4 (50%)	0/4 (0%)	1/3 (33%)	3/6 (50%)	3/4 (75%)
24-26 wks	4/31 (13%)	3/25 (12%)	4/27 (15%)	9/36 (25%)	3/30 (10%)
27-29 wks	2/46 (4%)	1/41 (2%)	1/47 (2%)	1/32 (3%)	3/38 (8%)
30-32 wks	0/22 (0%)	0/22 (0%)	0/29 (0%)	0/25 (0%)	0/27 (0%)
> 32wks	0/6 (0%)	0/10 (0%)	0/5 (0%)	0/5 (0%)	0/4 (0%)
Total	**8/109 (7%)**	**4/102 (4%)**	**6/111 (5%)**	**13/103 (13%)**	**9/103 (9%)**

4.126 Severe IVH: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	5%	6%	2%	6%	5%	7%	4%	5%	13%	9%
VON (rate)	8%	8%	8%	8%	8%	8%	8%	8%	8%	8%
VON (median)	7%	7%	7%	6%	7%	7%	7%	6%	6%	6%
ROI (median)	7%	0%	6%	0%	0%	0%	0%	0%	0%	0%

4.127 Shrunken and Composite Shrunken SMRs for IVH for NMH

Year	Shrunken SMR for IVH (any degree) with 95% CI	Years	Composite Shrunken SMR for IVH (any degree) with 95% CI	Year	Shrunken SMR for Severe IVH with 95% CI	Years	Composite Shrunken SMR for Severe IVH with 95% CI
2018	0.8 (0.6-1.1)	**2016-2018**	0.8 (0.6-1.0)	**2018**	0.9 (0.6-1.4)	**2016-2018**	0.8 (0.6-1.2)
2019	0.9 (0.6-1.2)	**2017-2019**	0.8 (0.6-1.0)	**2019**	0.9 (0.5-1.3)	**2017-2019**	0.8 (0.6-1.1)
2020	0.9 (0.6-1.2)	**2018-2020**	0.8 (0.6-1.0)	**2020**	0.9 (0.5-1.4)	**2018-2020**	0.8 (0.5-1.2)
2021	1.1 (0.6-1.4)	**2019-2021**	0.9 (0.7-1.1)	**2021**	1.2 (0.8-1.8)	**2019-2021**	1.0 (0.7-1.4)
2022	1.1 (0.8-1.5)	**2020-2022**	1.0 (0.8-1.3)	**2022**	1.0 (0.6-1.4)	**2020-2022**	1.1 (0.8-1.5)

**Lower and upper bounds of Confidence Interval (CI) does not include 1.0*

4.128 Outcome of Infants diagnosed with severe IVH including the development of Progressive Ventricular Dilatation (PVD)

Cases	GA	BW	Location of Birth	Ultrasound Findings	PVD documented	Outcome
1	23	470	Inborn	Grade 4 IVH on Left.	No	Died D32 of perforated NEC
2	23	555	Inborn	Grade 2 IVH on Right. Grade 3 IVH on Left.	No	Died D5 of E. Coli sepsis, extreme prematurity, severe RDS, clinical chorioamnionitis, PPROM x 2 days
3	23	740	Inborn	Grade 4 IVH on Right. Grade 3 IVH on Left.	No	Died D4 of Grade IV IVH, complications of extreme prematurity
4	26	450	Inborn	Grade 4 IVH on Left.	No	Died D10 of Gram negative sepsis, extreme prematurity, ELBW, severe RDs, seizures
5	26	660	Inborn	Grade 2 IVH on Right. Grade 4 IVH on Left.	No	Died D15 of NEC, extreme prematurity, EBW, IVH
6	26	935	Inborn	Bilateral Grade 4 IVH.	No	Died D4 of Grade IV IVH, extreme prematurity, triplet pregnancy
7	28	1395	Inborn	Grade 1 IVH on Right. Grade 4 IVH on Left.	No	Home D75
8	28	1470	Inborn	Grade 3 IVH on Left.	Yes but stabilised without the need for intervention	Home D99
9	29	1200	Inborn	Grade 4 IVH on Left.	No	Home D54

4.129 Neurosurgical Procedures for Progressive Ventricular Dilatation after Severe IVH

Year	2018	2019	2020	2021	2022
Infants with severe IVH	8	4	6	13	9
Infants who died prior to discharge	5	3	3	8	6
Infants requiring neurosurgical procedures	0	0	0	0	0
Infants who had serial LPs +/- ventricular taps prior to a neurosurgical intervention	0	0	0	0	0
No. of infants with VADs* placed	0	0	0	0	0
Infants with VP shunts placed	0	0	0	0	0

**VAD (Ventricular Access Device)*

4.130 Neurodevelopmental Outcome at 2 years Corrected Gestational Age of VLBW Infants born in 2020 who sustained a severe IVH

Cases	Ultrasound Findings	PVD Documented	Outcome
23 wks, 620g, Inborn	Grade 3 IVH on Right Grade 4 IVH on Left.	No	Died D8
24 wks, 490g, Inborn	Grade 2 IVH on Right Grade 4 IVH on Left.	No	Died D7
25 wks, 985g, Inborn	Bilateral Grade 4 IVH.	Yes but stabilised without the need for intervention	Cognitive score 105, Language score 89, Motor score 79. (Category 3)
26 wks, 995g, Inborn	Grade 4 IVH on Left.	No	Cognitive score 100, Language score 83, Motor score 94. (Category 4: Normal Assessment)
26 wks, 1000g, Outborn	Grade 2 IVH on Right. Grade 4 IVH on Left. Subtle signal abnormality reported within the subependymal white matter on the right side and within the right cerebellar hemisphere suggesting parenchymal injury.	No	Died D6
28 wks, 1260g, Inborn	Grade 4 IVH on Right. Grade 3 IVH on Left.	No	DNA for follow-up. Reportedly doing well.

4.131 Neurodevelopmental Outcome at 2 years Corrected Gestational Age of VLBW infants with Severe IVH 2018-2020

Gestational Age	No. of Cases	Death	Category 1 Severe	Category 2	Category 3	Category 4 Normal	No follow up
23 wks	3	3	0	0	0	0	0
24 wks	5	5	0	0	0	0	0
25 wks	2	0	1	0	1	0	0
26 wks	4	1	0	0	1	2	0
27 wks	2	1	0	1	0	0	0
28 wks	2	1	0	0	0	0	1
29 wks	0	0	0	0	0	0	0
30 wks	0	0	0	0	0	0	0
31 wks	0	0	0	0	0	0	0
Total	18 (100%)	11 (61%)	1 (6%)	1 (6%)	2 (11%)	2 (11%)	1 (6%)

4.132: Neurodevelopmental Outcome at 2 years Corrected Gestational Age for VLBW infants who sustained a Severe IVH 2008-2017 (10 years of data). From Annual Neonatal Report 2019

Gestational Age	No. of Cases	Death	Category 1 Severe	Category 2	Category 3	Category 4 Normal	No follow up
23 wks	7	7	0	0	0	0	0
24 wks	14	11	0	0	0	3	0
25 wks	12	9	1	2	0	0	0
26 wks	10	6	1	1	1	0	1
27 wks	8	1	3	2	0	2	0
28 wks	10	3	1	0	1	5	0
29 wks	4	1	1	0	0	1	1
30 wks	0	0	0	0	0	0	0
31 wks	1	0	1	0	0	0	0
Total	66 (100%)	38 (58%)	8 (12%)	5 (7%)	2 (3%)	11 (17%)	2 (3%)

Cystic Periventricular Leucomalacia (Cystic PVL)

To be classified by VON as cystic periventricular leucomalacia, there must be small periventricular cysts identified either on ultrasound or MRI. Periventricular echogenicity on ultrasound without cysts would not meet the criteria nor would the finding of a porencephalic cyst in an area of previously identified intraparenchymal haemorrhage. The denominator for this table is the number of infants admitted to the NICU who had cranial imaging (ultrasound, CT or MRI) performed prior to discharge (and not just on/before D28 as for IVH). .

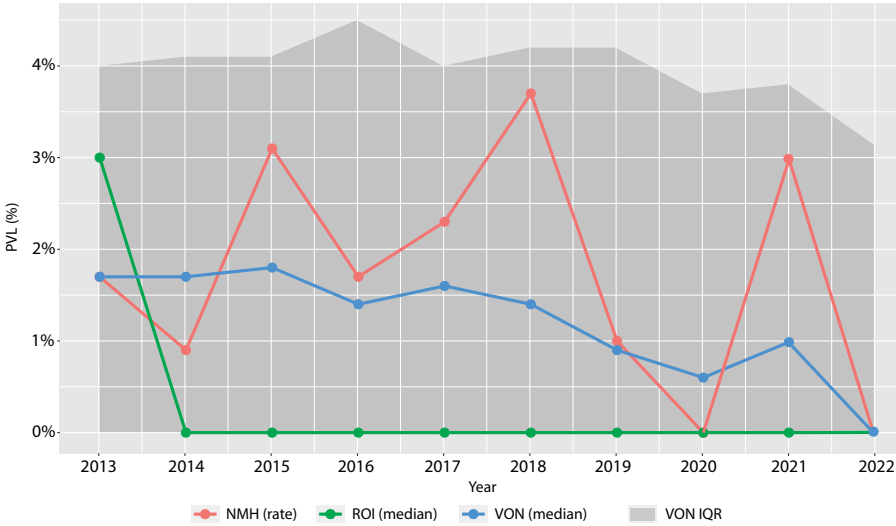
4.133 Periventricular Leucomalacia

Gestational Age	2018 (n=109)	2019 (n=102)	2020 (n=112)	2021 (n=106)	2022 (n=103)
< 24 wks	0/4 (0%)	0/4 (0%)	0/3 (0%)	0/7 (0%)	0/4 (0%)
24-26 wks	0/31 (0%)	1/25 (4%)	0/27 (0%)	0/37 (0%)	0/30 (0%)
27-29 wks	3/46 (7%)	0/41 (0%)	0/47 (0%)	1/31 (3%)	0/38 (0%)
30-32 wks	1/22 (5%)	0/22 (0%)	0/30 (0%)	1/26 (4%)	0/27 (0%)
> 32wks	0/6 (0%)	0/10 (0%)	0/5 (0%)	0/5 (0%)	0/4 (0%)
Total	**4/109 (4%)**	**1/102 (1%)**	**0/112 (0%)**	**2/106 (2%)**	**0/103 (0%)**

4.134 Clinical Details of VLBW Infants with cystic PVL

Cases	Ultrasound Findings	PVD Documented	Outcome
No cases to report			

4.135 PVL: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	2%	1%	3%	2%	2%	4%	1%	0%	3%	0%
VON (rate)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
VON (median)	2%	2%	2%	1%	2%	1%	1%	1%	1%	0%
ROI (median)	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%

4.136 Shrunken and Composite Shrunken SMRs for PVL for NMH

Year	Shrunken SMR with 95% CI	Years	Composite Shrunken SMR with 95% CI
2018	1.2 (0.4-2.4)	2016 - 2018	1.0 (0.5-1.6)
2019	0.6 (0.1-1.6)	2017 - 2019	0.9 (0.5-1.6)
2020	0.4 (0.0-1.2)	2018 - 2020	0.7 (0.3-1.3)
2021	1.0 (0.3-2.0)	2019 - 2021	0.6 (0.2-1.2)
2022	0.4 (0.0-1.2)	2020 - 2022	0.5 (0.2-1.0)

**Lower and upper bounds of Confidence Interval (CI) does not include 1.0*

Retinopathy of Prematurity (ROP)

All infants 1500g and <30 wks gestation in NMH undergo screening for ROP with the first retinal examination occurring around 30-31 wks corrected gestational age. The denominator for the tables pertaining to ROP is the number of infants admitted to the NICU in whom a retinal examination was performed. The denominator for the tables pertaining to ROP surgery and anti-VEGF therapy is all infant admitted to the NICU excluding DR deaths.

VON reports on the percentage of infants born between 22 and 30 weeks of gestation who receive an appropriate screening examination for ROP at the recommended age *(Ref: AAP Policy Statement. Screening Examination of Premature Infants for Retinopathy of Prematurity. Pediatrics 2006;117:572-576).* For the purpose of this measurement, the denominator is all infants who do not die in the DR, whose gestational age is between 22 wks and 0 days and 30 wks and 6 days and who are reportable by our hospital at the postmenstrual age recommended for retinal screening by the American Academy of Pediatrics (AAP). The measure calculates the percentage of infants who actually received a retinal examination. The data do not distinguish whether the examination took place early, on time or late. In 2021, the figure for NMH was 100%. In 2022, the figure was 95%. Of the three infants who were not screened, two infants were too unstable at the time to have a retinal examination and both of these infants subsequently died. The other infant was transferred back to their referring centre shortly before their assessment was due. Appropriate arrangements for made for this infant to be followed up locally.

4.137 ROP

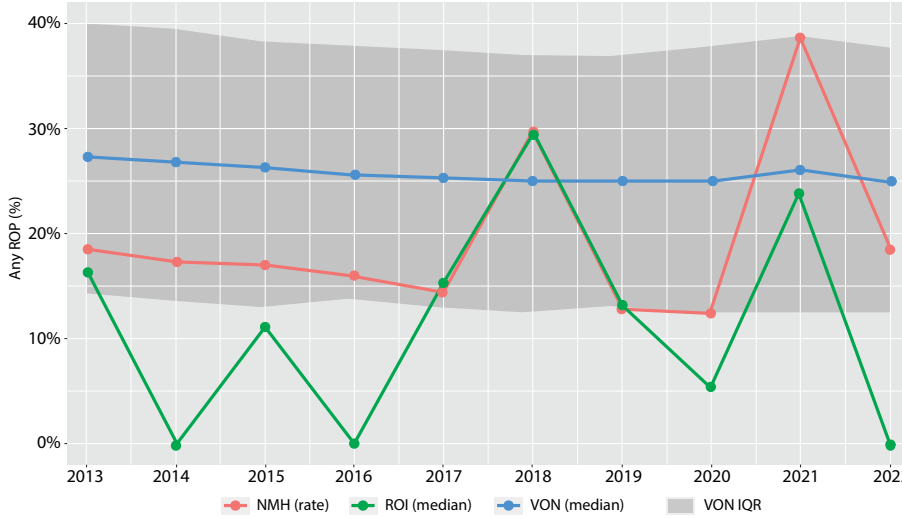
Gestational Age	Admissions	No ROP	Stage 1	Stage 2	Stage 3	Unknown (No retinal examination performed)
< 24wks	4	0	0	0	0	4
24-26wks	34	11	1	4	2	16
27-29wks	39	26	3	3	1	6
30-32wks	27	26	0	0	0	1
>32wks	6	4	0	0	0	2
Total	**110**	**67**	**4**	**7**	**3**	**29**

**No infant diagnosed with ROP Stage 4 or 5 in 2022*

4.138 ROP (Any Stage)

Gestational Age	2018 (n=101)	2019 (n=94)	2020 (n=98)	2021 (n=87)	2022 (n=81)
< 24 wks	1/1 (100%)	2/2 (100%)	1/1 (100%)	0 (0%)	0/0 (0%)
24-26 wks	19/28 (68%)	7/20 (35%)	6/20 (30%)	21/28 (75%)	7/18 (39%)
27-29 wks	8/45 (18%)	3/38 (8%)	5/44 (11%)	7/26 (27%)	7/33 (21%)
30-32 wks	2/19 (11%)	0/23 (0%)	0/28 (0%)	6/27 (22%)	0/26 (0%)
> 32wks	0/8 (0%)	0/11 (0%)	0/5 (0%)	0/6 (0%)	0/4 (0%)
Total	**30/101 (30%)**	**12/94 (13%)**	**12/98 (12%)**	**34/87 (39%)**	**14/81 (17%)**

4.139 ROP (Any Stage): NMH vs. VON and ROI

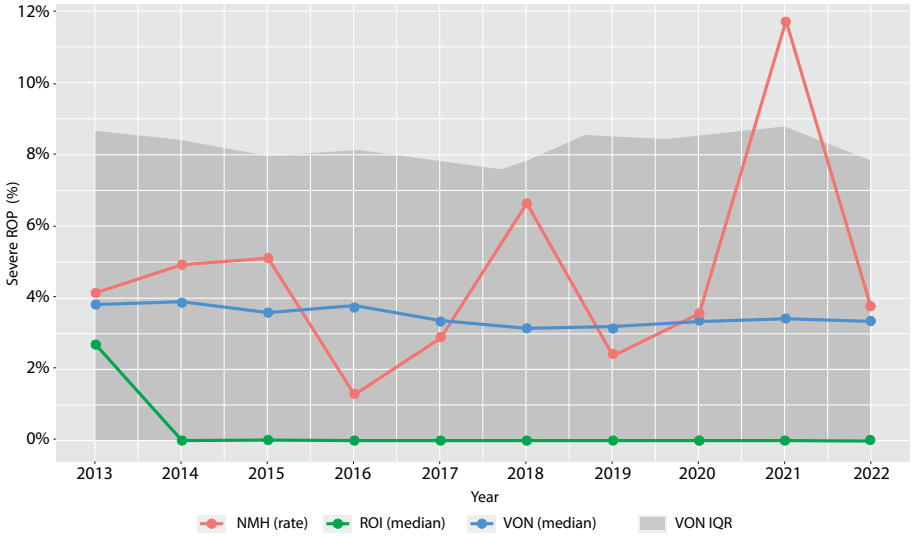


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	19%	17%	17%	16%	14%	30%	13%	12%	39%	17%
VON (rate)	32%	32%	31%	31%	31%	30%	30%	31%	31%	31%
VON (median)	27%	27%	26%	26%	25%	25%	25%	25%	26%	25%
ROI (median)	16%	0%	11%	0%	15%	29%	14%	6%	24%	0%

4.140 Severe ROP (Stage 3 or more)

Gestational Age	2018 (n=101)	2019 (n=94)	2020 (n=97)	2021 (n=87)	2022 (n=81)
< 24 wks	0/1 (0%)	1/2 (50%)	1/1 (100%)	0/0 (0%)	0/0 (0%)
24–26 wks	6/28 (21%)	1/20 (5%)	2/20 (10%)	10/28 (36%)	2/18 (11%)
27–29 wks	0/45 (0%)	0/38 (0%)	0/44 (0%)	0/26 (0%)	1/33 (3%)
30–32 wks	0/19 (0%)	0/23 (0%)	0/28 (0%)	0/27 (0%)	0/26 (0%)
> 32wks	0/8 (0%)	0/11 (0%)	0/5 (0%)	0/6 (0%)	0/4 (0%)
Total	**6/101 (6%)**	**2/94 (2%)**	**3/98 (3%)**	**10/87 (12%)**	**3/81 (4%)**

4.141 Severe ROP: NMH vs. VON and ROI

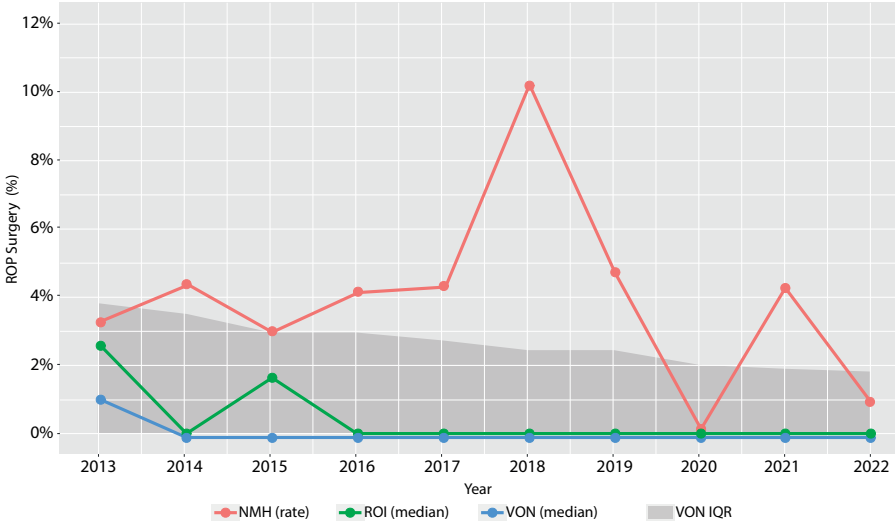


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	4%	4%	5%	1%	3%	6%	2%	3%	12%	4%
VON (rate)	6%	6%	6%	6%	6%	6%	6%	7%	6%	6%
VON (median)	4%	4%	4%	4%	3%	3%	3%	3%	4%	3%
ROI (median)	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%

4.142 ROP Surgery (retinal cryosurgery and/or laser surgery)

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	0/4 (0%)	0/5 (0%)	0/5 (0%)	0/7 (0%)	0/4 (0%)
24-26 wks	9/33 (27%)	4/25 (16%)	0/28 (0%)	5/39 (13%)	0/34 (0%)
27-29 wks	3/47 (6%)	1/42 (2%)	0/48 (0%)	0/31 (0%)	1/39 (3%)
30-32 wks	0/23 (0%)	0/25 (0%)	0/31 (0%)	0/31 (0%)	0/27 (0%)
> 32wks	0/8 (0%)	0/11 (0%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**12/115 (10%)**	**5/108 (5%)**	**0/117 (0%)**	**5/114 (4%)**	**1/110 (1%)**

4.143 ROP Surgery: NMH vs. VON and ROI

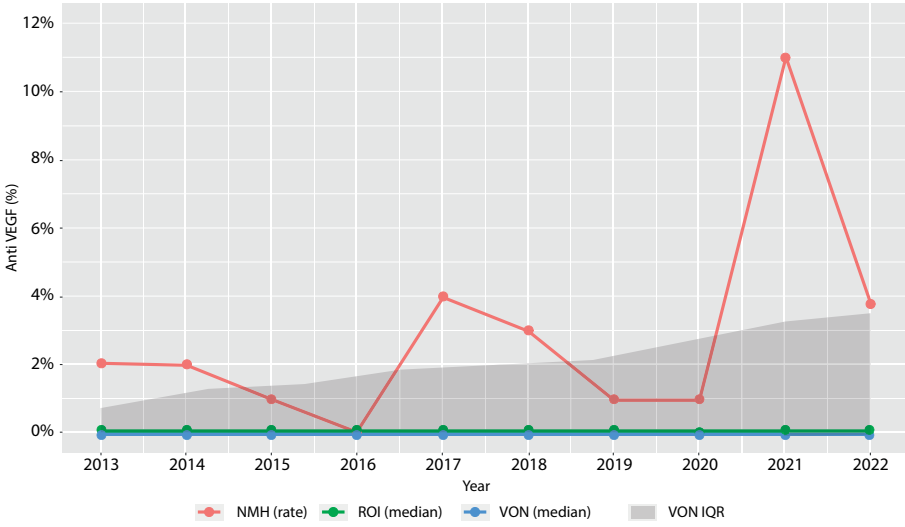


Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	3%	4%	3%	4%	4%	10%	5%	0%	4%	1%
VON (rate)	3%	3%	2%	2%	2%	2%	2%	2%	2%	2%
VON (median)	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROI (median)	2%	0%	2%	0%	0%	0%	0%	0%	0%	0%

4.144 Anti-VEGF Therapy

Gestational Age	2018 (n=115)	2019 (n=108)	2020 (n=117)	2021 (n=114)	2022 (n=110)
< 24 wks	1/4 (25%)	1/5 (20%)	1/5 (20%)	0/7 (0%)	0/4 (0%)
24-26 wks	2/33 (6%)	0/25 (0%)	0/28 (0%)	12/39 (31%)	4/34 (12%)
27-29 wks	0/47 (0%)	0/42 (0%)	0/48 (0%)	1/31 (3%)	0/39 (0%)
30-32 wks	0/23 (0%)	0/25 (0%)	0/31 (0%)	0/31 (0%)	0/27 (0%)
> 32wks	0/8 (0%)	0/11 (0%)	0/5 (0%)	0/6 (0%)	0/6 (0%)
Total	**3/115 (3%)**	**1/108 (1%)**	**1/117 (1%)**	**13/114 (11%)**	**4/110 (4%)**

4.145 Anti-VEGF Treatment: NMH vs. VON and ROP



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	2%	2%	1%	0%	4%	3%	1%	1%	11%	4%
VON (rate)	1%	1%	1%	1%	2%	2%	2%	2%	3%	3%
VON (median)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ROI (median)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

4.146 Clinical Details of VLBW Infants undergoing ROP Surgery and/or Anti-VEGF Therapy

Cases	GA	BW	Location of Birth	Worse stage of ROP	Unilateral/ bilateral ROP	Laser therapy	Anti-VEGF therapy	Survived to Discharge
1	24	610	Inborn	Stage 2	Bilateral	No	Yes	Home D96
2	24	660	Inborn	Stage 2	Bilateral	No	Yes	Home D134
3	25	675	Inborn	Stage 3	Bilateral	No	Yes	Home D101
4	25	900	Inborn	Stage 3	Bilateral	No	Yes	Home D108
5	28	905	Inborn	Stage 3	Bilateral	Yes: Bilateral	No	Home D75

** In 2022, no infant reported by our centre to VON was readmitted to our centre post-discharge for laser therapy /anti-VEGF therapy. We have not been notified of any infant admitted to one of the paediatric centres post-discharge for laser therapy but we acknowledge that we may not be informed of such cases.*

** In 2022, a further 5 infants (not eligible for reporting to VON by our centre as they were >28 days old when first admitted) were admitted to our unit for assessment of ROP. All 5 of these infants were born in 2022 (24wks x1, 25wks x1, 26 wks x3). Of the 5 infants, 1 required laser therapy to both eyes (26wks x1) and the remaining 4 required anti-VEGF therapy to both eyes (24wks x1, 25wks x1, 26 wks x2).*

4.147 Shrunken and Composite Shrunken SMRs for ROP for NMH

Year	Shrunken SMR for ROP (any stage) with 95% CI	Years	Composite Shrunken SMR for ROP (any stage) with 95% CI	Year	Shrunken SMR for Severe ROP with 95% CI	Years	Composite Shrunken SMR for Severe ROP with 95% CI
2018	1.0 (0.7-1.4)	**2016-2018**	0.8 (0.6–1.0)	**2018**	1.1 (0.5-2.0)	**2016 -2018**	0.9 (0.5-1.4)
2019	0.6 (0.4-0.9)*	**2017-2019**	0.7 (0.6-0.9)*	**2019**	0.6 (0.2-1.4)	**2017 -2019**	0.9 (0.5-1.4)
2020	0.5 (0.3-0.8)*	**2018-2020**	0.7 (0.5-0.9)*	**2020**	0.8 (0.3-1.6)	**2018 -2020**	0.9 (0.5-1.4)
2021	1.2 (0.8-1.6)	**2019-2021**	0.7 (0.6-0.9)*	**2021**	1.6 (0.9-2.6)	**2019-2021**	1.1 (0.6-1.7)
2022	0.8 (0.5-1.1)	**2020-2022**	0.8 (0.6-1.0)	**2022**	1.0 (0.4-1.9)	**2020-2022**	1.2 (0.7-1.9)

**Lower and upper bounds of Confidence Interval (CI) does not include 1.0*

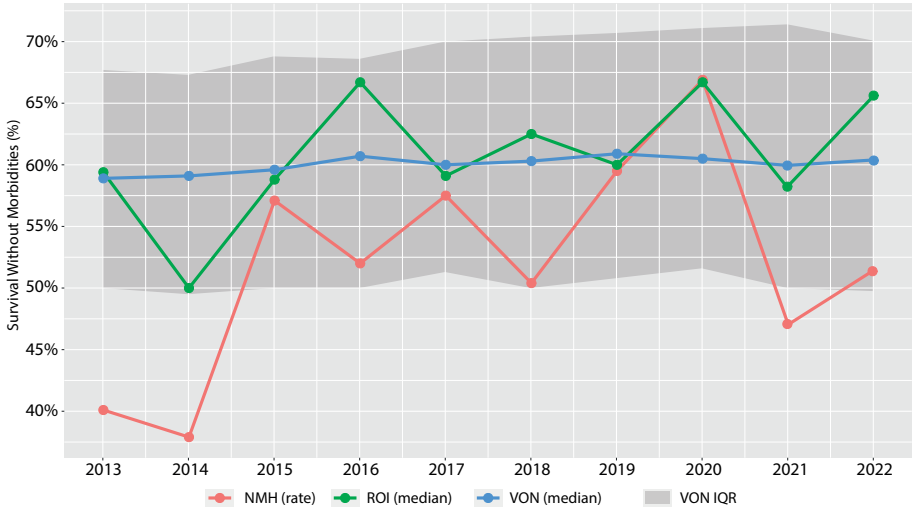
Survival without Specified Morbidities

An infant is classified as having survived without any specified morbidities if he/she survived without any of the following key morbidities: severe IVH, CLD in infants <33wks, NEC, Pneumothorax, Any Late Infection or PVL. Prior to 2011, Extreme Length of Stay was included as part of the definition. This was removed in 2011. In 2013, Chronic Lung Disease was changed to Chronic Lung Disease in Infants <33 wks.

4.148 Survival without Specified Morbidities

Gestational Age	2018 (n=121)	2019 (n=116)	2020 (n=118)	2021 (n=121)	2022 (n=120)
< 24 wks	0/9 (0%)	2/8 (25%)	0/6 (0%)	0/12 (0%)	0/10 (0%)
24-26 wks	12/34 (35%)	9/26 (35%)	13/28 (46%)	12/40 (30%)	10/37 (27%)
27-29 wks	27/47 (57%)	24/44 (55%)	33/48 (69%)	14/32 (44%)	22/40 (55%)
30-32 wks	15/23 (65%)	23/26 (89%)	28/31 (90%)	24/31 (77%)	24/27 (89%)
> 32wks	7/8 (88%)	11/12 (92%)	5/5 (100%)	6/6 (100%)	6/6 (100%)
Total	**61/121 (50%)**	**69/116 (60%)**	**79/118 (67%)**	**56/121 (46%)**	**62/120 (52%)**

4.149 Survival without Specified Morbidities: NMH vs. VON and ROI



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
NMH (rate)	42%	38%	57%	52%	58%	50%	60%	67%	47%	52%
VON (rate)	56%	56%	56%	57%	57%	57%	56%	56%	56%	55%
VON (median)	59%	59%	60%	61%	60%	60%	61%	60%	60%	60%
ROI (median)	59%	50%	59%	67%	59%	63%	60%	67%	58%	66%

Summary Statistics

Our NICU benchmarks its performance against VON on a yearly basis. Since 2011, it also benchmarks itself against the 'Republic of Ireland' group. Since 2014, the 'Republic of Ireland' group includes all VLBW infants born in the Republic of Ireland.

4.150 Mortality and Morbidity Outcomes of Infants with Birthweights of 501-1500g (congenital anomalies included): NMH compared to the Vermont Oxford Network and the Republic of Ireland (n=112)

	NMH Infants 501-1500g (n=115)	VON Network Infants 501-1500g (n=57,465)			ROI Infants 501-1500g (n=495)		
	NMH Rate	%	Median	Q1 – Q3	%	Median	Q1 – Q3
Inborn	103/112 (92%)	87%	93%	85% - 100%	89%	73%	33% - 94%
Male	62/112 (55%)	51%	50%	45% - 57%	53%	56%	48% - 68%
Chorioamnionitis	28/108 (26%)	12%	7%	0% - 17%	16%	10%	0% - 23%
Maternal Hypertension	30/111 (27%)	39%	38%	28% - 46%	28%	27%	14% - 38%
Maternal Diabetes	13/111 (12%)	12%	11%	5% - 15%	9%	2%	0% - 12%
Antenatal Steroids (partial or complete)	106/111 (95%)	85%	87%	79% - 92%	91%	95%	83% - 100%
C/S	82/112 (73%)	76%	77%	71% - 84%	79%	81%	72% - 100%
Antenatal Magnesium Sulphate	81/109 (74%)	65%	67%	50% - 78%	73%	67%	50% - 74%
Multiple Gestation	40/112 (36%)	25%	23%	16% - 30%	31%	26%	20% - 35%
Any major birth defect	9/112 (8%)	7%	4%	0% - 8%	7%	0%	0% - 8%
Small for gestational age	20/112 (18%)	20%	19%	14% - 25%	20%	24%	15% - 35%
Surfactant in DR	9/112 (8%)	17%	11%	1% - 29%	20%	13%	0% - 33%
DR ETT ventilation	21/112 (19%)	35%	33%	22% - 45%	26%	19%	0% - 34%
Conventional Ventilation	63/105 (60%)	50%	50%	36% - 61%	56%	36%	13% - 59%
High Frequency Ventilation	15/105 (14%)	21%	17%	7% - 28%	14%	4%	0% - 15%
Any Ventilation	63/105 (60%)	53%	52%	40% - 64%	56%	36%	13% - 60%
Nasal IMV/SIMV	40/105 (38%)	37%	32%	13% - 55%	21%	0%	0% - 25%
Nasal CPAP	75/105 (71%)	79%	80%	70% - 87%	83%	87%	69% - 100%
Ventilation after Early CPAP	46/74 (62%)	40%	38%	25% - 50%	50%	25%	0% - 48%
Surfactant after 2 hrs	27/56 (48%)	35%	33%	17% - 50%	45%	44%	0% - 62%

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	NMH Infants 501-1500g (n=115)	VON Network Infants 501-1500g (n=57,465)			ROI Infants 501-1500g (n=495)		
	NMH Rate	%	Median	Q1 – Q3	%	Median	Q1 – Q3
Surfactant after 2 hrs, Infants 501- 1250g	17/44 (39%)	31%	29%	14% - 46%	38%	30%	0% - 38%
Surfactant at any time	57/112 (51%)	56%	57%	46% - 67%	59%	50%	33% - 63%
Steroids for CLD	18/105 (17%)	13%	9%	0% - 16%	16%	0%	0% - 16%
Inhaled Nitric Oxide	14/105 (13%)	6%	3%	0% - 8%	13%	0%	0% - 11%
Caffeine	100/105 (95%)	85%	87%	77% - 93%	87%	86%	75% - 91%
RDS	63/105 (60%)	74%	79%	64% - 89%	81%	80%	63% - 97%
Pneumothorax	11/105 (10%)	4%	3%	0% - 5%	6%	0%	0% - 7%
Chronic Lung Disease (at 36 wks)	14/79 (18%)	26%	20%	10% - 31%	25%	0%	0% - 25%
Chronic Lung Disease, Infants <33 wks	13/73 (18%)	28%	22%	11% - 33%	27%	0%	0% - 27%
Early Bacterial Infection	0/105 (0%)	1%	0%	0% - 2%	1%	0%	0% - 0%
Late Bacterial Infection	6/98 (6%)	8%	5%	0% - 9%	10%	0%	0% - 13%
Coagulase Negative Staphylococcus Infection	7/98 (7%)	5%	1%	0% - 5%	8%	0%	0% - 7%
Nosocomial Bacterial Infection	13/98 (13%)	11%	8%	3% - 13%	16%	7%	0% - 20%
Fungal Infection	1/98 (1%)	1%	0%	0% - 0%	1%	0%	0% - 1%
Any Late Infection (Bacterial or Fungal)	14/98 (14%)	12%	8%	3% - 14%	17%	15%	0% - 20%
NEC Surgery	3/105 (3%)	3%	0%	0% - 4%	3%	0%	0% - 3%
PDA ligation	0/105 (0%)	3%	0%	0% - 3%	3%	0%	0% - 2%
Surgery for ROP	1/105 (1%)	2%	0%	0% - 1%	2%	0%	0% - 0%
Any Grade of IVH (Grade 1-4)	30/98 (31%)	27%	22%	13% - 31%	31%	31%	19% - 40%
Severe IVH (Grade3-4)	7/98 (7%)	8%	6%	0% - 10%	8%	0%	0% - 9%
Cystic PVL	0/98 (0%)	3%	0%	0% - 3%	3%	0%	0% - 2%
Retinopathy of Prematurity	14/79 (18%)	30%	25%	12% - 37%	23%	0%	0% - 26%
Severe ROP (Stage 3 or more)	3/79 (4%)	6%	3%	0% - 7%	4%	0%	0% - 3%
Anti-VEGF Drug	4/105 (4%)	2%	0%	0% - 3%	5%	0%	0% - 4%
NEC	6/105 (6%)	5%	3%	0% - 7%	5%	0%	0% - 5%
PDA	22/105 (21%)	24%	20%	8% - 31%	28%	23%	0% - 35%

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	NMH Infants 501-1500g (n=115)	VON Network Infants 501-1500g (n=57,465)			ROI Infants 501-1500g (n=495)		
	NMH Rate	%	Median	Q1 – Q3	%	Median	Q1 – Q3
■ Indomethacin	0/105 (0%)	6%	0%	0% - 6%	0%	0%	0% - 0%
■ Ibuprofen for PDA	5/105 (5%)	6%	1%	0% - 8%	6%	0%	0% - 8%
■ Acetaminophen for PDA	7/105 (7%)	10%	7%	0% - 15%	12%	2%	0% - 20%
■ Probiotics	0/105 (0%)	22%	0%	0% - 48%	52%	7%	0% - 63%
■ Died in DR	7/112 (6%)	1%	0%	0% - 2%	4%	0%	0% - 4%
■ Died within 12 hrs	3/105 (3%)	1%	0%	0% - 2%	2%	0%	0% - 0%
■ Mortality	26/112 (23%)	12%	10%	6% - 15%	18%	10%	0% - 22%
■ Mortality excluding Early Deaths	16/102 (16%)	10%	8%	4% - 13%	12%	2%	0% - 12%
■ Survival	86/112 (77%)	88%	90%	85% - 94%	82%	90%	78% - 100%
■ Survival without Specified Morbidities	59/112 (53%)	58%	63%	52% - 73%	52%	66%	54% - 100%

■ NMH Rate is within VON Interquartile range (IQR) ■ NMH Rate is outside VON Interquartile range (IQR)

Nosocomial Infection: *defined as any late bacterial infection or coagulase negative staphylococcus infection after D3.*
Any late Infection: *defined as any late bacterial infection, coagulase negative staphylococcus infection and/or fungal infection after D3.*
Mortality: *is defined as death at any time prior to discharge home or first birthday. It is applicable to all infants for whom survival status is known. In this table, it only includes infants 501-1500g and it includes infants with major congenital anomalies.*
Mortality excluding Early Deaths: *excludes infants who die within the first 12 hours of birth.*
Survival: *Indicates whether the infant survived to discharge home or first birthday.*
Survival without Specified Morbidities: *Indicates whether the infant survived with none of the following key morbidities: Severe IVH, CLD <33wks, NEC, pneumothorax, any late infection or PVL. Prior to 2011, extreme length of stay was included in the definition. IN 2013, CLD changed to CLD in infants <33 wks.*
Source: *Vermont Oxford Network Annual Report and Nightingale, the Vermont Oxford Network Internet Reporting Tool.*

4.151 Mortality and Morbidity Outcomes of VLBW Infants (congenital anomalies included): NMH compared to the Vermont Oxford Network and the Republic of Ireland (n=120)

Cohort	NMH All VLBW Infants (n=120)	VON All VLBW Infants (n=61,077)			ROI All VLBW Infants (n=484)		
Measure	%	%	Median	Q1 – Q3	%	Median	Q1 – Q3
Inborn	111/120 (93%)	87%	94%	86% - 100%	90%	72%	29% - 94%
Male	65/120 (54%)	51%	50%	46% - 57%	53%	52%	49% - 68%
Chorioamnionitis	33/116 (28%)	13%	7%	2% - 17%	17%	10%	0% - 21%
Maternal Hypertension	32/119 (27%)	38%	37%	27% - 45%	27%	25%	14% - 37%
Maternal Diabetes	15/119 (13%)	12%	11%	5% - 16%	9%	3%	0% - 11%
Antenatal Steroids (partial or complete)	111/119 (93%)	83%	85%	76% - 90%	89%	92%	81% - 100%
C/S	85/120 (71%)	74%	75%	68% - 83%	77%	77%	71% - 94%
Antenatal Magnesium Sulphate	85/117 (73%)	64%	66%	48% - 76%	71%	58%	42% - 73%
Multiple Gestation	40/120 (33%)	24%	23%	16% - 30%	30%	25%	20% - 33%
Any major birth defect	9/120 (8%)	7%	4%	0% - 8%	7%	0%	0% - 8%
Small for gestational age	22/118 (19%)	22%	21%	16% - 26%	21%	24%	15% - 35%
Surfactant in DR	9/120 (8%)	18%	11%	1% - 29%	20%	13%	0% - 33%
DR ETT ventilation	22/120 (18%)	36%	34%	22% - 45%	26%	19%	0% - 33%
Conventional Ventilation	65/110 (59%)	51%	50%	38% - 62%	56%	37%	25% - 59%
High Frequency Ventilation	17/110 (15%)	23%	19%	8% - 30%	15%	4%	0% - 16%
Any Ventilation	65/110 (59%)	55%	53%	42% - 65%	56%	37%	25% - 60%
Nasal IMV/SIMV	41/110 (37%)	37%	32%	13% - 54%	20%	0%	0% - 26%
Nasal CPAP	79/110 (72%)	78%	79%	67% - 86%	83%	88%	73% - 100%
Ventilation after Early CPAP	47/77 (61%)	41%	39%	25% - 50%	50%	25%	0% - 50%
Surfactant after 2 hrs	29/58 (50%)	34%	33%	17% - 49%	44%	42%	0% - 50%
Surfactant after 2 hrs, Infants 501- 1250g	17/44 (39%)	31%	29%	14% - 46%	38%	30%	0% - 38%
Surfactant at any time	59/120 (49%)	56%	57%	47% - 67%	58%	50%	35% - 61%

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Cohort	NMH All VLBW Infants (n=120)	VON All VLBW Infants (n=61,077)			ROI All VLBW Infants (n=484)		
Measure	%	%	Median	Q1 – Q3	%	Median	Q1 – Q3
Steroids for CLD	19/110 (17%)	13%	9%	0% - 17%	16%	0%	0% - 16%
Inhaled Nitric Oxide	15/110 (14%)	7%	4%	0% - 9%	13%	0%	0% - 12%
Caffeine	105/110 (95%)	86%	87%	77% - 93%	87%	87%	75% - 91%
RDS	65/110 (59%)	75%	79%	65% - 89%	81%	80%	63% - 97%
Pneumo-thorax	11/110 (10%)	4%	3%	0% - 6%	6%	0%	0% - 8%
Chronic Lung Disease (at 36 wks)	14/82 (17%)	27%	20%	10% - 31%	25%	0%	0% - 24%
Chronic Lung Disease, Infants <33 wks	13/76 (17%)	29%	22%	11% - 33%	26%	0%	0% - 26%
Early Bacte-rial Infection	0/110 (0%)	1%	0%	0% - 2%	1%	0%	0% - 0%
Late Bacterial Infection	7/103 (7%)	8%	5%	0% - 10%	10%	0%	0% - 12%
Coagulase Negative Staphy-lococcus Infec-tion	7/103 (7%)	5%	2%	0% - 6%	8%	0%	0% - 6%
Nosocomial Bacterial Infec-tion	14/103 (14%)	12%	8%	3% - 14%	16%	7%	0% - 20%
Fungal Infec-tion	1/103 (1%)	1%	0%	0% - 1%	1%	0%	0% - 1%
Any Late Infection (Bacte-rial or Fungal)	15/103 (15%)	12%	9%	4% - 14%	17%	14%	0% - 21%
NEC Surgery	3/110 (3%)	4%	0%	0% - 4%	3%	0%	0% - 3%
PDA ligation	0/110 (0%)	3%	0%	0% - 3%	3%	0%	0% - 2%
Surgery for ROP	1/110 (1%)	2%	0%	0% - 2%	2%	0%	0% - 0%
Any Grade of IVH (Grade 1-4)	34/103 (33%)	27%	22%	13% - 31%	32%	33%	18% - 41%
Severe IVH (Grade3-4)	9/103 (9%)	8%	6%	0% - 10%	9%	0%	0% - 9%
Cystic PVL	0/103 (0%)	3%	0%	0% - 3%	3%	0%	0% - 2%
Retinopathy of Prematurity	14/81 (17%)	31%	25%	13% - 37%	22%	0%	0% - 26%
Severe ROP (Stage 3 or more)	3/81 (4%)	6%	3%	0% - 8%	4%	0%	0% - 3%
Anti-VEGF Drug	4/110 (4%)	3%	0%	0% - 3%	5%	0%	0% - 4%
NEC	7/110 (6%)	5%	3%	0% - 7%	5%	0%	0% - 5%
PDA	23/110 (21%)	24%	20%	9% - 31%	28%	23%	0% - 32%
Indomethacin	0/110 (0%)	6%	0%	0% - 6%	0%	0%	0% - 0%
Ibuprofen for PDA	6/110 (5%)	6%	1%	0% - 8%	6%	0%	0% - 9%
Acetami-nophen for PDA	7/110 (6%)	10%	7%	0% - 15%	12%	2%	0% - 20%

continued on next page

Cohort	NMH All VLBW Infants (n=120)	VON All VLBW Infants (n=61,077)			ROI All VLBW Infants (n=484)		
Measure	%	%	Median	Q1 – Q3	%	Median	Q1 – Q3
Probiotics	0/110 (0%)	22%	0%	0% - 46%	52%	7%	0% - 63%
Died in DR	10/120 (8%)	4%	0%	0% - 5%	6%	0%	0% - 6%
Died within 12 hrs	3/110 (3%)	1%	0%	0% - 2%	2%	0%	0% - 1%
Mortality	31/120 (26%)	16%	14%	8% - 19%	20%	16%	0% - 25%
Mortality excluding Early Deaths	18/107 (17%)	11%	9%	5% - 14%	14%	6%	0% - 15%
Survival	89/120 (74%)	84%	86%	81% - 92%	80%	84%	75% - 100%
Survival without Specified Morbidities	62/120 (52%)	55%	60%	50% - 70%	51%	65%	52% - 88%

NMH Rate is within VON Interquartile range (IQR) NMH Rate is outside VON Interquartile range (IQR)

Nosocomial Infection: *defined as any late bacterial infection or coagulase negative staphylococcus infection after D3.*
Any late Infection: *defined as any late bacterial infection, coagulase negative staphylococcus infection and/or fungal infection after D3.*
Mortality: *is defined as death at any time prior to discharge home or first birthday. It is applicable to all infants for whom survival status is known. This table includes all VLBW infants and also includes infants with major congenital anomalies.*
Mortality excluding Early Deaths: *excludes infants who die within the first 12 hours of birth.*
Survival: *Indicates whether the infant survived to discharge home or first birthday.*
Survival without Specified Morbidities: *Indicates whether the infant survived with none of the following key morbidities: Severe IVH, CLD <33wks, NEC, pneumothorax, any late infection or PVL. Prior to 2011, extreme length of stay was included in the definition. IN 2013, CLD changed to CLD in infants <33 wks.*
Source: *Vermont Oxford Network Annual Report and Nightingale, the Vermont Oxford Network Internet Reporting Tool.*

Risk-Adjusted Outcome Measures

The Standardised Mortality Rate 2016 and 95% Confidence Intervals have been corrected or 'shrunken' using methods which recognize that some of the observed variation is random 'noise' particularly for small hospitals. Both the estimate of the shrunken SMR and the lower and upper bounds of the 95% confidence interval are based on a multivariable adjustment model which considers the case mix in each centre. The predictors in the model changed in 2011. The model for mortality includes the following predictors: gestational age, SGA (small for gestational age), Apgar score at 1 min, gender, vaginal birth, birth location (inborn or outborn) and birth defect severity. Shrunken SMRs are reported only for infants 501-1500g. VON also reports SMRs with 95% CI for a number of other important variables. Composite shrunken SMRs look at the data over a 3 year period.

4.152 Shrunken Standardised Morbidity and Mortality Rates for 2022 and Composite Shrunken SMRs for the years 2020-2022 inclusive.

Measure	SMR (95% confidence interval) 2022	SMR (95% confidence interval) 2020- 2022 inclusive
Mortality	1.5 (1.0-2.1)	1.6 (1.3-2.0)*
Death or Morbidity	1.0 (0.8-1.2)	1.0 (0.8-1.1)
CLD	0.8 (0.5-1.3)	0.8 (0.6-1.0)
CLD in <33 wks GA	0.8 (0.5-1.2)	0.8 (0.6-1.0)
NEC, any location	0.9 (0.4-1.7)	1.0 (0.6-1.5)
Late bacterial infection, any location	0.7 (0.3-1.3)	0.8 (0.5-1.2)
Coagulase negative infection, any location	1.5 (0.7-2.6)	1.5 (0.9-2.1)
Nosocomial infection, any location	1.1 (0.6-1.7)	1.1 (0.8-1.5)
Fungal infection, any location	1.0 (0.1-3.3)	0.4 (0.0-1.3)
Any late infection, any location	1.1 (0.6-1.6)	1.1 (0.8-1.4)
Any IVH, any location	1.1 (0.8-1.5)	1.0 (0.8-1.3)
Severe IVH	1.0 (0.6-1.4)	1.1 (0.8-1.5)
Pneumothorax, any location	1.6 (1.0-2.5)	2.0 (1.4-2.7)*
Cystic PVL	0.4 (0.0-1.2)	0.5 (0.2-1.0)
Any ROP	0.8 (0.5-1.1)	0.8 (0.6-1.0)
Severe ROP	1.0 (0.4-1.9)	1.2 (0.7-1.9)

**Lower and upper bounds of Confidence Interval (CI) does not include 1.0*

SECTION 5: Infection

The following tables and figures report the number of cases of infection that occurred in the NICU in 2022. Cases are reported based on the date that a positive culture is identified in the laboratory and are not based on the year of birth of the infant.

5.1: Cases of Infection in the NICU based on Laboratory Reports

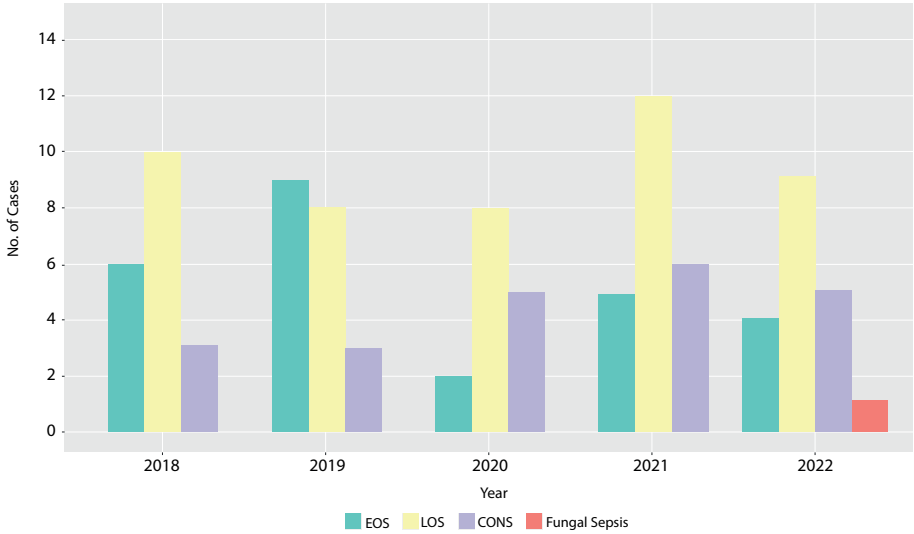
Infection	Infants with BW ≤1500g	Infants with BW >1500g
Early Onset Sepsis (< 72 hours)		
GBS	0	0*
E.coli	0	0
L. monocytogenes	0	0
Other	2 (Strep mitis/oralis (2))	2 (Staph aureus (1), E. faecalis (1))
Total	**2**	**2**
Late Onset Sepsis (>72 hours old)		
GBS	0	0
Gram Negative Bacilli (GNB)	7 (E. coli (3), E. Cloacae (3), K. pneumoniae (1))	0
Staph aureus	0	0
MRSA	0	0
Polymicrobial Sepsis	0	0
Other	0	0
Community Acquired	0	2 (E. coli (1), Strep. Pneumonia (1))
Total	**7**	**2**
Coagulase Negative Staphylococcal Sepsis (CONS)		
CONS	4	1
Candida		
Candida	1	0

Since 2013, NMH now includes cases of PCR proven sepsis. Judgment will be exercised in cases where the CSF is PCR positive as this may be due to contamination

** The above table excludes two cases of isolated meningitis in which no organism was identified on culture or PCR. The first case was in a term infant with neonatal encephalopathy who underwent cooling. MRI findings were suggestive of infection. CSF with WCC 66, RBC 78 and glucose of 2.0. The second case was in a 36 wks infant with neonatal seizures from 15 hours of age. MRI noted bilateral IVH with intraparenchymal extension. CSF with WCC 658, RBC 9100, Glucose 1.4.*

*** Four cases of meningitis were reported in the NMH Infection Prevention and Control Annual Report for 2022 (see table 5.6 for further details on 2 of these cases). All 4 cases were late in onset. One case was a readmission from home of a term baby with an E. coli UTI with associated sepsis and meningitis. The second case was a preterm infant with late onset enterobacter cloacae sepsis with associated meningitis. The final 2 cases were the 2 cases of culture and PCR negative meningitis mentioned above.*

5.2: No. of cases of Early Onset Sepsis and Late Onset Sepsis



Year	2018	2019	2020	2021	2022
EOS	6	9	2	5	4
LOS					
Bacterial	10	8	8	12	9
CONS	3	3	5	6	5
Fungal sepsis	0	0	0	0	1
Total	**19**	**20**	**15**	**23**	**19**

^One other infant not included in this number had a C. albicans identified in the blood culture at the same time as an E. faecium.

5.3: Pathogens causing Late Onset Bacterial Sepsis

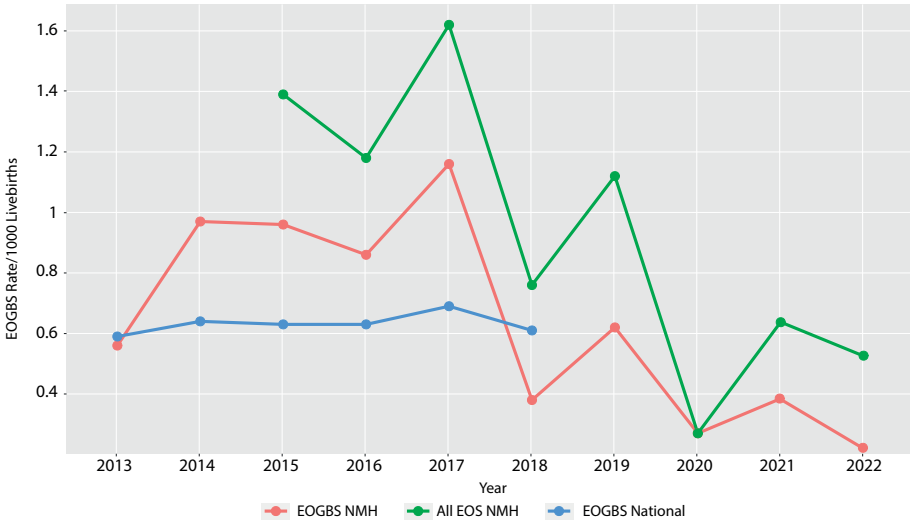
Year	2018	2019	2020	2021	2022
GBS	3	0	0	2	0
GNB	5	5	7	5	7
Staph aureus	1	1	0	2	0
MRSA	0	0	1	0	0
Poymicrobial sepsis	0	1	0	2	0
Other	0	0	0	0	0
Community acquired	1	1	0	1	2
Total	**10**	**8**	**8**	**12**	**9**

5.4: Cases of Early Onset Sepsis

Cases	GA	BW	Organism identified	Blood	CSF	Outcome	Cause of Death
1	23	560	Strep. mitis/ oralis	Culture positive	N/A	Died D8	Intestinal perforation, suspected NEC, extreme prematurity, ELBW.
2	26	695	Strep. mitis/ oralis	Culture positive	N/A	Discharged home	
3	30	1780	Staph aureus	Culture positive	Culture negative	Discharged home	
4	38	3265	E. faecalis	Culture positive	Culture negative	Presented on D2 with bilious vomiting. Midgut volvulus with malrotation diagnosed. Transferred to tertiary paediatric centre for surgery. Discharged home	

- *Note: All of the above cases were born in 2022*
- *N/A: implies no CSF sample obtained for culture or PCR*

5.5: Early-Onset Group B Streptococcus sepsis per 1000 live births



5.5: Early Onset Group B Streptococcus Sepsis per 1000 live births.

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EOGBS NMH	0.56	0.97	0.96	0.86	1.16	0.38	0.62	0.27	0.38	0.00
All EOS NMH	-	-	1.39	1.18	1.62	0.76	1.12	0.27	0.64	0.57
EOGBS National	0.59	0.64	0.63	0.63	0.69	0.61	-	-	-	-

Data from NMH and national data reported by Health Protection Surveillance Centre

5.6: Cases of Late Onset Bacterial Sepsis

Cases	GA	BW	Organism identified	Blood	CSF	Outcome	Cause of Death
1	23	555	E. coli	Culture positive	N/A	Died D5	E. Coli sepsis, extreme prematurity, severe RDS, clinical chorioamnionitis, PPROM x 2 days
2	25	900	E. coli	Culture positive	Culture negative	Discharged home	
3	26	590	E. coli	Culture negative	Culture negative	Died D54	Twin 2, MCDA. Severe respiratory failure, NEC, liver dysfunction, extreme prematurity, ELBW (Died in 2023)
4	38	3985	E. coli (community acquired)	Culture positive	CSF: WCC 46, Gram stain positive for GNR. CSF culture negative. Urine culture positive for E. Coli	Discharged home	
5	29	1180	K. pneumoniae	Culture positive	Culture negative	Discharged home	
6	24	520	E. cloacae	Culture positive	Culture negative	Discharged home	
7	26	450	E. cloacae	Culture negative	N/A	Died D10	Gram negative sepsis, extreme prematurity, ELBW, severe RDS, seizures.
8	26	700	E. cloacae	Culture positive	CSF: WCC 46, RBC 1832. Gram stain positive for GNR. Culture negative	Died D12	Twin 1, MCDA. Severe RDS, extreme prematurity gram negative sepsis
9	38	2980	Strep. pneumoniae (community acquired)	Culture positive	Culture negative	Diagnosed with TAPVD during this hospitalization. Transferred to tertiary paediatric hospital and underwent surgical repair. Discharged home	

- *Note: All of the above infants were born in 2022.*
- *No infant with early onset sepsis developed late onset bacterial sepsis.*
- *No infant with late onset bacterial sepsis had a bout of CONS sepsis*
- *N/A: implies no CSF sample obtained for culture or PCR*

Late Onset CONS Sepsis

Since 2016, NMH only reports cases of CONS sepsis if two or more blood cultures drawn on separate occasions are positive for the organism.

5.7: Cases of Late Onset CONS Sepsis

Cases	GA	BW	Organism identified	Blood	CSF	Outcome	Cause of Death
1	25	590	CONS	Culture positive x4	N/A	Died D28	Imperforate anus and colostomy formation, skeletal abnormalities, complications of extreme prematurity, ELBW, severe RDS
2	25	900	CONS	Culture positive x2	N/A	Discharged home	
3	26	550	CONS	Culture positive x2	N/A	Discharged home	
4	26	550	CONS (second bout)	Culture positive x2	N/A	Discharged home	
5	32	1595	CONS	Culture positive x2	Culture negative	Discharged home	

- *Note: All of the above cases were born in 2022*
- *No infant with EOS developed CONS sepsis*
- *No infant with late onset bacterial sepsis had a bout of CONS sepsis*
- *N/A: implies no CSF sample obtained for culture or PCR*

5.8: Cases of Fungal Sepsis

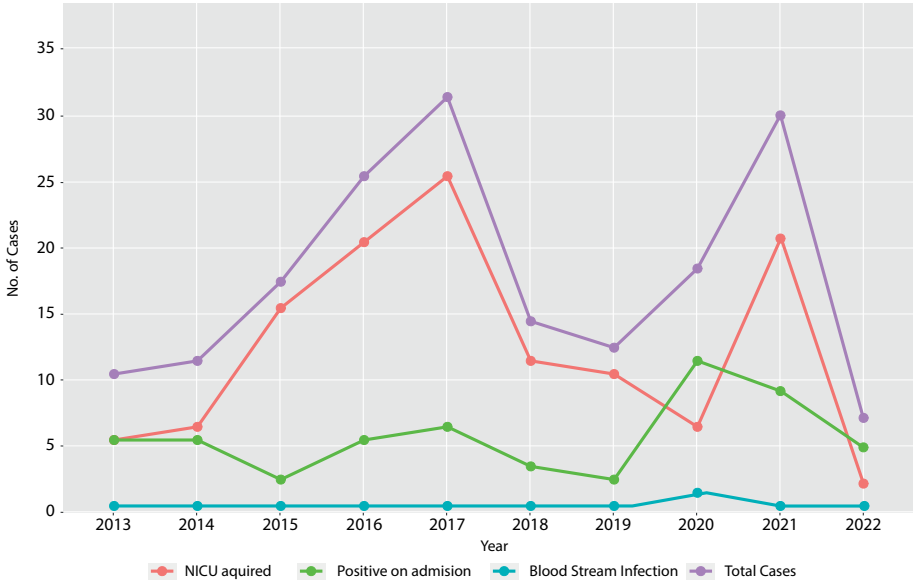
Cases	GA	BW	Organism identified	Blood	CSF	Outcome	Cause of Death
1	24	660	Candida albicans	Culture positive	Culture negative	Discharged home	

- *N/A: implies no CSF sample obtained for culture or PCR*

Methicillin Resistant Staphylococcus Aureus (MRSA)

In line with national recommendations, all infants are screened for MRSA carriage on admission to the NICU and weekly thereafter, using a very sensitive enrichment culture.

5.9: Neonatal Infection Surveillance for MRSA



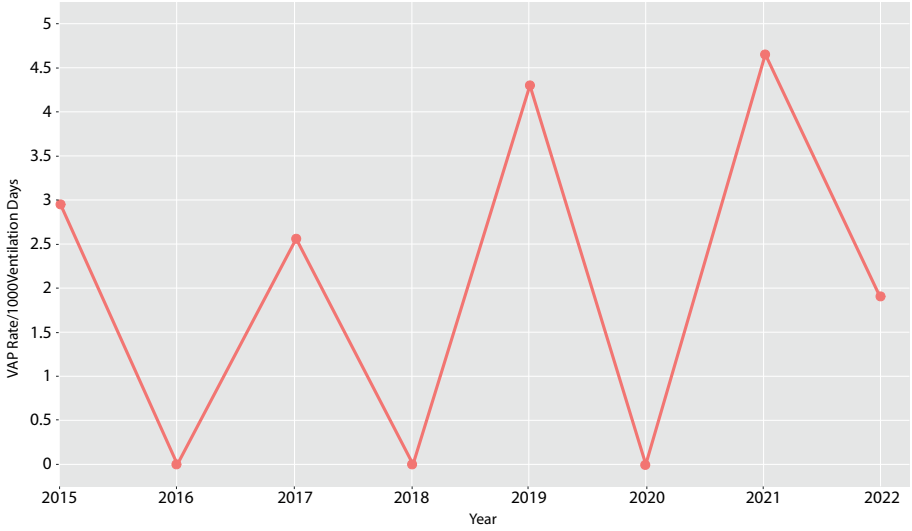
Year	2018	2019	2020	2021	2022
MRSA total	**14**	**12**	**18**	**30**	**7**
NICU acquired	11 (79%)	10 (83%)	6 (35%)	21 (70%)	2 (28%)
Positive on admission	3 (21%)	2 (17%)	11 (65%)	9 (30%)	5 (72%)
Blood stream infection	0	0	1	0	0
Admissions	1517	1579	1240	1242	1132
Total cases per 100 admissions	0.92	0.76	1.45	2.41	0.62
NICU -acquired cases per 100 admissions	0.73	0.63	0.48	1.69	0.18

5.10: Neonatal Infection Surveillance

Year	2019	2020	2021	2022
Multi Drug Resistant Organisms (MDRO)				
VRE	2*	1	0	10
CPE	0	0	0	1^
Gentamicin resistant GNB	8	13	5	10[∞]
ESBL	-	-	5	8
Ventilator Associated Pneumonia (VAP) VAP/1000 ventilator days	4.30	0.0	3.45	1.93
COVID 19	0	0	3	1

VRE: vancomycin resistant enterococci. Infants in the NICU/HDU are screened for VRE monthly. There were 10 cases identified in 2022, 9 of which were associated with an outbreak in Q2 and Q3. No case of infection occurred.
CPE: carbapenemase-producing enterobacterales. Infants in the NICU/HDU are screened for CPE weekly. ^The infant identified has a blood stream infection with an E.coli, cabapenamase type OXA-48, and this was linked with a maternal infection.
Gentamicin resistant GNB (gram negative bacilli) and Extended spectrum β-lactamase (ESBL) enterobacterales: Infants in the NICU/HDU are screened for carriage of gentamicin resistant enterobacterales fortnightly and ESBL enterobacterales monthly,
[∞]3 isolates were both gentamicin resistant and ESBL positive
VAP: Ventilator associated pneumonia

5.11: VAP rate per 1000 ventilator days



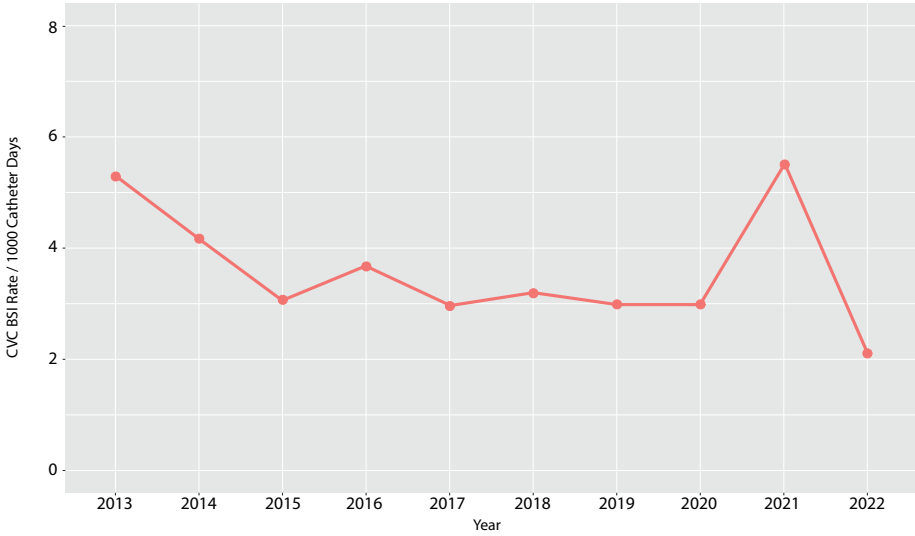
Year	2015	2016	2017	2018	2019	2020	2021	2022
VAP rate /1000 ventilator days	2.95	0.00	2.56	0.00	4.30	0.00	3.45	1.93

Note: Table updated in 2022

Central Line Associated Blood Stream Infection Surveillance

A record is kept (at a specified time each day) of the number of infants in the NICU with a central line in situ. A central line, for the purpose of our definition, is defined as the presence of a UAC, UVC, PICC and/or a surgically placed central line. The total number of central line days is calculated on a monthly basis and is reported to the Microbiology Department. The Microbiology Department, in turn, then reports the Central Line Associated Blood Stream Infection (CLA-BSI) rate. The CLA-BSI rate is calculated by dividing the number of CLA-BSIs by the number of central line days and multiplying by 1000 giving a central line associated BSI rate per 1000 catheter days.

5.12: CLA-BSI Rate per 1000 catheter days



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
CVC BSI/1000 catheter days	5.3	4.2	3.1	3.7	2.9	3.2	3.0	2.9	5.4	2.1

Number of Infections in VLBW Infants report to VON

The data presented in this section pertains to the infection rates in our very low birthweight (VLBW) population. It specifically reports on the 2022 cohort of VLBW infants reported to VON and so may include episodes of infection that occur in 2023. It may also include infections that are documented in another hospital, but according to the rules of the database, are required to be reported by our centre. For this reason, the figures reported here may vary slightly from those reported in the previous section.

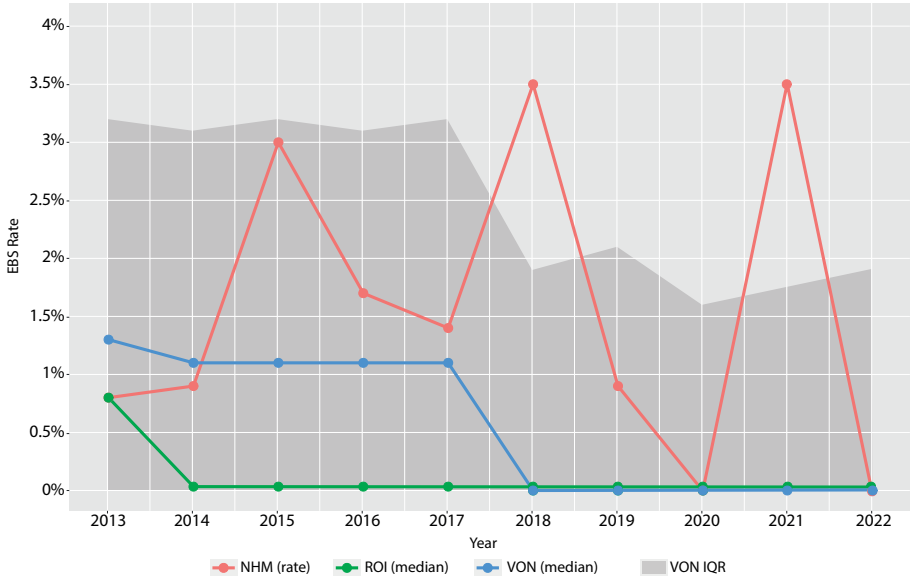
Cases of Early Onset Sepsis reported to VON

Early bacterial sepsis is defined as the recovery of any one of a listed number of "bacterial pathogens" from a blood culture and/or cerebrospinal fluid (CSF) obtained on D1, 2 or 3 of life. This is expressed as a percentage of the total number of infants admitted to the NICU excluding DR deaths. (Note: Strep mitis/oralis is not on the list of pathogens to be reported to VON).

5.13: Cases of Early Onset Sepsis reported to VON

No cases to report.

5.14: Early Bacterial Sepsis



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cases	1/124	1/114	3/99	2/121	2/141	4/115	1/108	0/117	4/114	0/110
NMH (rate)	0.8%	0.9%	3.0%	1.7%	1.4%	3.5%	0.9%	0.0%	3.5%	0.0%
VON (rate)	2.3%	2.3%	3.3%	2.4%	2.6%	1.4%	1.5%	1.4%	1.3%	1.3%
VON (median)	1.3%	1.1%	1.1%	1.1%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%
ROI (median)	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Cases of Late Onset Bacterial Sepsis reported to VON

Late bacterial infection is defined the recovery of any one of a listed number of "bacterial pathogens" from a blood culture and/or CSF obtained after D3 of life. The denominator in this case excludes infants who died or were transferred to another institution before/on D3.

If a bacterial pathogen and a coagulase negative staphylococcus are recovered from the same sepsis workup performed after D3, the case is only coded as a case of a late bacterial infection and not a CONS infection.

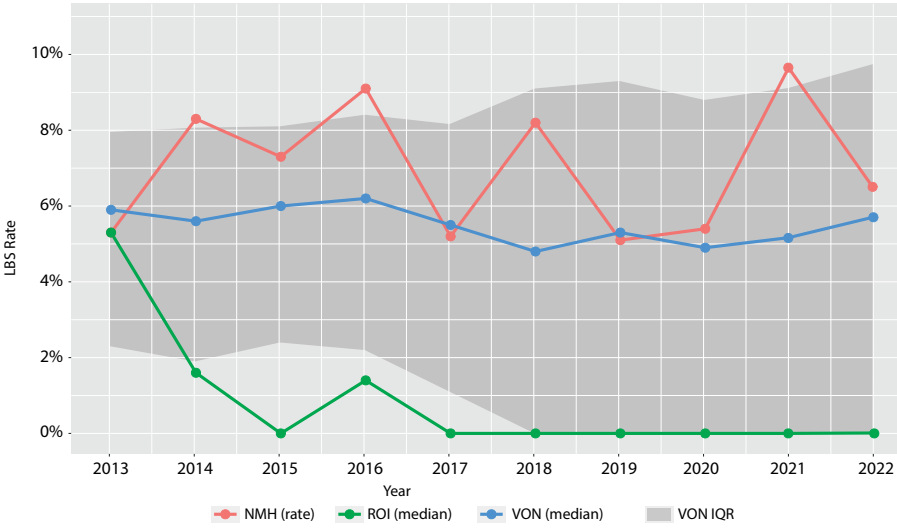
If a bacterial pathogen and a candida species are recovered from the same sepsis workup performed after D3, the case is coded both as a case of a late bacterial infection and a fungal infection.

5.15: Cases of Late Onset Bacterial Sepsis reported to VON

Cases	GA	BW	Organism identified	Blood	CSF	Outcome	Cause of Death
1	23	555	E. coli	Culture positive	N/A	Died D5	E. Coli sepsis, extreme prematurity, severe RDS, clinical chorioamnionitis, PPROM x 2 days
2	25	900	E. coli	Culture positive	Culture negative	Discharged home	
3	26	590	E. coli	Culture negative	Culture negative	Died D54	Twin 2, MCDA. Severe respiratory failure, NEC, liver dysfunction, extreme prematurity, ELBW (Died in 2023)
4	29	1180	K. pneumoniae	Culture positive	Culture negative	Discharged home	
5	24	520	E. cloacae	Culture positive	Culture negative	Discharged home	
6	26	450	E. cloacae	Culture positive	N/A	Died D10	Gram negative sepsis, extreme prematurity, ELBW, severe RDS, seizures.
7	26	700	E. cloacae	Culture positive	CSF: WCC 46, RBC 1832. Gram stain positive for GNR. Culture negative	Died D12	Twin 1, MCDA. Severe RDS, extreme prematurity gram negative sepsis

- *No infant with early onset sepsis developed late onset bacterial sepsis.*
- *No infant with late onset bacterial sepsis had a bout of CONS sepsis.*
- *N/A: implies no CSF sample obtained for culture or PCR*

5.16 Late Bacterial Sepsis



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cases	6/114	9/108	7/96	10/110	7/134	9/110	5/98	6/112	10/104	7/103
NMH (rate)	5.3%	8.3%	7.3%	9.1%	5.2%	8.2%	5.1%	5.4%	9.6%	6.8%
VON (rate)	8.1%	8.4%	8.6%	8.9%	8.3%	7.5%	7.7%	7.5%	7.5%	8.0%
VON (median)	5.9%	5.6%	6.0%	6.2%	5.5%	4.8%	5.3%	4.9%	5.0%	5.4%
ROI (median)	5.3%	1.6%	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

5.17: Pathogens causing Late Onset Bacterial Sepsis in Infants reported to VON

Year	2018	2019	2020	2021	2022
GBS	3	0	0	2	0
GNB	6	5	4	3	7
Staph aureus	1	1	0	2	0
MRSA	0	0	1	0	0
Polymicrobial sepsis	0	0	0	2	0
Other	0	0	0	1	0
Total	**10***	**6***	**5**	**10**	**7**

** No. of infants with 2 separate episodes of late onset sepsis*

Cases of Late Onset CONS Sepsis reported to VON

Coagulase negative staphylococcus infection is defined as a coagulase negative staphylococcus isolated from a blood culture obtained either from a central line or a peripheral blood sample and/or recovered from CSF fluid obtained by LP, ventricular tap or ventricular drain in association with signs of generalised infection (i.e. apnoea, temperature instability, worsening respiratory distress or haemodynamic instability) and treatment with 5 or more days of intravenous antibiotics after the above cultures were obtained. If the infant died, was discharged or transferred prior to completion of the 5 days of antibiotics, the condition would be still met if the intention was to treat for 5 or more days. The denominator is the same as that for late bacterial infection. If a bacterial pathogen and a coagulase negative staphylococcus are recovered from the same sepsis workup performed after D3, the case is only coded as a case of a late bacterial infection and not a CONS infection.

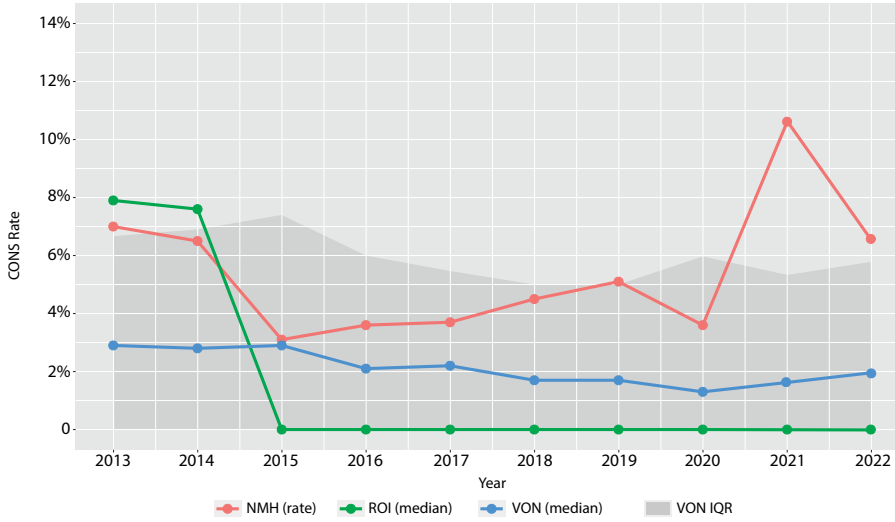
Of note, as VON only require one positive blood culture for a coagulase negative staphylococcus to meet their definition, there are often more cases of CONS sepsis reported to VON compared to the number of cases reported by our laboratory.

5.18: Cases of Late Onset CONS Sepsis reported to VON

Cases	GA	BW	Organism identified	Blood	CSF	Outcome	Cause of Death
1	25	590	CONS	Culture positive x4	N/A	Died D28	Imperforate anus and colostomy formation, skeletal abnormalities, complications of extreme prematurity, ELBW, severe RDS
2	25	675	CONS	Culture positive x1 on two separate occasions (2 bouts of CONS sepsis)	N/A	Discharged home	
3	25	900	CONS	Culture positive x2	N/A	Discharged home	
4	26	550	CONS	Culture positive x2 on 2 separate occasions (2 bouts of CONS sepsis)	N/A	Discharged home	
5	28	630	CONS	Blood culture x6 (documented in another centre)	N/A	Discharged home	
6	28	875	CONS	Blood culture x1	N/A	Discharged home	
7	32	1145	CONS	Blood culture x1	N/A	Discharged home	

- *No infant with early onset sepsis developed CONS sepsis.*
- *One infant with late onset bacterial sepsis had a bout of CONS sepsis*
- *N/A: implies no CSF sample obtained for culture or PCR*

5.19: CONS Sepsis



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cases	8/114	7/108	3/96	4/110	5/134	5/110	3/98	4/112	11/104	7/103
NMH (rate)	7.0%	6.5%	3.1%	3.6%	3.7%	4.5%	3.1%	3.6%	10.6%	6.8%
VON (rate)	5.3%	5.4%	5.9%	5.1%	4.9%	5.0%	4.8%	4.8%	4.7%	5.0%
VON (median)	2.9%	2.8%	2.9%	2.1%	2.2%	1.7%	1.7%	1.3%	1.5%	1.9%
ROI (median)	7.9%	7.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

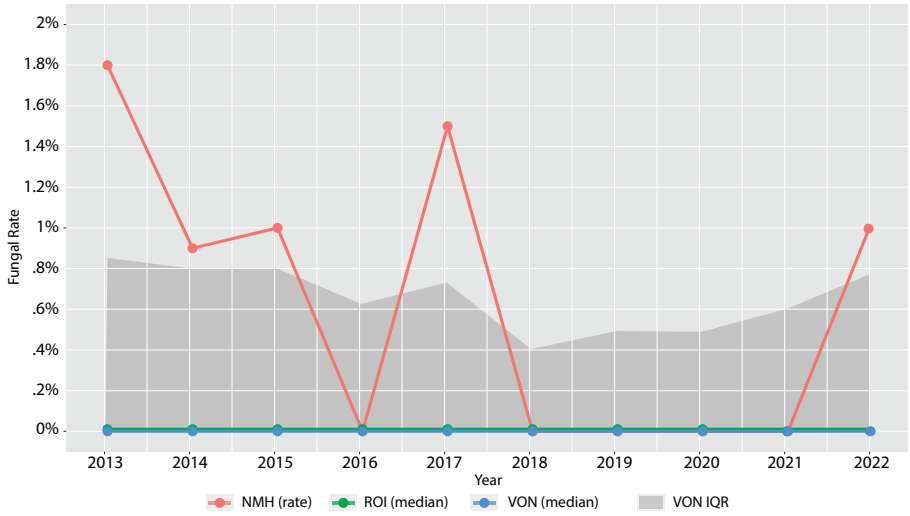
Cases of Fungal Sepsis reported to VON

Fungal infection is defined as a fungus being identified from a blood culture obtained either from a central line or from a peripheral blood sample after D3. The denominator is the same as for late bacterial infection.

5.20: Cases of Fungal Sepsis reported to VON

Cases	GA	BW	Organism identified	Blood	CSF	Outcome	Cause of Death
1	24	660	Candida albicans	Culture positive	Culture negative	Discharged home	

5.21: Fungal Sepsis



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cases	2/114	1/108	1/96	0/110	2/134	0/110	0/99	0/112	0/104	1/103
NMH (rate)	1.8%	0.9%	1.0%	0.0%	1.5%	0.0%	0.0%	0.0%	0.0%	1.0%
VON (rate)	0.9%	0.9%	0.9%	0.9%	1.0%	0.9%	0.9%	1.0%	1.0%	1.0%
VON (median)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ROI (median)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Shrunken SMRs with 95% Confidence Intervals for Infections for NMH

5.22 Yearly Shrunken SMRs with 95% Confidence Intervals for Infections for NMH

Year	2018	2019	2020	2021	2022
Shrunken SMR (Confidence Interval) for late bacterial infection (any location)	1.0 (0.5-1.7)	0.7 (0.3-1.3)	0.7 (0.3-1.3)	1.1 (0.5-1.7)	0.7 (0.3-1.3)
Shrunken SMR (Confidence Interval) for coagulase negative infection (any location)	0.9 (0.3-1.8)	0.9 (0.2-2.0)	0.8 (0.3-1.7)	2.0 (1.0-3.2)	1.5 (0.7-2.6)
Shrunken SMR (Confidence Interval) for nosocomial infection (any location)	1.0 (0.5-1.5)	0.8 (0.4-1.4)	0.7 (0.4-1.2)	1.4 (0.9-2.1)	1.1 (0.6-1.7)
Shrunken SMR (Confidence Interval) for fungal infection (any location)	0.2 (0.0-1.3)	0.4 (0.0-2.1)	0.3 (0.0-1.7)	0.2 (0.0-1.3)	1.0 (0.1-3.3)
Shrunken SMR (Confidence Interval) for any late infection (any location)	0.9 (0.5-1.1)	0.7 (0.3-1.3)	0.7 (0.3-1.2)	1.4 (0.9-2.0)	1.1 (0.6-1.7)

** Lower and upper bounds of Confidence Interval (CI) does not include 1.0*

5.23: Composite Shrunken SMRs with 95% Confidence Intervals for Infections for NMH

Year	2016-2018	2017-2019	2018-2020	2019-2021	2020-2022
Composite Shrunken SMR (Confidence Interval) for late bacterial infection (any location)	0.9 (0.6-1.3)	0.8 (0.5-1.2)	0.8 (0.5-1.2)	0.8 (0.5-1.2)	0.8 (0.5-1.2)
Composite Shrunken SMR (Confidence Interval) for coagulase negative infection (any location)	0.8 (0.4-1.2)	0.9 (0.5-1.4)	0.9 (0.5-1.4)	1.3 (0.8-1.9)	1.5 (0.9-2.1)
Composite Shrunken SMR (Confidence Interval) for nosocomial infection (any location)	0.9 (0.7-1.3)	0.9 (0.6-1.2)	0.9 (0.6-1.2)	1.0 (0.7-1.2)	1.1 (0.8-1.5)
Composite Shrunken SMR (Confidence Interval) for fungal infection (any location)	0.7 (0.1-1.8)	0.8 (0.1-2.1)	0.8 (0.1-2.1)	0.1 (0.0-0.7)*	0.4 (0.0-1.3)
Composite Shrunken SMR (Confidence Interval) for any late infection (any location)	0.9 (0.7-1.2)	0.8 (0.5-1.2)	0.8 (0.5-1.2)	1.0 (0.7-1.3)	1.1 (0.8-1.4)

** Lower and upper bounds of Confidence Interval (CI) does not include 1.0*

Immunisations

The NICU immunises all infants who are still in the unit at 8 weeks of age (D56 of life) according to recommended guidelines. Rotavirus vaccine is administered to infants in the NICU unless the infant is receiving Level 1 (intensive) care and/or the infant is recovering from a recent bout of NEC. In these clinical situations, rotavirus vaccine administration is generally deferred for one month. In 2022, all infants received their recommended immunisations at the recommended time.

5.24: Immunisations administered in the NICU

Year	2018	2019	2020	2021	2022
Sets of Immunisations administered	48	49	24	34	32
Infants immunised	44	46	24	33	31

SECTION 6: Infant Feeding and Nutrition in the Neonatal Unit

We continued to work hard through 2022 to provide the best possible nutrition and feeding experience for all infants in our care. Supporting the use of maternal milk (MM) remained a priority, with a key focus on improving breastfeeding (BF) rates. This was supported by our multidisciplinary quality improvement initiatives (QII)s, PRIME (PReterm Infants need Milk Early) and PRIME-B (Breastfeeding). We are delighted to report further improvements which we believe translates into improved outcomes for infants and experiences for their families.
2022 also saw the introduction of our ACoRN (Allied Care of at Risk Newborns) Programme which aims to support the neurodevelopment of infants in the neonatal unit and post discharge home. This multidisciplinary QII aligns with our PRME/PRIME-B and Family Integrated Care (FICare) initiatives, and is already demonstrating a positive impact.
Unfortunately, the year also saw the loss of valued dietetic staff, including temporary staff who left to take up permanent posts elsewhere. Difficulties with recruitment, likely due to competition with permanent vacancies elsewhere, resulted in the need for much planned project work and service expansion to be put on hold, as acute patient care was prioritised.
During the year we also welcomed a further return to 'normal', as the challenges experienced during the Covid-19 pandemic settled and more face-to-face contact was possible.

Our on-going audit of nutrition practices and growth amongst infants in the neonatal unit, revealed further improvements for our key performance indicators (KPIs), reflecting the on-going efforts of staff and parents. We also note some areas for improvement which we need to address. An updated summary is presented in the tables below, with some of the highlights for the year 2022 as follows:

- The percentage of inborn infants born ≤31 weeks gestation or ≤1500 g who received MM during their stay in the neonatal unit remained high at 99% (99% in 2021).
- The median time (age) at which MM was first received amongst inborn infants born ≤31 weeks gestation or ≤1500 g, reduced further to 17 hours (23 hours in 2022); and the percentage who received MM for the first time within 24 hours of birth increased to 63% (52% in 2021).
- The percentage of inborn infants born ≤31 weeks gestation or ≤1500 g who breastfed in the neonatal unit amongst those who received oral feeds, remained at 72% (72% in 2021).
- The percentage of infants born ≥31 weeks gestation or ≤1500 g who received MM at the time of discharge to home, increased to 86% (80% in 2021); and the percentage breastfeeding at that time increased to 78% (54% in 2021). Regrettably no infant in this cohort achieved exclusive breastfeeding prior to discharge, however, many breastfed for the first time and/or achieved full breastfeeding post-discharge to home, although these data are not routinely collected.
- The median time (age) at which PN was initiated amongst inborn infants born ≤31 weeks gestation or ≤1500 g, reduced further to 1.5 hours (1.9 hours in 2021); and the percentage who received PN within 4 hours of birth increased to 90% (84% in 2021).
- There was a further reduction in overall PN usage, with a total of 728 PN units dispensed (and used) (882 in 2021); and the proportion of individualised PN (IPN), as compared with standardised PN (SPN), reduced to 5% (11% in 2021). These reductions are associated with cost and time savings.

Please note

- Data refer to practices in our neonatal unit only.
- Data are based on infants' year of birth rather than year of admission or discharge unless otherwise specified. In most cases the year of birth and year or admission match, except occasionally when an outborn infant is admitted in the year following their birth, e.g. for Ophthalmology review.
- Values presented in tables refer to the number (%) of infants and are based on the year the infant was born, unless otherwise specified.
- Some values have been rounded for clarity; as a result, some percentage totals do not appear to equal 100%.
- Data are presented for the past 5 years. Please see earlier reports for information on previous years.
- Some tables are separated into inborn and outborn cohorts, as some of our practices may only be reflected amongst inborn infants.
- Tables are updated yearly. Data may vary slightly for those reported in previous years due to corrections.
- There may be some discrepancies between actual and reported practices due to challenges with data capture from the electronic health record (MN-CMS).
- **'Breast milk'** includes maternal milk (MM) and donor milk (DM); **'Maternal milk'** refers to mother's own milk provided directly as breastfeeds or expressed (pumped); **'Donor milk'** refers to pasteurised donor milk sourced from the Milk Bank in Enniskillen, Co Fermanagh. The main indication for using DM is to avoid the use of formula milk (FM) when establishing feeds if MM is not available for infants at higher risk of formula milk intolerance. In our unit this applies to infants born very preterm, i.e. ≤31 weeks gestation or very low birth weight (VLBW), i.e. 1.5 kg. Typically, infants who receive DM also receive MM suggesting that the reason for using DM is an issue with MM supply rather than a reluctance to provide MM.
- **'Feeds'** refers to feeds delivered via the gastro-intestinal tract, i.e. oral feeds and tube feeds, and includes breast milk and formula milk feeds; **'Oral feeds'** refers to feeds delivered directly into the mouth, and includes breastfeeds and bottle feeds; **'Tube feeds'** refers to feeds delivered via a feeding tube, and includes intra-gastric and intra-jejunal tube feeds. The standard tube-feed type is intra-gastric.
- **'Parenteral nutrition'** (PN) refers to nutrition delivered intravenously. For the purpose of this chapter, it refers to fluids containing amino acids and other nutrients, and excludes fluids containing glucose or electrolytes only.
- **Individualised PN** (IPN) is ordered according to an infant's individual needs and is supplied from off-site; **Standardised PN** (SPN) contains standard concentrations of nutrients and is available in stock for immediate use. SPN is provided according to the national neonatal SPN protocol.
- **Abbreviations: CA**: Corrected Age; DM: Pasteurised Donor Milk; **FM**: Formula Milk; **IPN**: Individualised PN; **IQR**: Interquartile Range (1st quartile – 3rd quartile); **KPI:** Key Performance Indicator; **MM**: Maternal / Mother's Own Milk; **MN-CMS**: Maternity and Newborn Clinical Management System; **NIS**: Newborn Information System; **PN**: Parenteral Nutrition; **QII**: Quality Improvement Initiative; **SPN**: Standardised PN.

6.1 Feed type received in the neonatal unit by infants born ≤31 weeks gestation or ≤1500g

Table 6.1.1 Infants born ≤31 weeks gestation or ≤1500g - inborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Maternal milk only	56 (45%)	37 (33%)	57 (47%)	85 (72%)	66 (59%)
Maternal milk and donor milk or formula milk (*combination*)	65 (52%)	74 (67%)	63 (52%)	32 (27%)	44 (40%)
Donor milk or formula milk only (*no maternal milk*)	3 (2%)	0 (0%)	1 (1%)	1 (1%)	*1 (1%)*
Total inborn cohort who received feeds	**124**	**111**	**121**	**118**	**111**
Feeds not received – excluded	*6*	*8*	*4*	*7*	*6*
Total inborn cohort	*130*	*119*	*125*	*125*	*117*

Any maternal milk: 2018: *121 (98%)****; 2019:*** *111 (100%);* ***2020:*** *120 (99%);* ***2021****:118 (99%);* ***2022:****110 (99%)*
Any donor milk: 2018: *28 (23%);* ***2019:*** *34 (31%);* ***2020:*** *43 (35%);* ***2021****:15 (13%);* ***2022:****34 (31%)*

Table 6.1.2 Infants born ≤31 weeks gestation or ≤1500g - outborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Maternal milk only	7 (25%)	9 (47%)	14 (61%)	14 (58%)	9 (50%)
Maternal milk and donor milk or formula milk (*combination*)	17 (61%)	8 (42%)	8 (35%)	8 (33%)	8 (44%)
Donor milk or formula milk only (*no maternal milk*)	4 (14%)	2 (11%)	1 (4%)	2 (8%)	1 (6%)
Total outborn cohort who received feeds	**28**	**19**	**23**	**24**	**18**
Feeds not received – excluded	*2*	*2*	*3*	*0*	*1*
Total outborn cohort	*30*	*21*	*26*	*24*	*19*

Any maternal milk: 2018: *24 (86%);* ***2019:*** *17 (89%);* ***2020:*** *22 (96%);* ***2021:*** *22 (92%);* ***2022:****17(94%)*
Any donor milk: : 2018: *7 (25%);* ***2019:*** *4 (21%);* ***2020:*** *5 (22%);* ***2021:*** *5 (21%)****; 2022:*** *3 (17%)*

6.2 First feed type received in the neonatal unit by infants born ≤31 weeks gestation or ≤1500g

Table 6.2.1: Infants born ≤31 weeks gestation or ≤1500g - inborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Maternal milk	109 (88%)	102 (92%)	114 (94%)	116 (98%)	107 (96%)
Donor milk	6 (5%)	8 (7%)	5 (4%)	1 (1%)	4 (4%)
Formula milk	9 (7%)	1 (1%)	2 (2%)	1 (1%)	0 (0%)
Total inborn cohort who received 1st feed	**124**	**111**	**121**	**118**	**111**
First feed not received – excluded	*6*	*8*	*4*	*7*	*6*
Total inborn cohort	*130*	*119*	*125*	*125*	*117*

Table 6.2.2: Infants born ≤31 weeks gestation or ≤1500g - outborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Maternal milk	14 (88%)	9 (90%)	16 (94%)	13 (93%)	8 (89%)
Donor milk	2 (13%)	1 (10%)	0 (0%)	1 (7%)	1 (11%)
Formula milk	0 (0%)	0 (0%)	1 (6%)	0 (0%)	0 (0%)
Total outborn cohort who received 1st feed	**16**	**10**	**17**	**14**	**9**
First feed not received – excluded	*14*	*11*	*9*	*10*	*10*
Total outborn cohort	*30*	*21*	*26*	*24*	*19*

'First feed' refers to the first feed an infant received in our neonatal unit.
'First feed not received' refers to infants who did not receive their first feed in our neonatal unit, e.g. if they did not receive feeds in our neonatal unit or if their first feed was given in another centre.

6.3 Time since birth to first receive maternal milk in the neonatal unit by infants born ≤31 weeks gestation or ≤1500g

Table 6.3.1: Infants born ≤31 weeks gestation or ≤1500g - inborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Time to receive 1st maternal milk (hours): median (IQR)	22 (11-37)	19 (11-36)	27 (13-49)	23 (13-44)	17 (9-43)
First maternal milk received within 24 hours	70 (58%)	67 (60%)	54 (45%)	61 (52%)	70 (63%)
Total inborn cohort who received 1st maternal milk	**121**	**111**	**119**	**117**	**111**
First maternal milk not received – excluded	*9*	*8*	*6*	*8*	*6*
Total inborn cohort	*130*	*119*	*125*	*125*	*117*

Table 6.3.2: Infants born ≤31 weeks gestation or ≤1500g – outborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Time to receive 1st maternal milk (hours): median (IQR)	68 (27-84)	61 (26-69)	42 (31-82)	43 (20-61)	58 (33-60)
First maternal milk received within 24 hours	4 (25%)	1 (10%)	2 (12%)	4 (29%)	2 (22%)
Total outborn cohort who received 1st maternal milk	**16**	**10**	**16**	**14**	**9**
First maternal milk not received – excluded	*14*	*11*	*10*	*10*	*10*
Total outborn cohort	*30*	*21*	*26*	*24*	*19*

"First maternal milk' refers to the first time maternal milk was received in our neonatal unit, even if donor milk or formula milk was received previously.
'First maternal milk not received' refers to infants who did not receive maternal milk for the first time in our neonatal unit, e.g. if they did not receive maternal milk or if the first time they received maternal milk was in in another centre.

6.4 Time since birth to first receive formula milk in the neonatal unit by infants born ≤31 weeks gestation or ≤1500g

Table 6.4.1: Infants born ≤31 weeks gestation or ≤1500g - inborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Time to receive 1st formula milk (days): median (IQR)	13 (5-27)	23 (10-42)	20 (10-39)	26 (12-43)	22 (16-33)
First formula milk received >14 days	33 (49%)	47 (72%	38 (67%	23 (70%)	36 (86%)
First formula milk received >28 days	17 (25%)	31 (48%)	22 (39%)	12 (36%)	15 (36%)
First formula milk received ≥32 weeks CA	65 (97%)	65 (100%)	56 (98%)	33 (100%)	42 (100%)
Total inborn cohort who received 1st formula milk	**67**	**65**	**57**	**33**	**42**
First formula milk not received – excluded	*63*	*54*	*68*	*92*	*75*
Total inborn cohort	*130*	*119*	*125*	*125*	*117*

Table 6.4.2: Infants born ≤31 weeks gestation or ≤1500g - outborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Time to receive 1st formula milk (days): median (IQR)	13 (11-18)	21 (9-41)	26 (7-35)	24 (15-37)	18 (18-18)
First formula milk received >14 days	4 (40%)	3 (60%)	4 (57%)	4 (100%)	2 (100%)
First formula milk received >28 days	0 (0%)	2 (40%)	3 (43%)	2 (50%)	0 (0%)
First formula milk received ≥32 weeks CA	10 (100%)	5 (100%)	6 (100%)	4 (100%)	2 (100%)
Total outborn cohort who received 1st formula milk	**10**	**5**	**7**	**4**	**2**
First formula milk not received – excluded	*20*	*16*	*19*	*20*	*17*
Total outborn cohort	*30*	*21*	*26*	*24*	*19*

'First formula milk' refers to the first time formula milk was received in our neonatal unit, even if maternal milk or donor milk was received previously.
'First formula milk not received' refers to infants who did not receive formula milk for the first time in our neonatal unit, e.g. if they did not receive formula milk or if the first time they received formula milk was in another centre.
Our current enteral feeding policy advises against using formula milk for infants born ≤31 weeks gestation or ≤1500 g until they are ≥32 weeks corrected age, ≥1500 g and tolerating enteral feeds x ≥7 days. As such, we expect most would be ≥14 days before receiving formula milk for the first time. Data for 2022 shows that this was not the case for 6 in-born infants (14%). On closer review, all 6 of these infants had a corrected age of ≥32 weeks, weight ≥1.42 kg, and were tolerating feeds at the time formula milk was first introduced.

6.5 Time since birth to first establish feeds at 150 mL/kg/day in the neonatal unit by infants born ≤31 weeks gestation or ≤1500g

Table 6.5.1: Infants born ≤31 weeks gestation or ≤1500g - inborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Time to 1st establish feeds at 150 mL/kg/d (days): median (IQR)	10 (8-13)	10 (9-11)	10 (8-11)	10 (9-13)	10 (9-12)
150 mL/kg/d feeds 1st established ≤9 days*	50 (44%)	39 (37%)	42 (38%)	30 (32%)	35 (36%)
Total inborn cohort who 1st established feeds at 150 mL/kg/d	**113**	**105**	**108**	**95**	**96**
150 mL/kg/d feeds 1st established prior to admission/ re-admission – excluded	*0*	*0*	*0*	*0*	*0*
150 mL/kg/d feeds not established – excluded	*17*	*14*	*17*	*30*	*21*
Total inborn cohort	*130*	*119*	*125*	*125*	*117*

Table 6.5.2: Infants born ≤31 weeks gestation or ≤1500g - outborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Time to 1st establish feeds at 150 mL/kg/d (days): median (IQR)	9 (8-12)	11 (8-13)	9 (8-14)	9 (8-12)	10 (9-12)
150 mL/kg/d feeds 1st established ≤9 days*	6 (50%)	3 (43%)	7 (50%)	6 (55%)	4 (44%)
Total outborn cohort who 1st established feeds at 150 mL/kg/d	**12**	**7**	**14**	**21**	**9**
150 mL/kg/d feeds 1st established prior to admission/re-admission – excluded	*9*	*9*	*3*	*10*	*7*
150 mL/kg/d feeds not established – excluded	*9*	*5*	*9*	*3*	*3*
Total outborn cohort	*30*	*21*	*26*	*24*	*19*

Infants subsequently may have advanced to a higher feed volume.
**Infants establishing feeds according to our current feeding protocol (i.e. feeds advancing by 20-30 mL/kg/day) would be expected to establish feeds of 150 mL/kg/day within 6-9 days of birth. Therefore, allowing for infants who may be advancing feeds at the slower rate of 20 mL/kg/day, all infants in our neonatal unit are expected to establish feeds of 150 mL/kg/day by day 9. The reasons why this may not be achieved include issues with feeding tolerance or delays with the supply of maternal milk.*

6.6 Oral feeding method in the neonatal unit by infants born ≤31 weeks gestation or ≤1500g

Table 6.6.1: Infants born ≤31 weeks gestation or ≤1500g - inborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Breastfeeding only	0 (0%)	1 (1%)	2 (3%)	2 (3%)	3 (4%)
Breastfeeding and bottle feeding (*combination*)	39 (39%)	59 (64%)	43 (55%)	52 (69%)	49 (68%)
Bottle feeding only (*no breastfeeding*)	62 (61%)	33 (35%)	33 (42%)	21 (28%)	20 (28%)
Total inborn cohort who received oral feeds	**101**	**93**	**78**	**75**	**72**
Tube feeds only (no oral feeds)– excluded	*23*	*18*	*43*	*44*	*39*
Feeds not received – excluded	*6*	*8*	*4*	*7*	*6*
Total inborn cohort	*130*	*119*	*125*	*125*	*117*

Any breastfeeding: 2018: *39 (39%);* ***2019:*** *60 (65%);* ***2020:*** *45 (58%);* ***2021:*** *54 (72%);* ***2022:*** *52 (72%)*
This table refers to oral feeds only, even if other feeds were received by tube.

Table 6.6.2: Infants born ≤31 weeks gestation or ≤1500g - outborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Breastfeeding only	0 (0%)	0 (0%)	1 (14%)	1 (7%)	0 (0%)
Breastfeeding and bottle feeding (*combination*)	2 (22%)	2 (25%)	3 (43%)	4 (29%)	3 (43%)
Bottle feeding only (*no breastfeeding*)	7 (78%)	6 (75%)	3 (43%)	9 (64%)	4 (57%)
Total outborn cohort who received oral feeds	**9**	**8**	**7**	**14**	**7**
Tube feeds only (no oral feeds)– excluded	*19*	*11*	*17*	*10*	*11*
Feeds not received – excluded	*2*	*2*	*2*	*0*	*1*
Total outborn cohort	*30*	*21*	*26*	*24*	*19*

Any breastfeeding: 2018: *2 (22%);* ***2019:*** *2 (25%);* ***2020:*** 4 (57%); ***2021:*** *5 (36%);* ***2022:*** *3 (43%)*
This table refers to oral feeds only, even if other feeds were received by tube.

6.7 Feed type received at final discharge to home from the neonatal unit by infants born ≤31 weeks gestation or ≤1500g

Year	2018	2019	2020	2021	2022
Maternal milk only	45 (49%)	34 (50%)	24 (45%)	28 (47%)	31 (63%)
Maternal milk and formula milk (*combination*)	12 (13%)	22 (32%)	15 (28%)	19 (32%)	11 (22%)
Formula milk only (*no maternal milk*)	34 (37%)	12 (18%)	14 (26%)	12 (20%)	7 (14%)
Total cohort discharged to home	**91**	**68**	**53**	**59**	**49**
Discharged to other centres or died – excluded	*69*	*72*	*98*	*90*	*87*
Total cohort	*160*	*140*	*151*	*149*	*136*

Any breast milk: 2018: *57 (63%);* ***2019****: 56 (82%);* ***2020****: 39 (74%);* ***2021****: 47 (80%);* ***2022****: 42 (86%)*

No infant was discharged home feeding on donor milk. The criteria for discontinuing donor milk was updated in 2021 and our neonatal unit now waits until infants are at least 32 weeks corrected age and weigh ≥1.5 kg, are tolerating full feeds and are considered to be no longer at higher risk of formula milk intolerance. These criteria are generally reached in advance of discharge home.

6.8 Feeding method at final discharge to home from the neonatal unit by infants born ≤31 weeks gestation or ≤1500g

Year	2018	2019	2020	2021	2022
Breastfeeding only*	0 (0%)	1 (2%)	0 (0%)	0 (0%)	0 (0%)
Breastfeeding and bottle feeding only (combination)	17 (19%)	27 (40%)	28 (53%)	31 (53%)	38 (78%)
Bottle feeding only	73 (80%)	39 (57%)	25 (47%)	27 (46%)	11 (22%)
Tube Feeding and breast or bottle feeding** (Combination)	1[a] (1%)	1[a,b] (1%)	0 (0%)	1[a,b] (2%)	0 (0%)
Total cohort discharged to home	**91**	**68**	**53**	**59**	**49**
Discharged to other centres or died – excluded	69	72	98	90	87
Total cohort	160	140	151	149	136

Any breastfeeding: 2018*: 17 (19%);* ***2019:*** *29 (43%);* ***2020:*** *28 (53%);* ***2021****: 32 (54%);* ***2022****: 38 (78%)*

**Some infants achieved exclusive breastfeeding post discharge home, but these data are not currently included in this audit.*

***No infant received exclusive tube feeds at the time of discharge to home.*

atube feeding and bottle feeding combined; btube feeding and breastfeeding combined.

The table refers to feeding method at the time of discharge only; some infants may have breastfed previously during their stay in the neonatal unit or started breastfeeding post discharge from the neonatal unit, but infants are only recorded as brea stfeeding at the time of discharge if they were breastfeeding at that time.

Data on breastfeeding at the time of discharge to home in 2018 may not be reliable due to difficulties extracting this data from MN-CMS.

6.9. Parenteral nutrition type in the neonatal unit by infants born ≤31 weeks gestation or ≤1500 g

6.9. Infants born ≤31 weeks gestation or ≤1500 g - inborn and outborn cohorts combined					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Standardised PN only	87 (63%)	110 (88%)	113 (85%)	96 (77%)	115 (90%)
Individualised PN only	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Standardised PN and Individualised PN (combination)	51 (37%)	15 (12%)	20 (15%)	29 (23%)	13 (10%)
Total cohort who received PN	**139**	**125**	**133**	**125**	**128**
PN not received – excluded	*21*	*15*	*18*	*24*	*8*
Total cohort	*160*	*140*	*151*	*149*	*136*

This table refers to the PN type received by infants in the neonatal unit at any time. It includes additional infants who may not have received PN for the first time in our unit and so are not included in table 6.9. An infant is included as SPN and IPN combined if they received any IPN in addition to any SPN while in the neonatal unit.
Our neonatal unit practice is to provide PN for all infants born ≤31 weeks or ≤1500 g until adequate feeds are established; however, some infants did not receive PN in our unit as either they died before PN could be initiated, they were admitted to the unit from another centre after PN had been discontinued, or they established feeds more quickly than usual and so did not receive PN.

6.10. Time since birth to first receive Parenteral nutrition in the neonatal unit by infants born ≤31 weeks gestation and/or ≤1500 g

6.10.1. Infants born ≤31 weeks gestation or ≤1500 g - inborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Time to receive 1st PN (hours): median (IQR)	2.6 (1.7-4.9)	2.2 (1.5-3.5)	1.7 (1.3-3.2)	1.9 (1.2-2.9)	1.5 (1.1-2.2)
First PN received within 4 hours	76 (64%)	93 (81%)	95 (82%)	94 (84%)	104 (90%)
Total outborn cohort who received 1st PN	**118**	**115**	**115**	**111**	**116**
First PN not received – excluded	*12*	*4*	*10*	*14*	*1*
Total outborn cohort	*130*	*119*	*125*	*125*	*117*

6.10.2. Infants born ≤31 weeks gestation or ≤1500 g - outborn					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Time to receive 1st PN (hours): median (IQR)	9.6 (5.8-12.2)	10.1 (9.2-14.2)	11.7 (8.0-25.7)	7.5 (7.2-13.9)	7.0 (4.7-8.0)
First PN received within 4 hours	2 (12%)	0 (0%)	1 (6%)	0 (0%)	2 (22%)
Total outborn cohort who received 1st PN	**17**	**10**	**16**	**12**	**9**
First PN not received – excluded	*13*	*11*	*10*	*12*	*10*
Total outborn cohort	*30*	*21*	*26*	*24*	*19*

These tables include infants who received PN for the first time in our neonatal unit. Additional infants may have received PN during their stay in our unit but are omitted from these tables if they did not receive PN for the first time in our unit.
Regarding time to first receive PN, no distinction is made between IPN or SPN, however SPN is generally the PN type when starting PN for the first time.

6.11 Parenteral Nutrition duration in the neonatal unit by infants born ≤31 weeks gestation or ≤1500g

6.11. Infants born ≤31 weeks gestation or ≤1500 g - inborn and outborn cohorts combined					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Duration of PN per infant who received PN (days):median (IQR)	7.4 (6.1-8.8)	7.7 (6.2-9.3)	7.5 (6.3-8.8)	7.7 (6.0-9.6)	7.8 (6.2-9.8)
Duration of PN per infant who received PN (days): range*	4-37	1-25	1-16	1-29	1-39
Total duration of PN (days)	**1057**	**970**	**953**	**987**	**972**

***'Duration of PN'** in this table refers to the duration of the initial period of PN, generally while establishing feeds, and excludes any subsequent PN that may have been provided after the initial PN had discontinued. Some infants received a shorter than expected duration of PN if they transferred or died before PN was due to discontinue.*
**The duration of PN (days) range has been rounded to full days; if the duration of PN is less than a day, it appears as 1 day.*
No distinction is made between IPN or SPN days

6.12 Parenteral Nutrition type in the neonatal unit by ALL infants who received Parenteral Nutrition

6.12. All infants who received Parenteral Nutrition					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Standardised PN only	94 (60%)	133 (87%)	125 (82%)	103* (78%)	127 (89%)
Individualised PN only	1 (1%)	1 (1%)	0 (0%)	1* (1%)	1 (1%)
Standardised PN and Individualised PN (combination)	61 (39%)	19 (12%)	28 (18%)	28* (21%)	14 (10%)
Total infants who received PN	**156**	**153**	**153**	**132***	**142**

Data provided from the MN-CMS and are based on the number of infants who received PN and the duration of PN during the specified **calendar year.** *An infant is included as SPN and IPN combined if they received any IPN in addition to any SPN while in the neonatal unit.*

**Due to the cyber-attack, data for 48 days from 14 May to 30 June 2021 is missing. This is equivalent to 13% of the year. Adjusting the totals upwards by 13% would suggest that the actual number of infants who would have received PN in 2021 was in the order of 116 for SPN, 32 for SPN and IPN combined, and 149 total, similar to other years.*

6.13. Parenteral nutrition duration in the neonatal unit by ALL infants who received parenteral nutrition

6.13. All infants who received Parenteral Nutrition					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Duration of PN per infant who received PN (days): median (IQR)	8 (5-11)	8 (5-10)	8 (6-10)	9 (6-10)	8 (6-10)
Duration of PN per infant who received PN (days): range	1-101	1-30	1-44	1-37	1-35
Total duration of Standardised PN (days)	1188 (76%)	1114 (93%)	1133 (94%)	1021* (93%)	1204 (97%)
Total duration of Individualised PN (days)	379 (24%)	79 (7%)	78 (6%)	82* (7%)	38 (3%)
Total duration of PN (days)	**1567**	**1193**	**1211**	**1103***	**1242**

Data provided from the MN-CMS and are based on the days of PN infusion during the specified ***calendar year.*** *Data refer to the total duration of all PN that infants received during their stay in the neonatal unit, i.e. days are cumulative and may include one or more episodes of PN. No distinction is made between IPN or SPN days unless specified.*

Prior to 2021, the number of days of PN is based on the number of PN orders which at that time generally corresponded to one day of PN for one infant. From 10 May 2021, we extended the infusion time for each SPN order from 24 to 48 hours. There was no change for IPN orders, i.e. each IPN order continues to correspond to one day of PN for one infant. From 2021, the number of days of PN is based on the number of hours that PN was infused per infant during each calendar year.

**Due to the cyber-attack, data for 48 days from 14 May to 30 June 2021 is missing. This is equivalent to 13% of the year. Adjusting the totals upwards by 13% would suggest that the actual duration of PN was in the order of 1154 for SPN, 93 days for IPN, and 1246 days for SPN and IPN combined, similar to other years.*

6.14. Parenteral nutrition usage in the neonatal unit by ALL infants who received parenteral nutrition

6.14. All infants who received Parenteral Nutrition					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Total Standardised PN units dispensed/used	1000 (74%)	956 (94%)	1069 (93%)	786 (89%)	694 (95%)
Total Individualised PN units dispensed/used	353 (26%)	66 (6%)	75 (7%)	96 (11%)	34 (5%)
Total PN units dispensed	**1353**	**1022**	**1144**	**882**	**728**

Data provided from the Pharmacy Department. One unit of PN refers to one bag of PN aqueous solution. This PN aqueous solution is generally infused together with a PN lipid solution.

6.15. Tube feeding in the neonatal unit by infants born ≥ 35 weeks gestation.

6.15. Infants born ≥35 weeks gestation who received tube feeds					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Duration of tube feeding (days):	3 (2-8)	3 (1-6)	3 (1-7)	3 (2-6)	3 (1-4)
Duration of tube feeding (days): range	1-68	1-43	1-42	1-31	1-29
Duration of tube feeding <4 days	93 (51%)	133 (56%)	142 (57%)	91 (57%)	144 (72%)
Duration of tube feeding 4-7 days	40 (22%)	62 (26%)	52 (21%)	40 (25%)	37 (19%)
Duration of tube feeding 8-14 days	33 (18%)	26 (11%)	36 (14%)	24 (15%)	14 (7%)
Duration of tube feeding >14 days	17 (9%)	18 (8%)	20 (8%)	5 (3%)	5 (3%)
Total infants born ≥35 weeks gestation who received tube feeds	183	239	250	160	200
Infants born 35 weeks gestation who did not receive tube feeds - excluded	912	1000	644	768	669
Total infants born 35 weeks gestation	1095	1239	894	928	869

Data provided from the MN-CMS and include infants who received more than one tube feed in the neonatal unit; it excludes infants who had a single tube feed recorded.
Infants born ≥35 weeks gestation are not expected to require tube feeding unless there is an issue with their oral feeding ability or they have a nutritional requirement that exceeds their oral feeding intake.
***Due to the cyber-attack, data for 48 days from 14 May to 30 June 2021 is missing. This is equivalent to 13% of the year. Adjusting the totals upwards by 13% would suggest that the actual total number of infants born ≥35 weeks gestation who received tube feeds is closer to 180*

6.16. Tube feeding at final discharge to home from the neonatal unit by ALL infants

6.16 All infants who received tube feeds at discharge to home					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Infants born 31 weeks gestation	0	1	0	1	0
Infants born 32-36 weeks gestation	2*	1	0	0	0
Infants born 32-36 weeks gestation	0	1	1	0	0
Total infants who received tube feeds at discharge to home	**2**	**3**	**1**	**1**	**0**

Data provided by Clinical Nurse Specialist - Neonatal Discharge Planning. This data includes all infants admitted to the neonatal unit, including those born ≤31 weeks or ≤1500 g who are also included in table 6.8.
**One of the infants born 32-36 weeks gestation had a birth weight <1500 g, and so is included in table 6.8, which reports on infants born ≤31 weeks gestation or ≤1500 g.*

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Thank you also to the Blood Bikes Medical Transport Service, which transports maternal milk from mothers who are unable to be present with their infants at NMH. This helps to ensure infants benefit from their mothers' milk in a timelier manner than might otherwise be possible.

Roberta McCarthy
Dietitian Manager (Neonatology)

I Demographics of first time admissions to the neonatal unit of infants born ≤31 weeks gestation or ≤1500g

Infants born ≤31 weeks gestation or ≤1500 g - first time admissions to the neonatal unit					
Year	**2018**	**2019**	**2020**	**2021**	**2022**
Admission source					
Inborn	130 (81%)	119 (85%)	125 (83%)	125 (84%)	117 (86%)
Outborn	30 (19%)	21 (15%)	26 (17%)	24 (16%)	19 (14%)
Total cohort	**160**	**140**	**151**	**149**	**136**
Gestation and birth weight					
Born <28 weeks gestation or <1 kg	70 (44%)	67 (48%)	60 (40%)	65 (44%)	62 (46%)
Born 28 weeks gestation and ≥1 kg or born 1-1.5 kg and ≥28 weeks gestation	90 (56%)	73 (52%)	91 (60%)	84 (56%)	74 (54%)
Total cohort	**160**	**140**	**151**	**149**	**136**
Gender					
Male	99 (62%)	76 (54%)	84 (56%)	72 (48%)	76 (56%)
Female	61 (38%)	64 (46%)	67 (44%)	77 (52%)	60 (44%)
Total cohort	**160**	**140**	**151**	**149**	**136**
Pregnancy					
Singleton	110 (69%)	92 (66%)	82 (54%)	101 (68%)	93 (68%)
Multiple (twin, triplet or higher)	50 (31%)	48 (34%)	69 (46%)	48 (32%)	43 (32%)
Total cohort	**160**	**140**	**151**	**149**	**136**
Gestation at birth					
Median (weeks)	29.4	29.1	29.4	29.4	29
Range (weeks)	23.1-36.1	23.1-36.0	23.3-34.5	23.1-36.0	23.3-33.9
IQR (weeks)	26.8-31.0	26.9-31.1	26.8-31.0	26.4-31.0	26.4-30.9
Total first time admissions	**160**	**140**	**151**	**149**	**136**
Weight at birth					
Median (kg)	1.17	1.19	1.18	1.21	1.18
Range (kg)	0.46-2.68	0.39-2.38	0.43-2.40	0.47-2.27	0.45 - 2.16
IQR (kg)	0.86-1.55	0.91-1.49	0.88-1.47	0.76-1.48	0.84 - 1.42
Weight <9th centile*	25 (16%)	24 (17%)	24 (16%)	20 (13%)	17 (13%)
Total cohort	**160**	**140**	**151**	**149**	**136**

**Centiles for preterm infants discharged before 40 weeks corrected age are based on the Fenton Growth Chart; centiles for infants discharged from 40 weeks corrected age are based on theWorld Health Organisation (WHO) Child Growth Foundation (CGF) Growth Chart..*

II Demographics at final discharge to home from the neonatal unit of infants born ≤31 weeks gestation or ≤1500 g

Infants born ≤31 weeks gestation or ≤1500 g discharged to home					
Year	**2018***	**2019**	**2020**	**2021**	**2022**
Gestation at discharge to home					
Median (weeks)	36.9	36.6	36.1	36.0	36.4
Range (weeks)	32.6*-46.0	34.9-43.0	34.8-41.0	34.9-44.7	34.6- 41.3
IQR (weeks)	35.3-38.9	35.5-37.8	35.2-37.1	35.4-37.4	35.3- 38.1
Total discharged to home	**91**	**68**	**53**	**59**	**49**
Discharged to other centres or died-excluded	*69*	*72*	*98*	*90*	*87*
Total cohort	*160*	*140*	*151*	*149*	*136*
Weight at discharge to home					
Median (kg)	2.67	2.47	2.33	2.28	2.43
Range (kg)	1.80-5.21	1.80-4.23	1.80- 3.50	1.80-4.23	1.88- 3.53
IQR (kg)	2.27-2.94	2.16-2.72	2.09-2.55	2.10-2.55	2.16 – 2.92
Weight <9th centile	17 (19%)	19 (28%)	12 (23%)	20 (33%)	13 (27%)
Total discharged to home	**91**	**68**	**53**	**59**	**49**
Discharged to other centres or died – excluded	*69*	*72*	*98*	*90*	*87*
Total cohort	*160*	*140*	*151*	*149*	*136*
Weight z-scoreat discharge to home					
Median (z-score)	-0.53	-0.71	-0.59	-0.82	-0.48
Range (z-score)	-3.78 –3.03	-7.47 – 1.42	-2.69 –1.11	-3.44 – 1.42	-3.12 – 1.08
IQR (z-score)	-1.08 - 0.16	-1.44 - 0.16	-1.28 -0.31	-1.62 - 0.40	-1.34 - 0.01
Change in z-score from birth to discharge home <0.8i.e. suggestive of 'no growth faltering'	54 (59%)	36 (53%)	28 (53%)	31 (53%)	27 (55%)
Change in z-score from birth to discharge home 0.8 - <1.2 i.e. suggestive of 'mild growth faltering'	20 (22%)	21 (31%)	13 (25%)	13 (22%)	11 (22%)
Change in z-score from birth to discharge home 1.2	17 (19%)	11 (16%)	12 (23%)	15 (25%)	11 (22%)
Total discharged to home	**91**	**68**	**53**	**59**	**49**
Discharged to other centre or died – excluded	**69**	**72**	**98**	**90**	**87**
Total cohort	**160**	**140**	**151**	**149**	**136**

**Data includes triplets of uncertain gestation at birth. At the time of discharge to home, the infants appeared clinically greater than 35 weeks gestation, however the gestation documented at that time was 32^{+4} (32.6) weeks due to the estimated gestation at birth.*

Clinical Nutrition and Dietetics (Neonatology Team)
Roberta McCarthy, Dietitian Manager
Roísín Gowan, Clinical Specialist Dietitian
Orla Haughey, Senior Dietitian (0.2 WTE temporary) to Feb (maternity leave from 2021)
Eimear Ryan, Senior Dietitian (0.6 WTE) from February to Oct
Catherine Shortall, Senior Dietitian (0.5 WTE temporary) from June to March

SECTION 7: Respiratory Support and Blood Product Usage

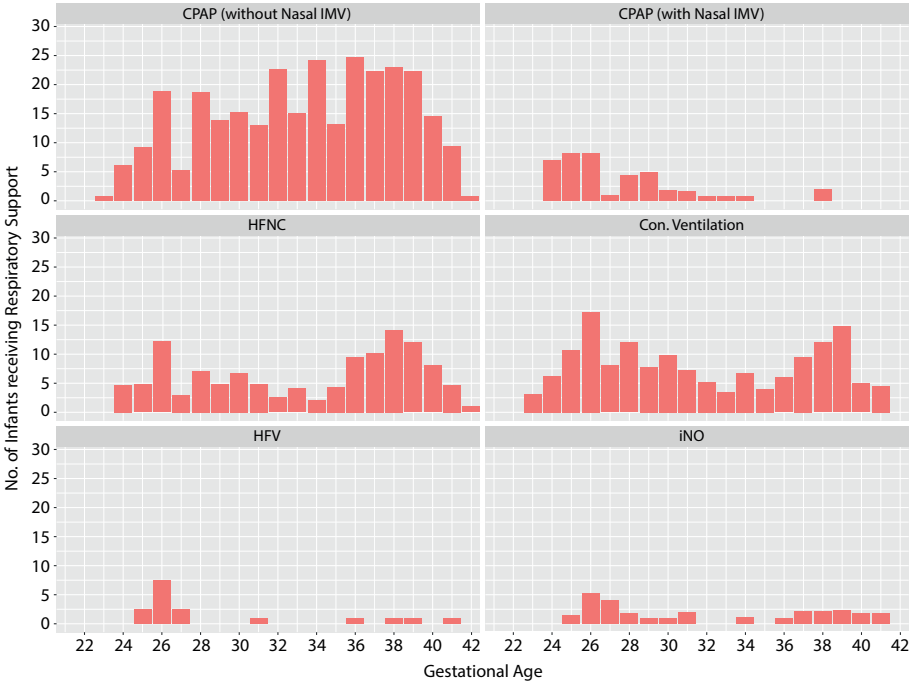
7.1 Respiratory Support

Ventilation remains the mainstay of intensive care medicine. Neonates require various levels of respiratory support depending on their gestational age and clinical presentation. The need for respiratory support in the form of ventilation is largely what determines whether an infant is classified as having received intensive care. Much of the workload in the NICU is directed towards those infants who require ventilation. The data presented in this section pertain to first time admissions for inborn and outborn infants. First time admissions from home and readmissions are not included. Respiratory Support provided in our NICU includes Conventional Ventilation, High Frequency Ventilation, CPAP (with or without nasal IMV) and/or High Flow Nasal Cannula.

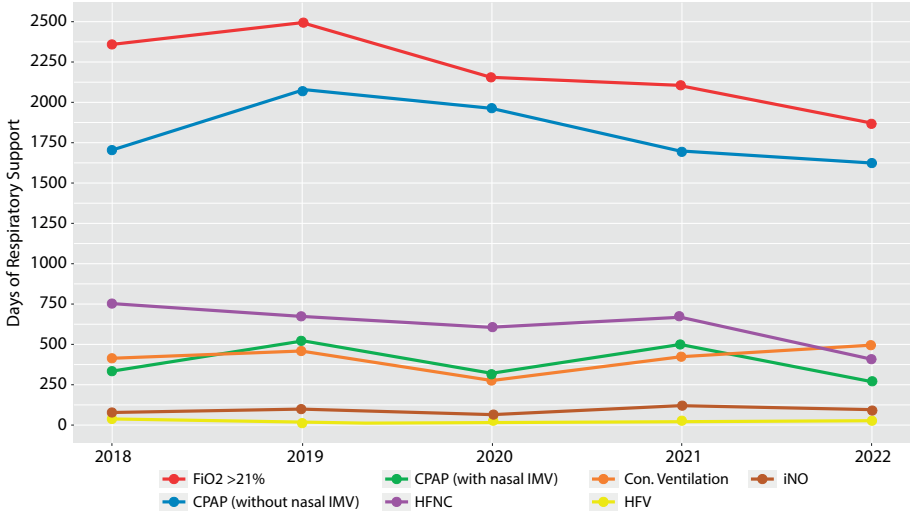
7.2: Days of Respiratory Support

	2018	2019	2020	2021	2022
FiO2 >21%					
Number of Days	2359	2494	2155	2080	1807
No. of Infants	362	440	362	335	359
Mean number of Days	6.5	5.6	5.9	6.2	5.0
CPAP *(without nasal IMV)*					
Number of Days	1704	2079	1964	1692	1612
No. of Infants	294	319	324	242	295
Mean number of Days	5.8	6.5	6.1	7.0	5.5
CPAP with Nasal IMV					
Number of Days	334	522	315	626	285
No. of Infants	61	66	53	41	43
Mean number of Days	5.4	7.9	5.9	15.0	6.6
HFNC					
Number of Days	753	674	607	801	416
No. of Infants	109	142	108	97	123
Mean number of Days	6.9	4.7	5.6	8.0	3.4
Conventional Ventilation					
Number of Days	414	459	276	551	498
No. of Infants	105	123	122	105	147
Mean number of Days	3.9	3.7	2.3	5.0	3.4
HFV					
Number of Days	38	12	27	28	22
No. of Infants	23	13	20	13	17
Mean number of Days	1.7	0.9	1.4	3.0	1.3
iNO					
Number of Days	78	99	65	154	83
No. of Infants	33	36	33	34	39
Mean number of Days	2.4	2.6	2.0	4.5	2.1

7.3: Mode of Respiratory Support by Gestation in 2022



7.4: Days of Respiratory Support by Year



7.5: Duration of Ventilation of Inborn Infants <28 weeks gestation

GA	Infants Ventilated	Survivors >28 days	Days on ventilation per infant	Avg. ventilation duration	Infants who died ≤28 days	Days on ventilation per infant	Avg. Ventilation duration
23	3	1	18*	18	2	6,9	8
24	5	5	1*,2*, 5*,16*,22	9	0		
25	9	5	1,1,2,9*,21*	9	4	1,6,9*,9*	3
26	16	10	1,1,4,4, 5*,9*,10,15* ,18*,30*	8	6	1,2,3*,6 12*	8
27	5	1	2	1	4	1,1,4,6*	3

7.6: Duration of Ventilation of Outborn Infants <28 weeks gestation

GA	Infants Ventilated	Survivors >28 days	Days on ventilation per infant	Avg. ventilation duration	Infants who died <28 days	Days on ventilation per infant	Avg. Ventilation duration
23	1	0			1	2	4
24	1	0			1	4	10
25	2	2	1,12*	7	0		
26	1	1	13	13	0		
27	1	1	2	2	0		

1) A partial day, i.e. <24 hrs is regarded as one day of ventilation. Days of ventilation =1 implies 24 hrs or less of ventilation.
2) Days of ventilation are cumulative and may include 1 or more episodes of ventilation.
3) Days of ventilation includes days of Conventional ventilation and High Frequency ventilation.
4) Implies an infant who received postnatal steroids.*

7.7 ECMO

Case	GA	BW	Sex	Diagnosis	Outcome
No cases to report					

7.8 Infants requiring ECMO

Year	2017	2018	2019	2020	2021	2022
No of Infants requiring ECMO	1	1	0	1	1	0

7.9 Blood product usage according to Gestational Age in the NICU

Estimated Weeks Gestation 2020	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	Total
Total No. of babies receiving blood products	4	6	7	14	5	7	1	0	1	0	1	1	4	2	2	3	3	0	1	0	62
Albumin	1	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Fibrinogen	1	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	5
Pedipack	14	22	18	38	10	8	1	0	0	0	3	1	10	1	2	4	3	0	2	0	137
Plasma	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3
Platelets	2	2	0	9	1	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0	17
Whole Blood	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	5
Total Transfusion Episodes	**21**	**25**	**19**	**51**	**12**	**9**	**1**	**0**	**1**	**0**	**3**	**1**	**10**	**2**	**5**	**5**	**6**	**0**	**2**	**0**	**173**
No. of babies receiving pedipacks	**4**	**6**	**7**	**14**	**5**	**7**	**1**	**0**	**0**	**0**	**1**	**1**	**4**	**1**	**1**	**2**	**2**	**0**	**1**	**0**	**57**
No. of babies exposed to more than one pedipack donor	0	2	2	5	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	10
No of Babies receiving Platelets	**2**	**1**	**0**	**3**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**0**	**0**	**10**
No. of babies exposed to more than one platelet donor	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Total babies	**4**	**7**	**11**	**23**	**8**	**18**	**15**	**20**	**18**	**33**	**36**	**61**	**61**	**126**	**140**	**131**	**153**	**124**	**68**	**8**	**1065**
% Babies receiving Blood Products	100	86	64	61	63	39	7	0	6	0	3	2	7	2	1	2	2	0	1	0	6

Blood Product usage is reported on the dateon which the blood product is transfused and not on the date of birth of the infant transfused. The number of units of albumin and fibringen reported are based on the number of units issued by the laboratory(but not necessarily transfused) asthe laboratory does not allocate a final outcome to thsese units unlike forother blood products.

7.10 Blood Product Usage according to Birthweight in the NICU

Weight Range (grams)	<501g	501 – 1000g	1001 - 1500g	1501 – 2000g	2001 – 2500g	>2500g	Total
Total No. of babies receiving blood products	**2**	**34**	**8**	**3**	**0**	**15**	**62**
Albumin	0	5	1	0	0	0	6
Fibrinogen	0	1	0	2	0	2	5
Pedipack	8	92	11	3	0	23	137
Plasma	0	2	0	0	0	1	3
Platelets	1	13	0	0	0	3	17
Whole Blood	0	3	1	0	0	1	5
Total Transfusion Episodes	**9**	**116**	**13**	**5**	**0**	**30**	**173**
No. of babies receiving pedipacks	**2**	**34**	**8**	**1**	**0**	**12**	**57**
No. of babies exposed to more than one pedipack donor	0	9	0	0	0	1	10
No of babies receiving Platelets	**1**	**6**	**0**	**0**	**0**	**3**	**10**
No. of babies exposed to more than one platelet donor	0	2	0	0	0	0	2
Total babies	**2**	**56**	**56**	**99**	**191**	**661**	**1065**
% babies receiving Blood Products	100	61	14	3	0	2	6

7.11 Trends in Blood Product Usage

Year	2018	2019	2020	2021	2022
No. of infants receiving blood products	86	63	64	69	62
Transfusion episodes	229	181	166	223	173
No. of infants receiving pedipacks	70	55	51	57	57
No. of infants receiving platelets	15	7	7	10	10
No. of infants receiving plasma	6	5	7	8	3
Units of fibrinogen issued	4	8	14	7	5
Units of albumin issued	6	8	18	34	6
No. infants exposed to more than one pedipack donor	19/70 (27%)	11/55 (20%)	5/51 (10%)	7/57 (12%)	10/57 (18%)
No. of infants exposed to more than one platelet donor	1/15 (7%)	2/7 (29%)	0/7 (0%)	3/10 (30%)	2/10 (20%)

7.12 Infants requiring an Exchange Transfusion

Year	2018	2019	2020	2021	2022
No. of Infants requiring an Exchange Transfusion	3	0	0	1	0

SECTION 8: Neurodevelopmental Follow Up of Very Low Birthweight Infants

8.1 Introduction

- All infants reported to the Vermont Oxford Network, and who survive to discharge, are followed in our Department until two years corrected age.
- In 2007, our Department changed from using the Bayley Scales of Infant Development-II (BSID-II) to the Bayley Scales of Infant and Toddler Development, 3rd Edition (Bayley-III). Therefore, all infants born after 2005 have been assessed using the Bayley-III.
- Since 2010, all infants with congenital anomalies are included in the two-year follow-up programme.
- The Covid-19 pandemic, beginning in March 2020, significantly impacted our ability to perform full Bayley-III Assessments at two years corrected age. Infants due for follow-up during the pandemic in 2020 were assessed primarily using a combination of the PARCA-R Questionnaire and the Ages and Stages Questionnaire. In some cases, it was possible to have a limited face-to-face assessment of the infant.
- Since 2021, while our gold standard for neurodevelopmental assessment at two years corrected age remains the Bayley Assessment, for those infants who cannot attend, our clinical psychologist offers an assessment using the PARCA-R Questionnaire in addition to a telephone consultation.
- PARCA-R stands for **Pa**rent **R**eport of **C**hildren's **A**bilities-**R**evised. It is a parent completed questionnaire that can be used to assess children's cognitive and language development between 23.5 and 27.5 months of age and has been used as an outcome measure in research studies and as a screening tool in child development clinics. It has been favourably compared with the Bayley-lll.
- As the PARCA-R has only been used in our preterm population since 2020, it has been decided that the outcomes of these assessments will be reported separately to the outcomes of those infants who underwent a complete Bayley-III assessment.
- Infants who were assessed by the Bayley Scales of Infant and Toddler Development, 3rd Edition (Bayley-III) will be categorized as in previous years (please see Table 1 below).
- Infants who were assessed using the PARCA-R will be categorized according to Table 2.
- Since 2021, the neurodevelopmental outcome of infants who are born SGA (small for gestational age) is reported separately to those infants who are born AGA (appropriately grown for gestational age). SGA is defined by VON as a birthweight <10th centile for GA. Tenth percentile values are based on US Vital Statistics Natality datasets for 2007 and 2008.

Table 1: Outcome Categories at 2 Years Corrected Gestational Age based on Bayley-III.

Category 1: (Severe)	Sensorineural deafness requiring hearing aids. Bilateral blindness. Severe cerebral palsy. Developmental delay: Bayley Composite Cognitive Score 2 or more standard deviations below the mean (i.e. < 70)
Category 2:	Bayley Composite Cognitive Score between 1 or 2 standard deviations below the mean (70-84). Mild-moderate cerebral palsy without developmental (cognitive) delay.
Category 3:	Presence of tone disorder or motor delay. Bayley Composite Motor Score more than 1 standard deviation below mean but Bayley Composite Cognitive Score within average range.
Category 4: (Normal)	No apparent disorder of tone. No apparent developmental delay (Bayley Composite Cognitive Score AND Bayley Composite Motor Score within average range (85-114) or above average range.

Table 2: Outcome Categories at 2 Years Corrected Gestational Age based on PARCA-R	
Category 1: (Severe)	Sensorineural deafness requiring hearing aids. Bilateral blindness. Severe cerebral palsy. Developmental delay: PARCA-R Cognitive Score 2 or more standard deviations below the mean (i.e. < 70)
Category 2:	PARCA-R Cognitive Score between 1 or 2 standard deviations below the mean (70-84). Mild-moderate cerebral palsy without developmental (cognitive) delay.
Category 3:	Presence of tone disorder or motor delay. This is assessed by our clinical psychologist during a telephone consultation with the parents
Category 4: (Normal)	PARCA-R Cognitive Score within average range (85-114) or above average (115)

Note: PARCA-R also scores language development. Language scores of ≥85 suggest normal language development, scores 70-84 suggest mild language delay, scores 55-69 suggest moderate language delay and scores <55 suggest severe language delay.

Summary of 2020 VLBW Cohort

- 118 VLBW infants reported to VON in 2020.
- A total of 99 infants were discharged home.
- No infant died post-discharge.
- Therefore, 99 infants due to be followed up at 2 years of age.
- Of these 99 infants, 77 infants were seen in our centre for Bayley Assessments and 14 were assessed using the PARCA-R questionnaire and a follow-up telephone consultation.
- In all, formal assessment scores are available on 91 infants giving a follow up rate of 92% this year, the same as last year, and higher than previously reported rates.
- Of the infants due for follow up, there were three infants with severe IVH (one case with bilateral grade 4, one case with a unilateral grade 4 and one case with a grade 4 IVH on the right and grade 3 IVH on the left), there was no case of an infant with cystic PVL and there were four infants with major congenital anomalies (Tetralogy of Fallot (1), Congenital hydrocephalus (1), Cleft palate (1), Trisomy 21 (1)). All 7 of these infants were inborn and 6 of the 7 infants were formally followed up (one infant with a grade 4 IVH on the right and grade 3 IVH on the left was not followed up). Of the 6 infants seen, 5 had formal Bayley Assessments. The remaining infant (Cleft palate) was assessed with the PARCA-R Questionnaire.
- Of the 8 infants for whom we have no follow up data, all 8 cases were inborn. One family was living abroad, 6 declined to attend but all reported that their infants were doing well and one family said they were attending another service who planned to carry out a Bayley Assessment.
- No infant was diagnosed with cortical blindness. One infant was diagnosed with sensorineural deafness requiring cochlear implants (30wks, 1285g).
- In summary, this year, we report on the outcome of 91 infants (77 of whom underwent a full Bayley Assessment). As with the previous year, the data obtained from Bayley Assessments and the PARCA-R Questionnaire are presented separately.

8.2: Gestational Age of VLBW infants due for follow up in 2022

Gestational Age	Due for follow up	Attended for follow up	Bayley Assessment performed	PARCA-R Questionnaire
< 24wks	1	1 (100%)	1	0
24-26wks	20**	20 (100%)**	19**	1
27-29wks	44*∞∞	39 (89%)∞∞	36∞∞	3
30-32wks	29∞	26 (90%)∞	16	10∞
>32wks	15∞	5 (100%)∞	5∞	0
Total	**99**	**91 (92%)**	**77**	**14**

8.3: Birthweight of VLBW infants due for follow up in 2022

Birthweight	Due for follow up	Attended for follow up	Bayley Assessment performed	PARCA-R Questionnaire
<501g	1	0 (0%)	0	0
501-750g	13	12 (92%)	11	1
751-1000g	20** ∞	18 (90%)**∞	17**	1∞
1001-1500g	62*∞∞∞	58 (89%) ∞∞∞	47∞∞∞	11
>1500g	3	3(100%)	2	1
Total	**99**	**91 (92%)**	**77**	**14**

Tables 8.2 and 8.3:
** indicates an infant who sustained a severe IVH (Grade 3-4) and who survived to discharge and is due for follow up at 2 years corrected age*
^ indicates an infant with cystic PVL who survived to discharge and is due for follow up at 2 years corrected age.
∞ indicates an infant with a major congenital anomaly who survived to discharge and is due for follow up at 2 years corrected age.

8.4: Yearly Follow Up Rates of VLBW infants

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Overall follow up rate	88%	83%	81%	89%	85%	85%	83%	87%	92%	92%

Note: this table includes infants who were seen for follow up but could not be assessed on the day

8.5a Neurodevelopmental Outcome according to Gestational Age in weeks by Bayley Scales for 2020 VLBW cohort (n=77)

Gestational Age	Category 1 Severe	Category 2	Category 3	Category 4 Normal	Total
23wks	0 (0%)	0 (0%)	0 (0%)	1 (100%)	1 (100%)
24wks	2 (40%)	0 (0%)	0 (0%)	3 (60%)	5 (100%)
25wks	0 (0%)	1 (11%)	2 (22%)*	6 (67%)	9 (100%)
26wks	0 (0%)	0 (0%)	0 (0%)	5 (100%)*	5 (100%)
27wks	0 (0%)	0 (0%)	2 (33%)	4 (67%)	6 (100%)
28wks	1 (9%)	0 (0%)	1 (9%)	9 (82%)	11 (100%)
29wks	1 (5%) ∞	2 (11%)	0 (0%)	16 (84%)∞	19 (100%)
30wks	1 (20%)	0 (0%)	0 (0%)	4 (80%)	5 (100%)
31wks	0 (0%)	0 (0%)	0 (0%)	4 (100%)	4 (100%)
32wks	0 (0%)	0 (0%)	1 (14%)	6 (86%)	7 (100%)
>32wks	2 (40%)	1 (20%)∞	1 (20%)	1 (20%)	5 (100%)
Total	**7 (9%)**	**4 (6%)**	**7 (9%)**	**59 (76%)**	**77 (100%)**

8.5b Neurodevelopmental Outcome according to Gestational Age in weeks by PARCA-R for 2020 VLBW cohort (n=14)

Gestational Age	Category 1 Severe	Category 2	Category 3*	Category 4 Normal	Total
23wks	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (100%)
24wks	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (100%)
25wks	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (100%)
26wks	0 (0%)	1 (100%)	0 (0%)	0 (0%)	1 (100%)
27wks	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (100%)
28wks	1 (50%)	0 (0%)	0 (0%)	1 (50%)	2 (100%)
29wks	1 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
30wks	0 (0%)	1 (25%)	0 (0%)	3 (75%)	4 (100%)
31wks	0 (0%)	1 (100%)	0 (0%)	0 (0%)	1 (100%)
32wks	*0 (0%)*	0 (0%)	0 (0%)	5 (100%)∞	5 (100%)
>32wks	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (100%)
Total	**2 (14%)**	**3 (21%)**	**0 (0%)**	**9 (64%)**	**14 (100%)**

1motor assessment is by telephone consultation with parents

8.6a Neurodevelopmental outcome according to Gestational Age Category by Bayley Scales for 2020 VLBW cohort (n=77)

Gestational Age	Category 1 Severe	Category 2	Category 3	Category 4 Normal	Total
< 24wks	0 (0%)	0 (0%)	0 (0%)	1 (100%)	1 (100%)
24-26wks	2 (10%)	1 (5%)	2 (10%)*	14 (74%)*	19 (100%)
27-29wks	2 (6%)	2 (6%)	3 (8%)	29 (80%)∞	36 (100%)
30-32wks	1 (6%)∞	0 (0%)	1 (6%)	14 (88%)	16 (100%)
>32wks	2 (40%)	1 (20%)∞	1 (20%)	1 (20%)	5 (100%)
Total	**7 (9%)**	**4 (6%)**	**7 (9%)**	**59 (76%)**	**77 (100%)**

8.6b Neurodevelopmental outcome according to Gestational Age Category by PARCA-R for 2020 VLBW cohort (n=14)

Gestational Age	Category 1 Severe	Category 2	Category 3[1]	Category 4 Normal	Total
< 24wks	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (100%)
24-26wks	0 (0%)	1 (100%)	0 (0%)	0 (0%)	1 (100%)
27-29wks	2 (67%)	0 (0%)	0 (0%)	1 (33%)	3 (100%)
30-32wks	0 (0%)	2 (20%)	0 (0%)	8 (80%)∞	10 (100%)
>32wks	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (100%)
Total	**2 (14%)**	**3 (21%)**	**0 (0%)**	**9 (64%)**	**14 (100%)**

1motor assessment is by telephone consultation with parents

8.7a Neurodevelopmental outcome according to Birthweight Category by Bayley Scales for 2020 VLBW cohort (n=77)

Birthweight	Category 1 Severe	Category 2	Category 3	Category 4 Normal	Total
< 24wks	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (100%)
24-26wks	2 (18%)	1 (9%)	1 (9%)	7 (64%)	11 (100%)
27-29wks	0 (0%)	0 (0%)	2 (12%)	15 (88%)*	17 (100%)
30-32wks	5 (11%)∞	3 (6%)∞	4 (8%)	35 (75%)∞	47 (100%)
>32wks	0 (0%)	0 (0%)	0 (0%)	2 (100%)	2 (100%)
Total	**7 (9%)**	**4 (6%)**	**7 (9%)**	**59 (76%)**	**77 (100%)**

8.7b Neurodevelopmental outcome according to Birthweight Category by PARCA-R for 2020 VLBW cohort (n=14)

Birthweight	Category 1 Severe	Category 2	Category 3[1]	Category 4 Normal	Total
< 501g	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (100%)
501-750g	0 (0%)	1 (100%)	0 (0%)	0 (0%)	1 (100%)
751-1000g	0 (0%)	0 (0%)	0 (0%)	1 (100%)∞	1 (100%)
1001-1500g	1 (9%)^	2 (18%)	0 (0%)	8 (73%)	11 (100%)
>1500g	1 (100%)	0 (0%)	0 (0%)	0 (0%)	1 (100%)
Total	**2 (14%)**	**3 (21%)**	**0 (0%)**	**9 (64%)**	**14 (100%)**

[1]motor assessment is by telephone consultation with parents
Tables 8.5-8.7:
** indicates an infant who sustained a severe IVH (Grade 3-4)*
^ indicates an infant with cystic PVL
∞ indicates an infant with a major congenital anomaly

8.8 The Likelihood of a Normal Neurodevelopmental Assessment at 2 years corrected age according to Gestational Age Category.

Gestational Age	Epoch 1: 2006-2010	Epoch 2: 2011-2015	Epoch 3: 2016-2020	Epoch 4: 2021-2022
< 24wks	0/0 (0%)	3/4 (75%)	4/7 (57%)	2/3 (67%)
24-26wks	48/72 (67%)	71/86 (83%)	40/59 (68%)	25/34 (74%)
27-29wks	146/171 (85%)	178/212 (84%)	118/134 (88%)	53/64 (83%)
30-32wks	102/113 (90%)	112/125 (90%)	97/110 (88%)	27/31 (87%)
>32wks	30/34 (88%)	28/33 (85%)	27/36 (75%)	6/14 (43%)
Total	**326/390 (84%)**	**392/460 (85%)**	**286/346 (83%)**	**113/146 (77%)**

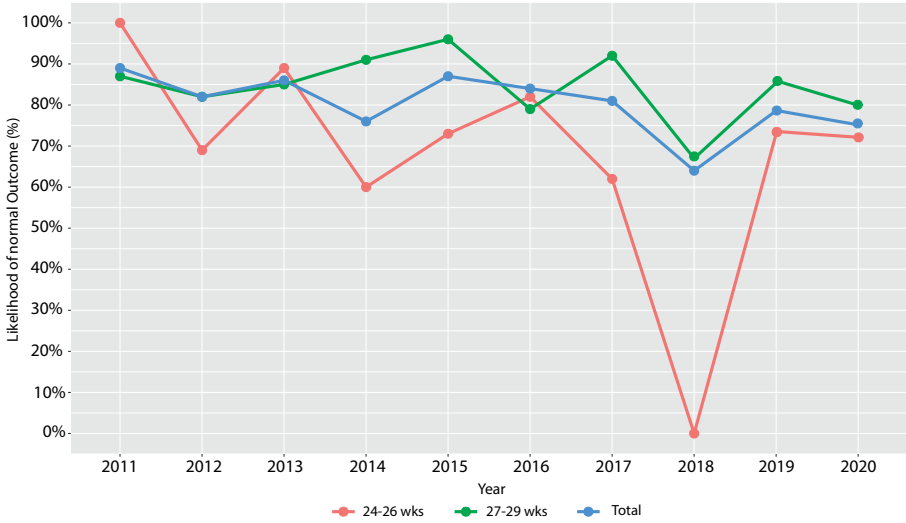
**Note: Epoch 1 reports on follow-up data obtained during theYears 2006-2010. It is based on the neurodevelopmental assessments at 2 years of age of the 2004-2008VON cohort and it includes both inborn and outborn infants. Epoch 2 reports on the follow up data of the 2009-2013VON cohort. Epoch 3 reports on the follow up of the 2014-2018VON cohort. Epoch 4 reports on the follow up of the 2019 and 2020 VON cohort.*
ONLY infants who underwent a Bayley Assessment are included in the above table.

8.9 The Likelihood of a Severe Neurodevelopmental Outcome at 2 years corrected age according to Gestational Age Category.

Gestational Age	Epoch 1: 2006-2010	Epoch 2: 2011-2015	Epoch 3: 2016-2020	Epoch 4: 2021-2022
< 24wks	0/0 (0%)	1/4 (25%)	2/7 (29%)	1/3 (33%)
24-26wks	13/72 (18%)	6/86 (7%)	8/59 (14%)	4/34 (12%)
27-29wks	10/171 (6%)	14/212 (7%)	7/134 (5%)	2/64 (3%)
30-32wks	4/113 (4%)	5/125 (7%)	4/110 (4%)	1/31 (3%)
>32wks	0/34 (0%)	3/33 (9%)	5/36 (14%)	2/14 (14%)
Total	**27/390 (7%)**	**29/460 (6%)**	**26/346 (8%)**	**10/146 (7%)**

**Note: Epoch 1 reports on follow-up data obtained during theYears 2006-2010. It is based on the neurodevelopmental assessments at 2 years of age of the 2004-2008VON cohort and it includes both inborn and outborn infants. Epoch 2 reports on the follow up data of the 2009-2013VON cohort. Epoch 3 reports on the follow up of the 2014-2018VON cohort. Epoch 4 reports on the follow up of the 2019 and 2020 VON cohort.*
ONLY infants who underwent a Bayley Assessment are included in the above table.

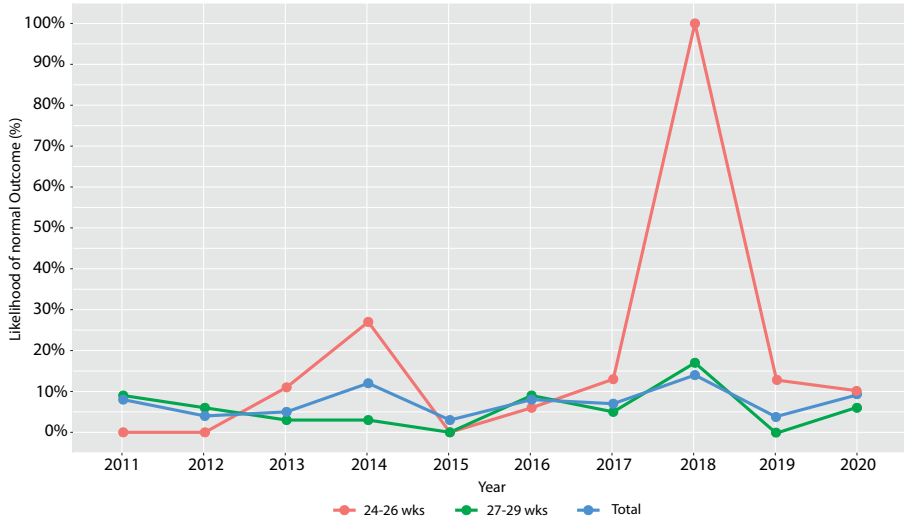
8.10: The Likelihood of a Normal Developmental Outcome of our VON Cohorts at 2 years corrected age according to Gestational Age Category



Normal Neuro-developmental Outcome in VON cohorts	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<24 wks	50%	100%	-	100%	0%	67%	0%	0%	50%	100%
24-26 wks	100%	69%	89%	60%	73%	82%	62%	0%*	73%	74%
27-29 wks	87%	82%	85%	91%	96%	79%	92%	67%	86%	80%
Total VON Cohort	**89%**	**82%**	**86%**	**76%**	**87%**	**84%**	**81%**	**64%**	**79%**	**76%**

Note: ONLY infants who underwent a Bayley Assessment are included in the above table.
** For clarification, there was only one infant in the 24-26 wk Gestational Age category who underwent a Bayley Assessment in 2020*

8.11 The Likelihood of a Severe Neurodevelopmental Outcome of our VON Cohorts at 2 years corrected age according to Gestational Age Category



Severe Neurodevelop-mental Outcome in VON cohorts	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
<24 wks	50%	0%	-	0%	100%	0%	100%	0%	50%	0%
24-26 wks	0%	0%	11%	27%	0%	6%	13%	100%	13%	10%
27-29 wks	9%	6%	3%	3%	0%	9%	5%	17%	0%	6%
Total VON Cohort	**8%**	**4%**	**5%**	**12%**	**3%**	**8%**	**7%**	**14%**	**4%**	**9%**

Note: ONLY infants who underwent a Bayley Assessment are included in the above table

8.12: The Likelihood of a Normal Developmental Outcome at 2 years corrected age according to Birthweight Category

Birthweight	Epoch 3: 2016-2020	Epoch 4: 2021-2022
< 501g	1/3 (33%)	0/2 (0%)
501-750g	26/38 (68%)	14/20 (70%)
751-1000g	57/68 (84%)	28/31 (90%)
1001-1500g	195/227 (86%)	64/86 (74%)
>1500g	7/10 (70%)	7/7 (100%)
Total	**286/346 (83%)**	**113/146 (77%)**

Note: ONLY infants who underwent a Bayley Assessment are included in the above table

8.13: The Likelihood of a Severe Developmental Outcome at 2 years corrected age according to according to Birthweight Category

Birthweight	Epoch 3: 2016-2020	Epoch 4: 2021-2022
< 501g	0/3 (0%)	1/2 (50%)
501-750g	7/38 (18%)	2/20 (10%)
751-1000g	3/68 (4%)	1/31 (3%)
1001-1500g	15/227 (7%)	6/86 (7%)
>1500g	1/10 (0%)	0/7 (0%)
Total	**26/346 (8%)**	**10/146 (7%)**

Note: ONLY infants who underwent a Bayley Assessment in are included in the above table

8.14: Outcome of Small for Gestational Age Infants born ≤ 29wks gestation at 2 years corrected age (based on 7 years of follow-up data of the 2014-2020 cohort)

	<24 wks	24-26wks	27-29wks	Total
Total No. of SGA Infants	1	17	35	53
Died before discharge	1 (100%)	9 (53%)	6 (17%)	16 (30%)
Survived to Discharge	0	8 (47%)	29 (83%)	37 (70%)
Assessed at 2 years corrected age	0	5	17 (but one could not be assessed on the day)	22 (one could not be assessed on the day)
Normal Outcome	N/A	2 (40%)	11 (69%)	13 (62%)
Category 2	N/A	1 (20%)	3 (19%)	4 (19%)
Category 3	N/A	2 (40%)	1 (6%)	3 (14%)
Severe Outcome	N/A	0 (0%)	1 (6%)	1 (5%)

***Infants who died included 23wks x1 (360g), 24wks x4 (420g, 440g, 490g, 495g), 25wks x1 (575g), 26wks x4 (465g, 470g, 500g, 535g), 27wks x1 (705g), 28wks x4 (550g, 580g, 610g, 635g), 29wks x1 (401g)*

Survivors to discharge: 25wks x1 (420g), 26wks x7 (490g, 566g^ 580g^, 585g, 600g^, 610g, 615g), 27wks x7 (390g, 505g, 535g^, 590g^, 665g, 670g, 710g), 28wks x10 (515g, 645g^, 650g, 695g, 700g, 700g, 750g, 770g, 760g^, 770g*), 29wks x12 (460g*, 565g*, 635g^, 705g^, 755g, 775g, 800g, 820g*, 820g, 840g, 900g*, 965g)*

**Did not attend for follow up*

^PARCA-R and ASQ-3TM Questionnaire completed. Of the 7 PARCA-R and ASQ-3TM assessments performed in 2020, the 1 PARCA-R assessment performed in 2021 and the 1 PARCA-R assessment performed in 2022, 2 infants were categorized as severely delayed (26wks at 600g and 28wks at 760g), 2 infants were in the moderately delayed category (26wks at 566g, 27wks at 590g), 3 infants were in the mildly delayed category (26wks at 580g, 28wks at 645g and 29wks at 635g) and 2 infants were categorised as normal (27wks at 535g and 29wks at 705g). These data have not been included in the table above which just includes Bayley Assessments.

Note: SGA is defined by VON as a birthweight <10th centile for GA. Tenth percentile values are based on US Vital Statistics Natality datasets for 2007 and 2008

Cognitive, Language and Motor Scores According to Gestational Age in AGA and SGA Infants

The following tables outline the Bayley Composite Cognitive, Language and Motor scores and the PARCA-R Cognitive and Language scores according to gestational age in infants who are AGA (appropriately grown for gestational age) and in infants who are SGA (small for gestational age). SGA is defined by VON as a birthweight <10th centile for GA. Tenth percentile values are based on US Vital Statistics Natality datasets for 2007 and 2008.

The Bayley Composite Cognitive, Language and Motor scores are divided into the following ranges:

- Very superior: ≥130
- Superior: 120-129
- High Average: 110-119
- Average: 90-109
- Low Average: 80-89
- Borderline: 70-79
- Extremely Low: ≤69

The PARCA-R Cognitive and Language scores are divided into the following ranges:

- Very Above Average: ≥130 (≥2 SD above mean)
- Above Average: 115-129 (between 1-2 SD above the mean)
- Average: 85-114 (1 SD above or below the mean)
- Mild Delay: 70-84 (between 1-2 SD below the mean)
- Moderate Delay: 55-69 (between 2-3 SD below the mean)
- Severe Delay: ≤54 (≥3 SD below mean)

8.15 Bayley Composite Cognitive, Language and Motor Scores (n=116) and PARCA-R Cognitive and Language Scores (n=23) according to Gestational Age in the 2019 and 2020 AGA Cohort

Bayley Composite Cognitive Score	23 wks	24 wks	25 wks	26 wks	27 wks	28 wks	29 wks	30-32 wks	>32 wks	Total
Very Superior (≥130)	0	0	0	0	0	0	1	3	0	4
Superior (120-129)	0	0	0	2	1	3	2	4	0	12
High Average (110-119)	1	0	2	6	5	3	10	4	0	31
Average (90-109)	1	3	6	6	4	6	11	8	0	45
Low Average (80-89)	0	0	2	1	4	2	3	3	0	15
Borderline (70-79)	0	0	1	0	0	0	1	0	0	2
Extremely Low (≤69)	1	2	0	2	0	1	1	0	0	7
Total	**3**	**5**	**11**	**17**	**14**	**15**	**29**	**22**	**0**	**116**

Bayley Composite Language Score	23 wks	24 wks	25 wks	26 wks	27 wks	28 wks	29 wks	30-32 wks	>32 wks	Total
Very Superior (≥130)	0	0	0	1	1	1	1	1	0	5
Superior (120-129)	1	0	0	1	1	0	2	3	0	8
High Average (110-119)	0	0	0	0	4	2	5	3	0	14
Average (90-109)	0	1	4	9	1	6	11	9	0	41
Low Average (80-89)	1	1	4	3	2	2	7	1	0	21
Borderline (70-79)	0	0	1	3	4	1	3	4	0	16
Extremely Low (≤69)	1	3	2	0	1	3	0	1	0	11
Total	**3**	**5**	**11**	**17**	**14**	**15**	**29**	**22**	**0**	**116**

Bayley Composite Motor Score	23 wks	24 wks	25 wks	26 wks	27 wks	28 wks	29 wks	30-32 wks	>32 wks	Total
Very Superior (≥130)	0	0	0	0	0	0	0	0	0	0
Superior (120-129)	0	0	1	1	1	2	2	1	0	8
High Average (110-119)	0	0	1	4	2	2	4	7	0	20

Bayley Composite Motor Score	23 wks	24 wks	25 wks	26 wks	27 wks	28 wks	29 wks	30-32 wks	>32 wks	Total
Average (90-109)	2	3	5	9	8	8	20	11	0	66
Low Average (80-89)	0	0	1	0	0	2	2	1	0	6
Borderline (70-79)	0	0	1	2	3	0	0	1	0	7
Extremely Low (≤69)	1	2	2	1	0	1	1	1	0	9
Total	**3**	**5**	**11**	**17**	**14**	**15**	**29**	**22**	**0**	**116**

PARCA-R Cognitive Score	23 wks	24 wks	25 wks	26 wks	27 wks	28 wks	29 wks	30-32 wks	>32 wks	Total
Very Above Average (≥130)	0	0	0	0	0	0	0	0	0	0
Above Average (115-129)	0	0	0	0	1	0	0	4	0	5
Average (85-114)	0	0	0	0	4	3	0	5	0	12
Mild Delay (70-84)	0	0	0	0	0	0	0	4	0	4
Moderate Delay (55-69)	0	0	0	0	0	1	1	0	0	2
Severe Delay (≤54)	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**5**	**4**	**1**	**13**	**0**	**23**

PARCA-R Language Score	23 wks	24 wks	25 wks	26 wks	27 wks	28 wks	29 wks	30-32 wks	>32 wks	Total
Very Above Average (≥130)	0	0	0	0	0	0	0	0	0	0
Above Average (115-129)	0	0	0	0	0	0	0	3	0	3
Average (85-114)	0	0	0	0	1	2	1	8	0	12
Mild Delay (70-84)	0	0	0	0	1	1	0	2	0	4
Moderate Delay (55-69)	0	0	0	0	3	1	0	0	0	4
Severe Delay (≤54)	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**0**	**5**	**4**	**1**	**13**	**0**	**23**

8.16 Bayley Composite Cognitive, Language and Motor Scores (n=30) and PARCA-R Cognitive and Language Scores (n=7) according to Gestational Age in the 2019 and 2020 SGA Cohort

Bayley Composite Cognitive Score	23 wks	24 wks	25 wks	26 wks	27 wks	28 wks	29 wks	30-32 wks	>32 wks	Total
Very Superior (≥130)	0	0	0	0	0	0	1	0	0	1
Superior (120-129)	0	0	0	0	0	0	0	2	0	2
High Average (110-119)	0	0	0	0	0	0	0	3	2	5
Average (90-109)	0	0	0	0	1	2	0	3	6	12
Low Average (80-89)	0	0	0	1	1	0	0	0	1	3
Borderline (70-79)	0	0	0	0	1	0	0	1	4	6
Extremely Low (≤69)	0	0	0	0	0	0	0	0	1	1
Total	**0**	**0**	**0**	**1**	**3**	**2**	**1**	**9**	**14**	**30**

Bayley Composite Language Score	23 wks	24 wks	25 wks	26 wks	27 wks	28 wks	29 wks	30-32 wks	>32 wks	Total
Very Superior (≥130)	0	0	0	0	0	0	1	0	0	1
Superior (120-129)	0	0	0	0	0	0	0	3	0	3
High Average (110-119)	0	0	0	0	0	0	0	1	1	2
Average (90-109)	0	0	0	1	2	1	0	1	4	9
Low Average (80-89)	0	0	0	0	0	1	0	1	2	4
Borderline (70-79)	0	0	0	0	0	0	0	2	4	6
Extremely Low (≤69)	0	0	0	0	1	0	0	1	3	5
Total	**0**	**0**	**0**	**1**	**3**	**2**	**1**	**9**	**14**	**30**

Bayley Composite Motor Score	23 wks	24 wks	25 wks	26 wks	27 wks	28 wks	29 wks	30-32 wks	>32 wks	Total
Very Superior (≥130)	0	0	0	0	0	0	1	0	0	1
Superior (120-129)	0	0	0	0	0	0	0	1	0	1
High Average (110-119)	0	0	0	0	0	0	0	2	1	3

Bayley Composite Motor Score	23 wks	24 wks	25 wks	26 wks	27 wks	28 wks	29 wks	30-32 wks	>32 wks	Total
Average (90-109)	0	0	0	0	1	2	0	5	5	13
Low Average (80-89)	0	0	0	1	1	0	0	0	0	2
Borderline (70-79)	0	0	0	0	0	0	0	1	4	5
Extremely Low (≤69)	0	0	0	0	1	0	0	0	4	5
Total	**0**	**0**	**0**	**1**	**3**	**2**	**1**	**9**	**14**	**30**

PARCA-R Cognitive Score	23 wks	24 wks	25 wks	26 wks	27 wks	28 wks	29 wks	30-32 wks	>32 wks	Total
Very Above Average (≥130)	0	0	0	0	0	0	0	0	0	0
Above Average (115-129)	0	0	0	0	0	0	0	0	0	0
Average (85-114)	0	0	0	0	0	0	0	3	1	4
Mild Delay (70-84)	0	0	0	1	0	0	1	0	1	3
Moderate Delay (55-69)	0	0	0	0	0	0	0	0	0	0
Severe Delay (≤54)	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**3**	**2**	**7**

PARCA-R Language Score	23 wks	24 wks	25 wks	26 wks	27 wks	28 wks	29 wks	30-32 wks	>32 wks	Total
Very Above Average (≥130)	0	0	0	0	0	0	0	0	0	0
Above Average (115-129)	0	0	0	0	0	0	0	0	0	0
Average (85-114)	0	0	0	1	0	0	1	2	0	4
Mild Delay (70-84)	0	0	0	0	0	0	0	1	2	3
Moderate Delay (55-69)	0	0	0	0	0	0	0	0	0	0
Severe Delay (≤54)	0	0	0	0	0	0	0	0	0	0
Total	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**3**	**2**	**7**

Neurodevelopmental Follow-up Report by Marie Slevin, Developmental Psychologist, Department of Neonatology: 2022 Report

8.17 Neurodevelopmental Follow-up of Infants Born Preterm and Term

Our neurodevelopmental follow-up of infants born preterm (both inborn and outborn) now spans 23 years from 1997- 2020. Our follow-up of term infants diagnosed with neonatal encephalopathy (NE) at birth is in its 13th year. The Bayley Scales (Bayley-lll) which is one of the most widely used standardised tools for the assessment of neurodevelopment in early childhood is our key measurement of developmental outcome in these cohorts. In all, 99 of 109 infants (91%) due for follow up attended for an assessment and 84 of these infants (85%) underwent a formal Bayley assessment.

The PARCA-R – a parent report questionnaire (see below for details on this questionnaire) was used for families who did not wish to travel to Dublin for the Bayley assessment for various reasons, for example, distance to travel, busy family life, being happy with their child's development to date, and being already linked in with their local Early Intervention Service. The PARCA-R accepts that parents are good judges of their child's current abilities. It assesses cognitive and language development from 23.5 – 27.5 months of age. Unfortunately, the PARCA-R does not have a motor scale. Hence, motor follow-up was by discussion with the child's parents similar to the Ages and Stages Questionnaire.

A total of 99 preterm infants born 1500g and/or 29 weeks gestation, and 10 term infants with Neonatal Encephalopathy, were referred for follow-up in 2022. A total of 84 (77 preterm; 7 NE term) Bayley assessments and 15 (14 preterm;1 NE term) PARCA-R Questionnaires were completed. The infants born preterm were assessed at two years corrected age. The term infants with Neonatal Encephalopathy were assessed at two years' chronological age. An assessment at two years of age (2 years corrected age for preterm infants) is the optimum time to measure cognitive, language and motor outcome when following up these cohorts.

Of the 99 preterm infants listed for assessment, 91 (92%) were formally assessed. Of those families who did not have a formal follow-up, one child was living in England without forwarding contact details, three families, one with triplets (3), one with twins (2) and one singleton (1), did not attend, due to a busy family lifestyle and did not complete the PARCA-R despite many attempts to engage them. All of these families reported that their children were doing fine, suggesting normal development. One assessment is still pending being performed locally.

There were 4 additional independent referrals (3 Bayley Assessments and 1 PARCA-R) which are not included in the figures mentioned above.

8.18 Preterm Group

In the preterm cohort, 24% were from the Dublin area. The remaining 76% children assessed lived outside the Dublin area travelling from as far as Donegal (8 children), Mayo/Sligo (5 children), Wexford (11 children) and spanning counties Longford, Offaly, Westmeath, Meath and Wicklow. Six (6) children were from Northern Ireland.
Seventy-seven children (85%) were assessed using the Bayley-lll Scales and 14 (15%) children were assessed using the PARCA-R Questionnaire.

Table 1: Bayley Composite Scores using Bayley Classification for Cognitive, Language and Motor Outcomes: Preterm Infants born in 2020; Assessed in 2022 (n=77).

Composite Scores	Cognitive Scale (No.)	%	Language Scale (No.)	%	Motor Scale (No.)	%	Interpretation
≥ 130	4	5%	5	7%	1	1%	Very Superior
120-129	5	7%	5	7%	4	5%	Superior
110-119	14	18%	6	8%	9	11%	High Average
90-109	37	48%	21	27%	45	59%	Average Range
80-89	9	11%	17	22%	5	7%	Low Average
70-89	2	3%	14	18%	4	5%	Borderline
≤ 69	6	8%	9	12%	9	12%	Extreme Delay
Total	**77**	**100%**	**77**	**100%**	**77**	**100%**	

Table 1 outlines the outcome of our preterm population who were assessed with a Bayley Assessment in 2022. Preterm children did well overall in terms of their Cognitive Outcomes - 12% performed within the Superior Range, 66% performed within the Average/High Average Range, 14% showed Mild-Moderate Delay (Low Average/Borderline Range) and 8% showed Extreme Delay.

The results were concerning regarding Language Outcomes. Only 35% performed within the Average /High Average Range in comparison to 66% for Cognitive Outcomes. A total of 40% showed Mild-Moderate Language Delay (Low Average/Borderline Range) and 12% showed Extreme Language Delay indicating that Language Delay is a risk factor for this cohort of children. While the Covid-19 pandemic may have been a factor, these results reflect previous pre-Covid outcomes and are more likely representative of the impact of prematurity as opposed to Covid-19.

When the Motor Outcomes were examined, it was very encouraging to see that 70% of the children were performing within the Average/High Average Range. In all, 12% showed Mild-Moderate Motor Delay and 12% showed Extreme Delay. For the 6% showing Superior Performance, this meant that this group of children were running with better coordination, were kicking a small ball and were able to ascend/ descend steps independently. They would also have been following task commands better.

The outcomes in the table above represent the Composite Scores. These give a general overview of the results and are the scores that are used when reporting outcomes for most audit reviews and research studies. However, valuable information can be lost. The Composite Scores can sometimes mask Expressive Speech Delay and Gross Motor Delay if the Receptive Scores and Fine Motor Scores are high. When examining these results, it is also important to look at the Scaled Scores that make up these Composite Scores. For example, the Receptive and Expressive Communication Scales make up the Composite Language Score and the Fine Motor and Gross Motor Scales make up the Composite Motor Score.

Bayley Scaled Scores are divided into the following ranges:

- 16-19: Superior Performance
- 13-15: High Average Performance
- 8-12: Average Performance
- 5-7: Mild Delay
- 1-4: Moderate-Severe Delay

Table 2: Bayley Scaled Scores for Cognitive, Receptive and Expressive Communication Skills (Language Scale) and Fine and Gross Motor Skills (Motor Scale): Preterm Infants Born in 2020; Assessed in 2022 (n=77)

Scaled Scores	Cognitive Scale	%	Receptive Communication Scale	%	Expressive Communication Scale	%	Fine Motor Scale	%	Gross Motor Scale	%	Outcome
16-19	4	5%	5	7%	5	7%	4	5%	1	1%	Superior
13-15	14	18%	10	13%	8	10%	13	17%	1	1%	High Average
8-12	42	55%	38	49%	24	31%	49	64%	53	69%	Average
5-7	10	13%	15	19%	33	43%	5	6%	14	18%	Mild Delay
1-4	7	9%	9	12%	7	9%	6	8%	8	10%	Moderate-Severe Delay
Total	77	100%	77	100%	77	100%	77	100%	77	100%	77

Looking at Table 2, 49% of the children performed within the Average Range on the Receptive Communication Scale compared to 31% on the Expressive Communication Scale. While 20% showed Mild Delay on the Receptive Communication Scale, this figure was more than double at 43% for the Expressive Communication Scale. A total of 12% experienced Moderate–Severe Delay for Receptive Communication Skills while 9% experienced same for Expressive Communication Skills. These figures indicate that a total of 31% of children were below average on the Receptive Communication Scale compared to 52% on the Expressive Communication Scale. If it is recommended that any preterm infant who is performing below average at 2 years of age would benefit from intervention, then over 50% of our cohort in 2022 meet the criteria for access to speech and language therapy.

In terms of Motor Outcomes, Gross Motor Outcome was very good with 69% of the children performing within the Average Range and 64% performing within the Average Range for Fine Motor skills. Fine Motor Skills represented an area of strength within the Motor scale with 22% of children performing within the Superior Range compared with just over 2% for Gross Motor performance. There was more Mild Gross Motor Delay than Mild Fine Motor Delay (18% vs 6%). A total of 10% showed Moderate-Severe Gross Motor Delay compared with 8% for the Fine Motor Delay.

In summary, by analysing the scaled scores, it is evident that delays in gross motor skills were more prevalent than delays in fine motor skills in our preterm population and delays in expressive communication skills were more common than delays in receptive communication skills. It is important that there is greater awareness that expressive speech delay and gross motor delay may present as co-morbidities in this cohort of children.

Table 3: Bayley Outcomes according to Gestational Age for Preterm Infants Born in 2020; Assessed in 2022 (n=77)

Gestational Age	Number of Children Assessed	Number of Children in Normal Range for ALL Parameters	Percentage (%)
23	1	0	0%
24	5	0	0%
25	9	4	44%
26	5	3	60%
27	6	2	33%
28	11	4	36%
29	19	12	63%
30	5	2	40%
31	4	2	50%
32	7	4	57%
>32	5	0	0%
Total	**77**	**33**	**43%**

Table 3 above looks at the number of children of each gestational age who achieved a normal outcome across all 5 parameters assessed, namely cognitive development, receptive communication

skills, expressive communication skills, fine motor development and gross motor development. A normal outcome is defined as performing within the average, high average or superior range and equates to achieving a scaled score >7 for the relevant parameter.

Only 1 child born at 23 wks survived to follow up at 2 years of age. This child had a normal outcome across 4 of the 5 parameters but showed a mild delay in Receptive Communication Skills. Five children born at 24 wks were assessed and none of these infants achieved normal outcomes across all 5 parameters. Also of note is that fact that of the 5 children >32 wks who were assessed, none of these children achieved normal outcomes across all 5 parameters. A possible explanation for this may be the negative impact of intra-uterine growth retardation on long-term neurodevelopmental outcome which is an area that warrants further scrutiny.

Table 4: PARCA-R Outcomes for Non-Verbal Cognition and Language Development: Preterm Infants Born in 2020; Assessed in 2022 (n=14)

Standard Scores	Non-Verbal Cognition (No.)	%	Language (No.)	%	Interpretation
≥ 130	0	0%	0	0%	Very Above Average
115-129	1	7%	3	22%	Above Average
85-114	8	57%	8	57%	Average
70-84	3	22%	1	7%	Mild Delay
55-69	2	14%	1	7%	Moderate Delay
≤ 54	0	0%	1	7%	Severe Delay
Total	14	100%	14	100%	

Table 4 outlines the outcome of our preterm population who were assessed using the PARCA-R questionnaire in 2022. Results indicate a good outcome overall. In all, 9 of the 14 children (64%) were in or above the Average Range for Cognitive Development. With regards to Language, 11 of the 14 children (79%) were in or above the Average Range.

Table 5: PARCA-R Standard Score Outcomes according to Gestational Age for Preterm Infants Born in 2020; Assessed in 2022 (n=14)

Case	Gestational Age	Non-Verbal Cognition	Language	Developmental Profile
1	26	Mild Delay	Average	Mild Cognitive Delay/ Normal Language
2	28	Average	Average	Normal
3	28	Moderate Delay	Moderate Delay	Moderate Delay
4	29	Moderate Delay	Average	Moderate Cognitive Delay/Normal Language
5	30	Average	Average	Normal
6	30	Average	Above Average	Normal
7	30	Above Average	Above Average	Normal
8	30	Mild Delay	Average	Mild Cognitive Delay/ Normal Language
9	31	Mild Delay	Mild Delay	Mild Delay
10	32	Average	Average	Normal
11	32	Average	Average	Normal
12	32	Average	Average	Normal
13	32	Average	Average	Normal
14	32	Average	Average	Normal

Table 5 outlines the PARCA-R outcomes according to Gestational Age. In our hospital, the PARCA-R is generally avoided as an assessment tool for the extremely low gestational age infant as evidenced by the fact that only 3 children born ≤28 wks gestation were assessed using this tool in 2022. This is the most likely the reason why the outcomes for the children assessed using this questionnaire were so good (see table 4). Of the children who demonstrated cognitive delay within the group, it was mostly due to undeveloped 'pretend play skills'.

Our assessment of choice is the Bayley Assessment. While the PARCA-R is useful as a screening tool, the Bayley Assessment which is a face-to-face assessment yields more information about how each child is doing as more tasks/activities are tested and behaviour during testing can be observed. How a child is performing yields valuable insight about the child especially on how the child is managing in terms of sensory regulation and engagement which are important for future learning and executive function skills.

8.19 Neonatal Encephalopathy Group

In the neonatal encephalopathy group, 4 (44%) children were living within the Dublin area and 4 (50%) outside Dublin. The child living furthest away did not travel for a Bayley assessment but completed a PARCA-R questionnaire.

Ten (10) term children were referred for follow-up. Of these 10 infants, 8 (80%) were assessed, 7 children were assessed using the Bayley Scales (6 cooled and one not cooled) and 1 was assessed using the PARCA-R Questionnaire (cooled). Of the 2 children not seen, one family declined an assessment but shared that the child was demonstrating signs of severe gross motor delay and delayed cognitive, language and fine motor development. The other family, who declined an assessment, had a normal assessment in the OPD clinic at 18 months of age apart from mild speech delay.

Table 6: Neurodevelopmental Outcomes for the Neonatal Encephalopathy Cohort Born in 2020: Assessed in 2022.

Cases	Classification	TH/ Cooling	Bayley Cognitive	Language	EC	RC	Motor	FM	GM	Outcome
1	HIE Severe Grade 3	Yes	135	132	14	17	124	19	9	Superior Performance
2	HIE Moderate Grade 2	Yes	100	112	14	10	107	10	12	Average Performance
3	HIE Moderate Grade 2	Yes	105	100	11	9	97	10	9	Average Performance
4	HIE Moderate Grade 2	Yes	90	77	6	6	88	10	6	Mild Delay in Receptive and Expressive Language Skills and in Gross Motor Skills.
5	HIE Moderate Grade 2	Yes	85	56	1	4	91	10	7	Sensory Issues resulting in the Moderate-Severe Receptive and Expressive Language Skills delay.
6	HIE Moderate Grade 2	Yes	70	74	7	4	49	2	1	Borderline Composite Cognitive Score, Mild Delay in Receptive Communication Skills, Moderate Delay in Expressive Communication Skills and Severe Motor Delay
7	Seizures/No Encephalopathy	No	120	121	13	14	130	19	11	Superior Performance

Cases	Classification	TH/ Cooling	PARCA-R Cognitive	PARCA-R Language	Motor (Discussion with Family)	Outcome
8	HIE Moderate Grade 2	Yes	100	120	Average	Average Performance
Cases	**Classification**	**TH/ Cooling**	**Cognition**	**Language**	**Motor**	**Outcome**
9	HIE Severe Grade 3	Yes	Parent Report	Parent Report	Parent Report	Global Developmental Delay
10	Seizures/No Encephalopathy	No	Normal at OPD review at 18 months	Slow to develop at OPD review at 18 months	Excellent FM/ Very Good Motor at OPD review at 18 months	Average Cognitive and Motor Development with slow speech development

Table 6 provides the details of the individual profiles for this cohort of infants. Notably, 4 of the 7 children (57%) diagnosed with HIE/Neonatal Encephalopathy and treated with therapeutic hypothermia who were formally assessed at 2 years of age, were functioning within the Average Range (one child was in the Superior Performance range). One child had significant sensory issues causing severe receptive language delay, moderate expressive language delay, mild cognitive delay, normal fine motor development and mild gross motor delay. Another child had mild delay. The seventh child had more global developmental delay (cognitive, language and motor).

8.20 What are the Bayley Scales of Infant and Toddler Development (Bayley-lll)?

The Bayley-lll is an ability test of global development. It comprises of a series of play tasks and language stimulus books broken up into 3 composite scales with 5 sub-categories – cognitive development (**Cognitive Scale**), receptive and expressive communication (**Language Scale**) and fine motor and gross motor development (**Motor Scale**). It can classify delayed or advanced development within the specific sub-categories. The assessment session can take 2 hours or more to complete depending upon toddler cooperation, duration of assessment feedback and discussion with parents. The process can be tedious as the children are only 2 years of age, active and busy. It can be demanding when children are tired or challenged (especially for those travelling for more than 2-3 hours for the assessment). During the testing session, the child's emotional and behavioural reactions are noted. A full report is documented. The scores generated allow for a comparison between a child's performance over time and in relation to peers of the same age range. The scale identifies children with developmental delay and hence provides information for intervention planning.

8.21 What is the PARCA-R (Parent Report of Children's Abilities–Revised)?

The PARCA-R is a standardised, UK norm-referenced assessment of children's cognitive and language development at 24 months of age. It can assess a child's developmental level and can classify delayed development of any severity as well as advanced development. The children need to be assessed at 23.5 to 27.5 months to derive the standardised scores. There are separate scores for Non-Verbal Cognition and Language. The outcomes, 'above average', 'average', 'mild', 'moderate' and 'severe delay' can be calculated as used in conventional standard deviation (SD-banded) cut-offs. It is available in 14 languages. The PARCA-R is free and is immediately available to download www.parca-r.info.

Since its first validation study was published in 2004, it has been used as an outcome measure in clinical trials, observational studies, and as a screening tool in child development clinics and neonatal follow-up services. The PARCA-R is a well-researched tool that took 20 years to develop. It was the popular substitute for the Bayley Scales during the pandemic. It has been recommended by the NICE Guidelines as an assessment tool to screen for developmental delay. It has validity and reliability ratings providing standardised scores. It has been accepted as producing standard scores similar to other IQ/ developmental tests. It has been favourably compared with the Bayley-lll.

8.22 Extreme Preterm Birth

Extreme preterm birth can be associated with high rates of adverse neurodevelopmental outcomes including cognitive impairment (low IQ - especially non-verbal, poor working memory, slow processing speed and deficits in executive functions), attention problems/ADHD, peer relationship

problems/Autistic Spectrum Disorder, anxiety/emotional disorders and physical disability as well as subtle learning difficulties. Neurosensory issues are increasingly recognised. The preferred Bayley assessment enables the clinician to identify specific developmental delays, early signs of poor attention skills, poor auditory processing skills, poor sensory integration skills and poor motor/coordination skills. All of these factors are relevant in terms of later classroom performance. The process of administering the scale alone generates valuable information about a child's learning potential. Identifying and managing these issues at an early age is important to facilitate optimum long-term outcome. The assessment experience is also educational for parents as it gives them an insight into the range of developmental activities from which their child can benefit. The process can strengthen a child's potential by bringing about a change in parent attitude, knowledge and behaviour. Providing Bayley Assessments is a valuable service in terms of assessing two-year outcomes for preterm babies and the data is used to counsel parents when their babies are admitted to the Neonatal Intensive Care Unit (NICU).

Over the years, it has been noted that attention and sensory processing skills are two notable challenges for the preterm child who, despite having a good outcome, is not achieving his/her potential in terms of learning and language development. We looked at a home intervention programme to address these issues in a small cohort of infants. Our research paper titled 'Therapeutic Listening for Preterm Children with Sensory Dysregulation, Attention and Cognitive Problems' was published in January 2020.1 The research showed this home intervention programme to be a feasible intervention for preterm children improving their attention levels and sensory processing skills. These skills are very important for future learning and language development. We are continuing to research these issues so that we can get a better understanding of the needs of our preterm population in terms of attention and sensory processing skills.

8.23 Neonatal Encephalopathy (NE) Diagnosis

The National Neonatal Encephalopathy collaborative is of increasing importance for term infants, particularly since the advent of therapeutic hypothermia (January 2009). Outcome for this group of infants is improving since the introduction of therapeutic hypothermia as evidenced by our follow-up and international studies. However, we have seen from our small cohort over the years that neonatal encephalopathy impacts neurodevelopmental outcomes, and that outcome is mainly determined by the extent of injury to the brain. In a NMH retrospective study looking at developmental outcomes in a cohort of 115 NE infants from 2009-2016, developmental delay was greater in the infants with abnormal MRI brain scans compared to those with normal MRIs. In the cohort of infants with normal MRIs, language delay was 27%, motor delay was 9% and cognitive delay was 9%. In the cohort of infants with abnormal MRIs, language delay was 48%, cognitive delay was 40%, and motor delay was 30% indicating a marked difference.2 High seizure burden was also associated with poor outcome.

In the Neonatal Therapeutic Hypothermia in Ireland Annual Report 2020 (national aggregate report 2016-2019) 3 published recently, Bayley outcome follow-up data for 85 children showed that 26% had Gross Motor Delay, 21% had Receptive Language Delay, 21% had Expressive Language Delay,16% had Cognitive Delay, and 12% had Fine Motor Delay.

From the data presented above, neonatal encephalopathy that is treated with therapeutic hypothermia but not followed by severe impairments such as CP, can still be associated with impairments in sensory regulation, cognitive, motor, language and educational outcomes. Hence, we need to structure our neonatal encephalopathy follow-up to identify the best interventions both in the NICU and during the recovery and subsequent neurodevelopment of this highly vulnerable group of infants. As these children are at 'high risk' of potentially modifiable neurodevelopmental sequelae, they should be enrolled in neonatal follow-up programmes such as in our recently introduced ACoRN Programme which is discussed below.

8.24 Why are we doing these assessments?

Great advances have been made in neonatal intensive care over the past decade. Survival of infants born at 23 weeks gestation is now increasingly reported. Unless we measure our neonatal outcomes, we cannot hope to make improvements in the care we provide. These assessments are also an important service for our babies and their families. The parents receive a detailed copy of their child's report. Copies of the report, if requested by the family, may be sent to other clinicians who are involved in the care of their child.

Professional resources continue to be very limited for those children requiring developmental intervention such as speech therapy, physiotherapy and occupational therapy. This was particularly evident during the Covid pandemic when many children did not receive any follow-up at all. Waiting lists continue to be long. There is often no service available when a therapist is on leave. There was a lack of consistency in how publicly funded services were provided throughout the country. This was addressed by the launch of a National Policy on Access to Services which was approved by the HSE in September 2021 to ensure more equitable access to services for children in need and to Children Disability Network Teams (CNDTs). The CNDT has replaced existing disability teams provided by Enable Ireland, the Health Service Executive (HSE) Early Intervention Teams and School-Aged Assessment Teams, St. Catherine's Association, St. John of Gods Services and St. Michael's House. Unfortunately, as reported in the Irish Times on 3rd March 2023 and in the Houses of the Oireachtas Report on Autism published in June 20234, over one third of these service approved posts remain vacant. In 2022, there were more than 850 vacancies across the country's 91 CDNTs with the average national vacancy rate quoted at 34%.

We need to improve educational outcomes. Neurodevelopmental outcomes do not appear to be improving despite improved survival and neonatal care. In a UK survey, carried out in 2020, more than 90% of 426 families reported that there should be more awareness and understanding of the educational needs of children born preterm. Impairments in speech and language impact negatively on academic learning and executive functioning skills during the school years. Recognising these challenges, the PRISM E–learning resource programme, consisting of 5 x1 hours sessions, with interactive multimedia content, has been devised for educational professionals in the UK.[5] The sessions examine preterm birth, educational outcomes, cognitive outcomes, behavioural outcomes and social and emotional outcomes. It outlines strategies to support children with inattention, working memory difficulties, slow processing speed, poor visuospatial skills, social and emotional problems and mathematics difficulties. There is a need to bridge the gap between healthcare and education to determine what support children and families need, to understand the factors that contribute to attainment after preterm birth and to develop and evaluate intervention programmes.

Our newly appointed neonatal speech and language therapist (SLT) took up her post in November 2021. The importance of such a role is highlighted in the HSE Model of Care6 document and the NICE Guidelines.7 A speech and language therapist working with parents during the neonatal period and for the first two years is now deemed an essential service for children born preterm. The support of an SLT is vital for children struggling with feeding or who present with speech and language delays. Our SLT works with parents to initiate and develop their child's attention and listening skills, play skills, their comprehension and expression of language (combining words to make sentences), and their speech articulation, all which contribute to language development.

We know that preterm infants who have had early feeding problems are more likely to have language impairment, some with lasting effects into childhood and adolescence. Although preterm infants will not speak for a few years, elements of their care in the NICU may impact on their speaking ability over the long-term. For 2022, 52% had an expressive speech delay and 31% had a receptive speech delay (see Table 2). The extent of language delay as a problem in preterm infants is often under-appreciated, as many centres, including ours, primarily report on composite cognitive, language and motor scores as opposed to scaled (receptive and expressive) language scores. Our data support the need for early speech and language therapy input commencing in the NICU. Please note that our speech and language therapist was not in post in the NICU for this cohort of preterm infants followed up in 2022.

8.25 The ACoRN Programme

We now know that early identification of developmental delay is critical as early intervention is likely to be the most effective in decreasing impairment. With this in mind, we introduced the **ACoRN (Allied Care of at Risk Newborns) Programme in February 2022**, a teamed approach providing ongoing formal developmental assessments and interventions by Physiotherapy (PT), Speech and Language Therapy (SLT), Dietetics, Medical Social Work (MSW), Pharmacy and Psychology in conjunction with the NICU Medical and Nursing teams. In April 2023, our Department will appoint its first neonatal Occupational Therapist, who is a very welcome addition to the multi-disciplinary team.

The ACoRN NICU Programme incorporates a structured weekly allied health developmental ward round on all infants at risk of developmental delay during their time in the NICU.

The ACoRN Outpatients (OPD) Clinic Programme will be following up all our Very Low Birth Weight (VLBW) infants) at 3, 6, 9,12,18 and 24 months corrected age as they attend their medical outpatient appointments. This programme means that these infants will have access to a structured therapeutic developmental pathway in tandem with their scheduled general paediatric OPD assessments until they reach 2 years corrected age. These two programmes (NICU and OPD) are comprehensive and supportive allowing early management of developmental delays and facilitating timely onward referral, in keeping with international recommendations for at-risk infants.

The ACoRN programme will now be an integral part of follow-up care. During most of 2022, the ACoRN Programme improved the access our babies had to physiotherapy, speech and language therapy, pharmacy, medical social work, nutrition and dietetic input using a teamed approach that had begun in the NICU. We are very excited by our OPD ACoRN programme as parents have often expressed how lost they felt during those precious first two years in terms of supporting

their child's developmental needs. We will now be able to measure the impact of this programme by comparing Bayley outcomes prior to and after the introduction of our ACoRN programme. In anticipation of this, this year, we are now including tables with more detailed developmental outcome data which will facilitate any future comparisons.

For our cohort of children, born preterm and term with neonatal encephalopathy, the NICE Guideline NG72 provides a very comprehensive outline of the biomarkers for delay and the need for follow-up at 2 years and 4 years of age respectively7 We have introduced the ACoRN Programme to ensure all our VLBW infants (and hopefully soon our NE babies) receive early intervention while in NICU and during their first 2 years post discharge. However, these babies are not yet being seen at 4 years of age, which should be our next goal, if we wish to better support their school life and learning potential.

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2. *Power BD, Slevin M, Donoghue V, Sweetman D, Murphy JFA. Neonatal Therapeutic Hypothermia for Neonatal Encephalopathy: Mortality and Neurodevelopmental Outcome. Ir Med J; 2021: 114 (2); 264.*
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4. *Final Report on the Joint Committee on Autism. Houses of the Oireachtas Report, 14th June 2023*
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SECTION 9: Physiotherapy and Neonatal Speech and Language Therapy Service

The Neonatal Physiotherapy Team:

- Jo Egan – Clinical Specialist Physio
- Eithne Lennon – Senior Physiotherapist
- Sarah Fitzmaurice – Senior Physiotherapist

2022 saw the neonatal physiotherapist providing 3-4 day presence in NICU and continuing to provide the inpatient and outpatient musculoskeletal and developmental specialist services for neonatal patients, working as part of the NMH ACoRN team and also seeing infants referred for physiotherapy assessment and management. As well as clinical duties, the physiotherapists are involved in service development within the neonatal and multidisciplinary team and specialist education of neonatal nursing and allied health colleagues.

9.1 Attendance for Physiotherapy Service.

Year 2022	New Neonatal Inpatients	New Neonatal Outpatients
Neurodevelopmental assessment intervention	175	94
Talipes	74	72
Upper Limb Assessment follow up	15	15
Upper limb fractures therapy follow up	8	8
Developmental Dysplasia of Hip – requiring Pavlik harness	16	Followed up in TSH
Head & neck musculskeletal Assessment and follow up	0	48
Total	**288**	**237**

Neonatal Speech and Language Therapy (S&LT)

This is an emerging service since late 2021. This data is collated from both MNCMS and also S&LT own records.

In 2022, 141 inpatients were seen by S&LT according to S&LT records.

On discharge, 92 went home and 49 were transferred to another hospital. All infants who were transferred to other hospitals were eligible for S&LT inpatient follow up there. Only 2 of 8 centres currently have inpatient S&LT services for these infants.

38 inpatients born in 2022 qualified for follow up in the NMH OPD ACoRN clinic (see ACoRN Programme at the end of this section).

9.2 Inpatient Data 2022

Discharged	N	VON	Cleft	T21	NE/TH	NAS
Home	92	38	5	3	3	3
To other hospital	49	29	3	-	1	-
Total	**141**	**67**	**8**	**3**	**4**	**3**

9.3 Transfers to Other Hospitals who are eligible for inpatient S&LT follow up at local hospital

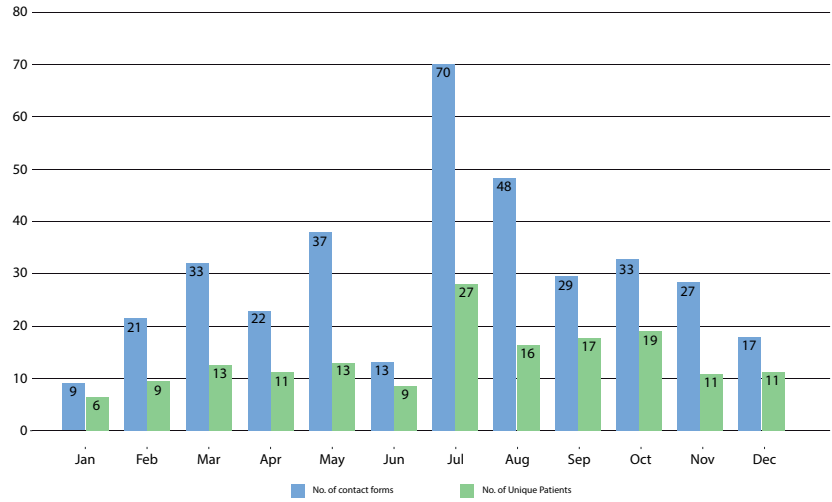
Hospital	Number transferred	VON	Cleft	HIE
Mullingar	16	14	0	0
Letterkenny	9	4	1	1
Castlebar	6	6	0	0
Sligo	3	0	0	0
Kilkenny	2	0	0	0
Waterford	1	1	0	0
OLOL Drogheda*	1	1	0	0
CHI Group*	9	0	0	0

**SLT in situ*

9.4 S&LT referral policy (Dec 2021) states that all infants <34 weeks eligible for SLT referral/input

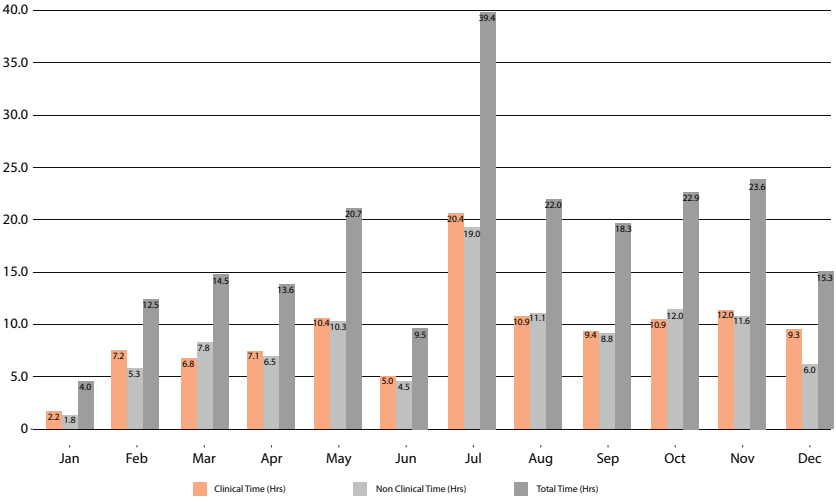
Born (gestational age)	Number Admitted To Unit	Number with S&LT Contact Form
<28 weeks	74	34
29-32 weeks	89	46
33-36 weeks	309	20
32 weeks	17	16
33 weeks	30	6
34 weeks	60	4

9.5 S&LT Contact Data - No. of Contact Forms / Unique Patients



109 patients had 359 SLT contacts recorded in MNCMS in 2022 across the whole range of gestational ages.

9.6 S&LT Contact Data - Clinical / Non-Clinical Time Spent



A total of 216.2 patient hours (111.5 clinical hours and 104.6 non-clinical hours) were recorded in MNCMS in 2022 across the whole range of gestational ages.

9.7 S&LT Eligibility Audit Dec 2021-Nov 2022

Audit was conducted on different days by SLT during routine neonatal ward round. All babies on the neonatal unit were included on the day. Based on the SLT referral criteria the following information was recorded: Age, medical stability, respiratory support, weight, presence of syndrome/craniofacial problems, neurological presentation, nursing concerns about oral feeding. If the baby met criteria for SLT referral or if the baby was already known to SLT this was recorded as 'eligible'.

12 audits were completed on 12 different days from Dec 2021 – Nov 2022.

320 babies were included in total across the 12 days, 158 were deemed eligible for SLT (49%).

On Day of Audit Number of Babies:	Mean	Range
On the Neonatal Unit	27	19-36
Eligible for SLT service on day	13	7-18
% Eligible	49%	39-62%

The majority of infants were preterm, other conditions included cleft palate, syndromic/ neurological presentation, neonatal encephalopathy, NAS.

9.8 Outpatient Information

Consultant referrals from OPD Clinic were received for 16 infants in 2022 and 17 encounters occurred.

ACORN 2022 (see ACORN Programe on next page)

First ACORN multidisciplinary Out Patients Clinic Programe was in June 2022.

To end Dec 2022:

- 38 inpatients were identified as eligible for follow up in Outpatients post discharge
- 14 three month assessments were offered/13 took place in 2022 (1 DNA)
- 5 six month assessments were offered/1 DNA & 1 abroad
- 1 nine month assessment offered/took place

Zelda Greene MSc
Clinical Specialist Speech and Language Therapist in Neonatology
Sept 2023

ACoRN Developmental Care Programme

In 2022 our **A**llied **C**are **o**f at **R**isk **N**ewborns Programme was established as a structured multidisciplinary quality improvement initiative to support the developmental care of at-risk infants in the neonatal unit and following discharge home.

Infants considered 'at risk' and eligible for inclusion were those born before 30 weeks ($<29^{+6}$/40) gestational age or with a birth weight of less than or equal to 1.5 kg (very low birth weight) and admitted to our neonatal unit (n=120) in 2022. Infants born at such early gestation and/ or low birthweights are at increased risk for developmental delays as measured at age 2 years and beyond. The use of developmental supports in the neonatal unit and dedicated developmental post discharge surveillance is intended to help reduce these delays and improve longer term outcomes.

The core therapy ACoRN team has representation from Physiotherapy (PT), Speech and Language Therapy (SLT), Clinical Nutrition and Dietetics, Clinical Psychology, Medical Social Work (MSW) and Pharmacy who work in conjunction with Medical and Nursing/ Midwifery colleagues. The inclusion of Occupational Therapy (OT) is awaited pending the appointment of an Occupational Therapist expected in 2023.

The main activities during 2022 included the introduction of a multidisciplinary in-patient ward round and out-patient clinic focusing on developmental care and supporting parental involvement (see below). A range of standardised and clinical assessments were used to assess motor skills, positioning, feeding skills, behaviour and nutrition. Educational supports were also developed with the wider neonatal team, and Key Performance Indicators (KPIs) were identified.

Activities also took place to celebrate the following events and highlight the support of our ACoRN programme: World Book Day, April 23rd; World Infant, Child and Adolescent Mental Health Day, 23rd April; International Kangaroo Care Awareness Day, 15th May; International Breastfeeding Week, 1-8th August; National Breastfeeding Week, 1-8th October, World Prematurity Day, 17th November.

ACoRN Multidisciplinary Developmental In-Patient Ward Round

The ACoRN ward round offers a structured approach to developmental assessment and management of eligible infants in the neonatal unit. The main focus during 2022 was the establishment of the weekly ward round, assessment protocol and care plan and the preparation of a developmental care resource pack for parents, including bespoke leaflets about kangaroo care, breastfeeding and a letter for siblings.

Eligible infants were enrolled when considered stable. The first developmental ward round took place on 17th February and throughout the remainder of 2022, a total of 35 rounds took place. 44 infants were included, with 18 reviewed more than once. Ward round attendance varied depending on staff availability with SLT, PT, Pharmacist and Dietitian attending most.

ACoRN Multidisciplinary Developmental Out-Patient Clinic

The ACoRN outpatient clinic offers ongoing comprehensive and supportive developmental surveillance at established intervals, currently planned to take place at 3, 6, 9, 12, 18 and 24 months corrected age (CA). Clinics were led by PT, SLT and/or Clinical Psychology, with onward referral to Dietetics, Medical Social Work, Pharmacy and Medical Teams on a case by case basis.

All infants born in the hospital catchment area and enrolled in the 2022 ACoRN inpatient developmental programme were eligible for follow up.

For the year 2022, of the 44 infants included in the ACoRN in-patient programme, 35 were eligible for out-patient follow up.

The 3-month CA follow up assessments commenced on 15th June, and were completed for 11 of 14 eligible infants. The 6-month CA follow up assessments commenced in October, and were completed for 2 of 6 eligible infants. There were 3 non-attenders.

SLT and PT consistently attended all appointments. Dietitian consults were required for 5 assessments. MSW were available for consultation as required. To date it appears that the time for SLT and PT out-patient appointments is approx. 2.5 hours per appointment and it is expected that each baby would attend x 3 appointments per year up to age 2 years. This would equate to a minimum of 7.5 therapy hours per baby per year or 15 hours per baby per 2-year follow-up.

ACoRN Programme Outcomes

Staff and parents have been supportive of the programme and feedback has been positive. The resource pack and leaflets have been well received and staff have reported improved confidence and earlier signposting of developmental concerns, with at-risk infants identified and engaging with the allied health developmental therapy earlier. Developmental care is also becoming more standardised and team building and co-working is progressing. The ACoRN outpatient clinic has also facilitated earlier management of developmental delays and timely onward referral, in keeping with international recommendations for at-risk infants.

A key challenge is staffing and the administrative burden on overstretched services, as well as the need for a suitable clinic space, especially as numbers increase and the service evolves.

More structured assessment and clinic data analysis is planned to drive further service development.
The impact on neonatal outcomes will also be assessed, with developmental progress and longer term 2 year neurodevelopmental outcomes tracked for the ACoRN cohort and compared with age-matched cohorts pre introduction of the programme.

ACoRN Team

Physiotherapists: Joanne Egan and Eithne Lennon
Speech and Language Therapist: Zelda Greene
Dietitians: Roisin Gowan and Roberta McCarthy
Pharmacist: Montserrat Corderroura
Medical Social Workers: Ciara Buggy and Deirdre Real
Clinical Psychologist: Marie Slevin

Acknowledgements
We would like to express our thanks to parents and staff for their involvement and support as well as the NMH Foundation who funded a number of initiatives.

SECTION 10: Report from the Regional Neonatal Units with the Ireland East Network

The three regional units in the Ireland East Network are:

- Wexford General Hospital
- St Luke's General Hospital, Kilkenny
- Midlands Regional Hospital, Mullingar

10.1: Admissions to the Regional Neonatal Units

Regional Unit	Wexford	Kilkenny	Mullingar
No. of Admissions to the Regional Neonatal Units	277	273	183
No. of VLBW *inborn* VLBW infants	2	2	1
No. of VLBW infants reported to VON	5	4	1
No. of infants transferred to another centre	7	18	9
No. of these infants transferred to NMH	7	5	6

10.2 GA of VLBW Infants Born in Regional Neonatal Units

Regional Unit	Wexford	Kilkenny	Mullingar
< 24 wks	0	0	0
24-26 wks	3	0	0
27-29 wks	1	1	1
30-32 wks	1	2	0
> 32 wks	0	1	0
Total	**5**	**4**	**1**

10.3 Birthweight of VLBW Infants Born in Regional Neonatal Units

Regional Unit	Wexford	Kilkenny	Mullingar
< 501g	0	0	0
501-750g	2	0	0
751-1000g	2	0	0
1001-1250g	1	0	0
1251-1500g	0	4	1
> 1500g	0	0	0
Total	**5**	**4**	**1**

10.4a Clinical Demographics on VLBW Infants

Regional Unit	Wexford	Kilkenny	Mullingar
Inborn	2	2	1
Male	3	3	1
Chorioamnionitis	1	1	0
Maternal Hypertension	2	1	0
Antenatal Steroids (partial or complete)	4	3	1
C/S	3	4	1
Antenatal Magnesium Sulphate	3	2	0
Multiple Gestation	0	1	0
Any major birth defect	0	1	0
Small for gestational age	2	2	0

10.4b Respiratory Support for VLBW Infants

Regional Unit	Wexford	Kilkenny	Mullingar
Surfactant in DR	3	0	1
DR ETT ventilation	3	0	0
Conventional Ventilation	3	0	0
High Frequency Ventilation	0	0	0
High Flow Nasal Cannula	0	0	0
Nasal IMV/SIMV	0	0	0
Nasal CPAP	2	3	1
Ventilation after Early CPAP	2	0	0
Surfactant at any time	1	2	0
Inhaled Nitric Oxide	0	0	0

10.4c Major Morbidities in VLBW Infants

Regional Unit	Wexford	Kilkenny	Mullingar
RDS	4	2	1
Pneumothorax	1	0	0
Chronic Lung Disease (at 36 wks)	1	0	0
Early Bacterial Infection	2	0	0
Late Bacterial Infection	0	0	0
Coagulase Negative Staphylococcus Infection	0	0	0
Fungal Infection	0	0	0
NEC	1	0	0
NEC Surgery	0	0	0
PDA	1	0	0
Ibuprofen for PDA	0	0	0
PDA ligation	0	0	0
Retinopathy of Prematurity	2	0	0
Severe ROP (Stage 3 or more)	0	0	0
Surgery for ROP	0	0	0
Any Grade of IVH (Grade 1-4)	1	1	1
Severe IVH (Grade3-4)	0	0	0
Cystic PVL	0	0	0
Died in DR	0	1	0
Died within 12 hrs	0	0	0
Mortality	1	1	0
Mortality excluding Early Deaths	1	0	0
Survival	4	3	1
Survival without Specified Morbidities	4	3	1

Clinical Academic Profile

We have a strong commitment to undergraduate and postgraduate education at the Neonatal Unit in the National Maternity Hospital. Each year, we teach (in lectures, in small group tutorials and at the cot-side) over 200 medical students from University College Dublin (UCD) who attend during their rotation in Obstetrics and Gynaecology. In addition, we have undergraduate medical students and post-graduate doctors from other Irish medical schools and from overseas who attend our unit to learn during a period of elective rotation or observership. We examine undergraduate medical students in Neonatology and in Paediatrics, and postgraduate students (MSc, MD and PhD) in Ireland and overseas.

We have particular interest and experience in clinical research. The neonatal department at the National Maternity Hospital are committed to researching the best way to care for newborn babies. Over the past decade we have conducted multiple randomised controlled trials that have informed changes in clinical practice locally, nationally and internationally. Current clinical research focuses on delivery room management of preterm infants, thermoregulation, intubation, respiratory support and transfusion medicine.

The following randomised controlled trials were active in the Neonatal Unit in 2022:

APOLLO-PB: a randomised trial of placing preterm infants in a polyethylene bag before or after cord clamping. Primary outcome was rectal temperature on admission to the neonatal unit.
Dr Emma Dunne, Prof. Colm O'Donnell, Dr. Lisa McCarthy,

APOLLO-UP; a randomised trial of inserting umbilical or peripheral venous catheter in preterm infants on admission to the neonatal unit. Primary outcome was rectal temperature two hours following admission.
Dr Emma Dunne, Prof. Colm O'Donnell, Dr. Lisa McCarthy

The NOSI trial: Nasal High Flow to Optimise Stability during Intubation. This was a pilot randomised trial of high flow oxygen during neonatal intubation. The objective of this pilot study was to calculate duration of peripheral oxygen saturation below 75% during single and multiple intubation attempts in order to inform development of a larger definitive trial. Recruiting completed end 2021 and analysis and publication occurred in 2022.
Dr Jason Foran, Dr Carmel Moore, Dr Caitriona Ni Chathasaigh, Dr Jyothsna Purna, Ms Shirley Moore, Dr Anna Curley

ROSA: A randomised trial of Routine Or Selective Application of a facemask for preterm infants at birth
NMH Team: Dr Caitriona Ni Chathasaigh, Dr Emma Dunne, Dr Lucy Geraghty, Prof. Colm O' Donnell.
Research question; Among infants born before 32 weeks' gestation, does selectively applying a face mask to give PPV for apnoea or bradycardia only compared to routinely applying a face mask to give CPAP to all infants reduce the number of infants who receive positive pressure ventilation

VODE: A Randomised Trial of Videolaryngoscopy OR Direct Laryngoscopy for Endotracheal Intubation of Newborns: ClinicalTrials.gov Identifier: NCT04994652. Dr. Lucy Geraghty, Dr. Lisa McCarthy, Dr. Eoin O' Currain, Prof. Colm O Donnell. This study seeks to establish if there is a benefit to using a newer type of device to insert breathing tubes for babies. We hope to add to the evidence base around how best to support newborn breathing in an era of less and less invasive supports. The study recruited throughout 2022; from January - July 2022 it was kindly supported by the first research grant by the NMH Foundation.

GEPPHI: a randomised, placebo-controlled trial of dextrose gel for prevention of hypoglycaemia on admission to the neonatal unit among preterm infants.
NMH Team: Dr Jyosthsna Purna, Ms Shirley Moore

The SafeBoosC-III trial 'Safeguarding the Brains Of Our Smallest Children'.
NMH team: Dr Caitriona Ni Chathasaigh, Dr Anna Curley
Research question; Among infants born less than 28 weeks' gestation, does monitoring of the brain's oxygenation with near-infrared spectroscopy compared to routine care increase the chance of survival and decrease the risk of brain injury? Funding: The National Women and Infant's Health Programme / The SafeBoosC Trial Group, Department of Neonatology, Rigshospitalet Hospital, Copenhagen, Denmark. Local Sponsor University College Cork

Additional studies in the neonatal unit :

Transfusion Studies
The following transfusion related studies were all carried out in 2022:
NMH team Dr Carmel Moore, Dr Anna Curley

The INSPIRE Study: A study explore the point prevalence of transfusion over a 6-week period in October-December 2022 across two tertiary neonatal units in Dublin. This also formed part of a wider European Study funded by European Society for Pediatric Research and the European Blood Alliance

Platelet Transfusion through central lines study: Development of an *in vitro* model of platelet transfusion in order to address safety and feasibility of platelet transfusion through neonatal central lines.

PlaNeT-2/MATISSE Two year outcome study; This study aimed to assess whether platelet transfusion-related harm persists beyond the neonatal period through analysis of neurodevelopmental outcomes at two years corrected age in the cohort of children who participated in the PlaNeT-2/MATISSE randomised controlled trial of platelet transfusion thresholds.

SCrIPT Study Comparing inflammation befo**r**e and after **P**latelet **T**ransfusion: this study aimed to improve understanding of potential inflammatory mechanisms of platelet mediated harm through a study of changes in inflammatory proteins following platelet transfusion.

Development of protocol for the PLaNeT-3 Study: We aimed to improve understanding of potential volume and dose mediated inflammatory harm through the development of a protocol for a randomised controlled trial of platelet transfusion volumes in premature neonates.

Parents Understanding of Blood Transfusion in the NICU: this qualitative study aimed to explore parents' understanding and experiences of their babies' blood transfusion in the neonatal unit.

National Survey; Survey of current neonatal and paediatric transfusion practice and policies in 2022 across the Republic of Ireland: a national survey (in conjunction with the National Transfusion Advisory Group and National Clinical Lead for Transfusion) to ascertain current practice prior to the creation and introduction of new guidelines in the Republic of Ireland.

Airway studies
The following airway related studies were carried out in 2022

The ART study: The Assessment of the role of a Respiratory function monitor in neonatal facemask ventilation Training.
Dr. Caitríona Ní Chathasaigh, Ms Linda Smiles, Dr. Eoin O' Currain, Dr Anna Curley
Research question; Among health care professionals learning neonatal facemask ventilation, does individualised training with a novel feedback device (respiratory function monitor) reduce facemask leak?

The VAN study: Videolaryngoscopic Analysis of Neonatal intubation.
Dr. Caitríona Ní Chathasaigh, Dr. Eoin O' Currain, Dr Anna Curley
Video analysis of neonatal intubations using a videolaryngoscope and GoPro recording device. Analysis of the procedure, instructions given and terminology used in order to identify barriers and aids to successful intubation. The goal is creation of an e-learning programme for trainees in General Paediatrics and Neonatology

Direct Laryngoscopy versus Indirect Videolaryngoscopy for Intubating Newborn Mannequins: A Randomised Crossover Study,
Dr. Lucy Geraghty, Dr. Greta Gambacorta, Prof. Colm O Donnell
This study examined the role of 3 different laryngoscopes for use by neonatal staff of varying levels of experience in intubating babies in a simulated environment. We found similarities and differences between them which helped educate the VODE clinical trial further. We also established the preferences of staff in the hospital across levels of experience. The study was subsequently presented locally at the NMH Research & Innovation Symposium Exhibition 2022.

Other
Neonatal Effects of Maternal Hypothyroidism (The NEMaH Study)
Dr Lucy Geraghty, Dr Deirdre Sweetman, Marie Culliton, Dr Recie Davern, Dr Mensud Hatunic, Dr Eoghan Mooney, Dr Paul Downey, Dr Anne Twomey.
This multi-disciplinary study seeks to establish if maternal or cord-blood thyroid-receptor antibody (TRAb) levels correlate with the neonatal outcomes of newborns. The study recruited throughout 2022 via Dr Hatunic's Endocrine Clinic and the postnatal wards.

Postgraduate degree students 2022:
The neonatal department at the National Maternity Hospital are committed to researching the best way to care for newborn babies. Over the past decade we have conducted multiple randomised controlled trials that have informed changes in clinical practice locally, nationally and internationally. Current clinical research focuses on delivery room management of preterm infants, thermoregulation, intubation, respiratory support and transfusion medicine.

In 2022 we had 4 neonatal research fellows undertaking postgraduate research degrees with University College Dublin. Three of our neonatal nurses also completed an MSc in Neonatal Nursing in 2022

Dr. Emma Dunne (PhD, UCD Clinical Lecturer Jan-Jun2022)
July 2019 – present
PhD thesis: APOLLO: A Prospective investigation Of the prevention of heat Loss in LOw birth weight infants. This included two randomised controlled trials APOLLO-PB ands APOLLO-UP, several benchtop studies and a cohort study of continuous temperature monitoring on admission to the neonatal ICU.
Supervisors: Dr. Lisa McCarthy, Prof. Colm O'Donnell
University affiliation: University College Dublin
Funding

Dr. Carmel Moore
July 2020 – present
PhD thesis: Neonatal blood and platelet transfusion; unanswered questions
Supervisors: Dr Anna Curley, Prof Colm O'Donnell, Prof Fionnuala NiAinle
University affiliation: University College Dublin
Funding: Aspire Fellow (HSE NDTP funded)/NMH Foundation

Dr. Caitríona Ní Chathasaigh
July 2021 – present
MD thesis: The Neonatal Airway
Supervisors: Dr Anna Curley, Dr Eoin O' Currain
University affiliation: University College Dublin
Funding: National Women and Infants Programme

Dr. Lucy Geraghty (MD, UCD Clinical Lecturer July 2022 to present)
July 2022-present
MD thesis: Neonatal Intubation
Supervisor: Prof Colm O'Donnell
University affiliation: University College Dublin
Funding NMH Foundation, UCD School of Medicine

Awards
Second place, European Society of Pediatric Research, Young Investigator of the year 2022
Dr Carmel Moore

Best Trainee Presentation, INFANT Research Symposium: Clinical Trials Cork
Dr Emma Dunne

The Niall O'Brien Medal
This was awarded to two of our Neonatal Nurses, Ma. Crystelle Villena and Shiela Joy Cuidno for academic and clinical excellence while undertaking the post-graduate diploma in Neonatal Intensive Care Nursing.

Published Research

Journal articles

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Neonatal Nursing Academic Profile 2022

Foundation Programme in Neonatal Nursing

We had a number of candidates undertake these modules in 2021/2022.

- Principles of Special Care Nursing---8 nurses
- Principles of Intensive Care Nursing---2 nurses

Post-Graduate Diploma in Neonatal Intensive Care Nursing

- Four of our neonatal nurses completed their post-graduate diplomas in Neonatal Intensive Care Nursing in 2021/2022.

The Niall O'Brien Medal

- This was awarded to two of our Neonatal Nurses, Ma. Crystelle Villena and Shiela Joy Cuidno for academic and clinical excellence while undertaking the post-graduate diploma in Neonatal Intensive Care Nursing.

MSc in Neonatal Nursing

- Three of our neonatal nurses also completed an MSc in Neonatal Nursing in 2022.

Nursing Education

- Alongside specific neonatal education, many nursing staff have undertaken education to further expand their role and improve the care offered to the infants in our care
- These include: Venepuncture and cannulation
  Infection control
  Bereavement
  Communication
  Leadership

Advanced Neonatal Nurse Practitioner Role

Ms. Shirley Moore, has been accredited and registered to this post since 2014. The role of the Advanced Neonatal Nurse Practitioner includes clinical workload, training with the NCHDs and nursing staff alongside involvement in audit and education. She is involved in local and national tenders and committees. Shirley is also a member of the simulation committee and an NRP instructor.

She has been actively involved in a number of RCTs in the unit and is a member of the research committee.

She was also actively involved in the NOSI study and the following publication in Archives of Disease in Children; Fetal and Neonatal edition. First published online October 2022.

"Nasal high-flow therapy to Optimise Stability during Intubation: the NOSI pilot trial"
Shirley Moore is also on the committee for curriculum development for the post-graduate diploma in Neonatal Intensive Care Nursing alongside in-house committees including drugs and therapeutics and blood transfusion. She is actively involved in the development of neonatal policies. She has presented a number of academic lectures locally.

A further candidate ANP (Neonatology) post was approved in late 2022, the successful applicant was Ms Linda Smiles who will commence the role in early 2023.

Clinical Skills Facilitators, Clinical Nurse Specialists, RANP and NICU Staff Nurses

A large number of our specialist nurse roles and senior nurses contribute greatly to the profile of the unit. These include the following;

- Involvement in committees for neonatal education programmes
- Members of the research committee and involved in active ongoing research on the unit
- Contribution to MNCMS neonatal chart development and most recent upgrade
- Educational presentations and lectures regarding neonatal topics
- Audits conducted in the unit to include <1500g audit, central line sepsis audit, hypoglycaemia audit
- Overview of the unit provided to transition year students
- Train the trainer for the introduction of new equipment or updates to allow for peer training
- A number of nursing staff are NRP instructors
- Contribution to the content of the information screen available for parents on the unit

Research

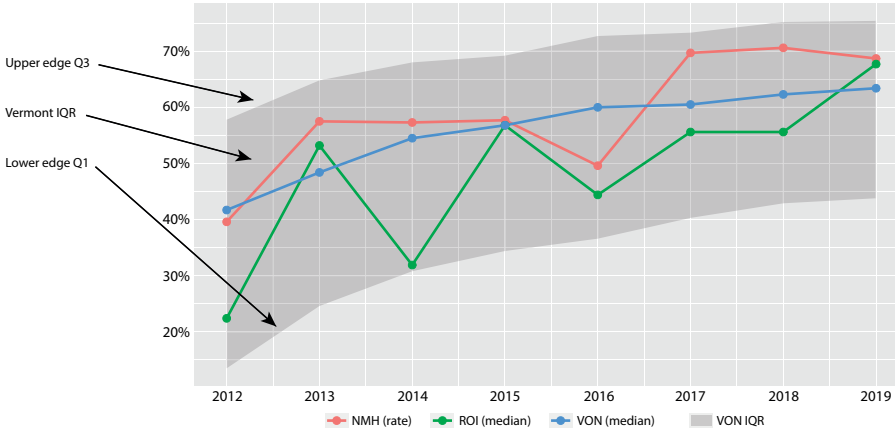
There were a number of research studies ongoing in the Neonatal department and delivery involving neonates throughout 2022. These studies could not be facilitated without the nursing staff working in the NICU.

Appendices

Appendix 1: Understanding the Comparison Plots in Section 4

From 2019 onwards all comparison plots in Section 4 use the median rate for both the Vermont Oxford Network (VON) and the Republic of Ireland (ROI) group of hospitals as opposed to the mean rate which was used in previous years.

Each plot has a grey shaded area which represents the Vermont Interquartile Range (IQR), Q1 - Q3. The lower edge of this shaded area is the 25th quartile Q1 and the upper edge is the 75th quartile Q3 while the blue line represents the 50th quartile or median. By plotting the NMH rate and the ROI median rate on top of this shaded area we can see whether or not these rates stay within or stray outside the Vermont IQR.



For some of the metrics in this section, the median rate for the ROI group of hospitals is 0%. This is explained by the fact that of the 19 hospitals in the ROI group, four are Level 1 units, four are Level 2 units and eleven are Level 3 units. As the majority of very preterm infants are cared for in Level One or Level Two units, some units may have no data to report on these metrics. Therefore this will result in a median value of 0% for the ROI group as a whole

Appendix 2

CANDIDACY CHECKLIST FOR NEONATAL THERAPEUTIC HYPOTHERMIA (COOLING)

PATIENT'S NAME: _____ **HOSP. NO:** _____

TIME of BIRTH: _____:_____ hrs. **CURRENT AGE in hours /minutes:** _____ hrs._____ mins.

If current age is greater than 6 hours, call tertiary cooling centre before proceeding.

Directions for the use of this checklist: Start at the top and work through each numbered component. When directed to proceed to the exam, refer to the exam found on page 2. If there is missing data,(such as a known perinatal event and / or Apgar scores) and you are in doubt as to whether or not the patient qualifies for cooling, consult with the tertiary cooling centre promptly to discuss the patient.

**Note: If patient is < 6 hours old and meets the gestation, weight and blood gas criteria and has a witnessed seizure, patient is eligible for 'COOLING' regardless of additional exam findings. Consult the tertiary cooling centre to discuss any questions or concerns.*

Clinical Information	Criteria *(place a tick in the box that corresponds to the patient information)*	Instructions
Gestation	1 ≥ 36 weeks gestation ☐	Go to ⇒ 2 **Weight**
	= 35 weeks gestation ☐	May not be eligible *Contact cooling centre*
	< 35wks gestation ☐	Not Eligible
Weight	2 ≥ 1800 grams ☐	Go to ⇒ 3 **Blood Gas**
	< 1800 grams ☐	Not Eligible
Blood Gas pH = _____ Base Excess = _____ Source: Cord ☐ *Or* 1st infant blood gas at <1hour of life ☐ Arterial ☐ Capillary ☐ Venous Time Obtained: _____ : _____	3 pH < 7.0 *or* Base excess ≥ -16 ☐	Criteria met thus far. Go to **EXAM***
	No gas obtained ☐ *or* pH 7.0 to 7.15 ☐ *or* Base excess -10 to -15.9 ☐	Go to ⇒ 4 **History of acute perinatal event**
	pH >7.15 or Base Excess < 10 ☐	May not be eligible; Go to ⇒ 4 **History of acute perinatal event**
Acute Perinatal Event *(tick all that apply)*	4 Variable / late foetal HR decelerations ☐ Prolapsed / ruptured / tight nuchal cord ☐ Uterine Rupture ☐ Maternal haemorrhage / placental abruption ☐ Maternal trauma (eg. vehicle accident) ☐ Mother received CPR ☐	Any ticked, Go to ⇒ 5 **Apgar score**
	No perinatal event *or* Indeterminate what the event was because of home birth or missing information	May not be eligible; Go to ⇒ 5 **Apgar score**
Apgar Score at 1 minute _____ 5 minute _____ 10 minute _____	5 Apgar ≤ 5 at 10 minutes (yes) ☐	Criteria met thus far. Go to **EXAM***
	Apgar ≤ 5 at 10 minutes (no) ☐ *(no, was 6 or greater at 10 minutes)*	Go to ⇒ 6 **Resuscitation after delivery**
Resuscitation after Delivery *(tick all that apply)* _____ PPV/intubated at 10 minutes _____ CPR _____ Adrenaline administered	6 Continued need for PPV or Intubated at 10 minutes?(yes) ☐	Criteria met thus far. Go to **EXAM***
	PPV/Intubated at 10 minutes?(no) ☐	May not be eligible Go to **EXAM***

This checklist, adapted from the 'STABLE Program', 6th edition, 2013, has been produced by the National Neonatal Transport Programme (NNTP) and endorsed by the Faculty of Paediatrics, Royal College of Physicians, Ireland, in March 2014.

Circle findings for each domain

PATIENT IS ELIGIBLE FOR COOLING WHEN 3 OR MORE DOMAINS HAVE FINDINGS IN COLUMNS 2 OR 3

Domain	1	2	3
Seizures	**None**	**Seizures common:** (focal or multifocal seizures) (Multifocal: clinical activity involving > one site which is asynchronous and usually migratory) Note: If the patient is < 6 hours old and meets the gestation, weight and blood gas criteria and has a witnessed seizure, patient is eligible for cooling regardless of the rest of this exam	**Seizures uncommon:** (excluding decerebration) ***Or*** Frequent seizures
Level of Consciousness	**Normal** **or** **Hyperalert**	***Lethargic*** Decreased activity in an infant who is aroused and responsive **Definition of Lethargic:** • Sleeps excessively with occasional spontaneous eye opening • Responses are delayed but complete • Threshold for eliciting such responses increased • Can be irritable when disturbed	**Stuporous / Comatose** Demonstrates no spontaneous eye opening and is difficult to arouse with external stimuli **Definition of Stuporous:** • Aroused only with vigorous and continuous stimulation **Definition of Comatose:** • No eye opening or response to vigorous stimulation In both stupor and / or coma, the infant may respond to stimulation by grimacing / stereotyped withdrawal / decerebrate posture
Spontaneous activity when awake or aroused	**Active** **Vigorous, doesn't stay in one position**	**Less than active, not vigorous**	**No activity whatsoever**
Posture	**Moving around and does not maintain only one position**	**Distal flexion, complete extension or "frog-legged" position** Term infants with HIE often exhibit • Weakness in hip-shoulder distribution (eg proximal part of extremities) • Distal joints, fingers and toes often exhibit strong flexion • Thumbs strongly flexed and adducted. • Wrists often flexed • Above postures are enhanced by any stimulation	**Decerebrate with or without stimulation (all extremities extended)**
Tone	**Normal** • Resists passive motion **Hypertonic, jittery** • Lowered threshold to all types of minimal stimuli eg light touch, sudden noises • Infant may even respond to his/her own sudden movements	**Hypotonic or floppy,** • Axial hypotonia (ie. head lag) and/or limb hypotonia	**Completely flaccid like a rag doll**
Primitive reflexes	***Suck:*** Vigorously sucks finger or ETT ***Moro:*** Normal: Limb extension followed by flexion with stimulus	***Suck:*** Weak ***Moro:*** Incomplete	***Suck:*** Completely absent ***Moro:*** Completely absent
Autonomic system	***General Activation of Sympathetic nervous system*** ***Pupils:*** • Normal size (-1/3 of iris diameter) • Reactive to Light ***Heart Rate:*** • Normal, > 100bpm ***Respirations:*** • Regular spontaneous breathing	***General Activation of Parasympathetic nervous system*** ***Pupils:*** • Constricted (< 3mm estimated) • but reactive to light ***Heart Rate:*** • Bradycardia (< 100bpm, variable up to 120) ***Respirations:*** • Periodic, irregular breathing effort • Often have more copious secretions and require frequent suctioning	***Pupils:*** • Skew gaze, fixed, dilated, • not reactive to light ***Heart Rate:*** • Variable, inconsistent heart rate, irregular, may be bradycardic ***Respirations:*** • Completely apnoeic, requiring PPV & / or ET intubation and ventilation

Neurological Exam to evaluate candidacy for cooling: If in doubt as to whether patient qualifies for cooling, consult with the cooling centre promptly to discuss the patient.

Definitions

Obstetrical Definitions

Maternal death: Death of a patient, booked or unbooked, for whom the hospital has accepted responsibility, during pregnancy or within six weeks of delivery whether in the hospital or not.

Stillborn infant: A baby with birthweight greater than or equal to 500g, who shows no signs of life at delivery.

Early neonatal death: A baby born alive with birthweight greater than or equal to 500g, who dies within 7 days.

Perinatal mortality rate: The sum of stillbirths and early neonatal deaths per 1,000 total births whose birthweight is greater than or equal to 500g.

Corrected perinatal mortality rate: The sum of stillbirths and early neonatal deaths per 1,000 total births whose birthweight is greater than or equal to 500g excluding congential anomalies.

Gestation: The best estimate is the duration of gestation using the first day of the last normal menstrual period and early ultrasound as appropriate in the clinical circumstances.

Preterm: Less than 37 completed weeks.

Postdates: 42 weeks or greater.

Prolonged labour: Labour more than 12 hours - nulliparous.

Labour length: Duration of time spent in the labour ward.

Blood Gases: Capillary, Arterial and Venous Blood gases given in order pH, Partial Pressure of Oxygen (PO2), Partial Pressure of Carbon (PCO2) and Base Excess (BE).

Classification for indications for Caesaerian Section in spontaneous Labour or after having had labour induced

Fetal reason
Caesarean section for fetal indication before any oxytocin has been given.

Dystocia

Inefficient uterine action/inability to treat/fetal intolerance
Problem is inadequate progress with no fetal problems until oxytocin is started.

Inefficient uterine action/inability to treat/overcontracting
Problem is inadequate progress but oxytocin does not reach maximum dose as per protocol in unit because of overcontracting uterus.

Inefficient uterine action/poor response
Problem is inadequate progress which does not improve after being treated with the maximum dose of oxytocin according to the protocol in the unit.

Inefficient uterine action/no oxytocin
Problem is inadequate progress which for whatever reason has not been treated with oxytocin.

Efficient uterine action/CPD/POP*
Adequate progress (1cm/hr) and in nulliparous women would need to have been treated with oxytocin) but vaginal delivery not possible.
*In multiparous women the term CPD/POP is replaced with obstructed labour.

CLASSIFICATION OF INDICATIONS FOR INDUCTIONS OF LABOUR

Fetal reasons
Includes all indications for induction that are carried out for the benefit of the fetus.

PET/Hypertension
Includes all indications for induction that are carried out for hypertensive disorders.

Post Dates
Includes all inductions that are carried out specifically for 42 weeks gestation or greater.

SROM
Includes all inductions for spontaneous rupture of the membranes

Maternal reasons/Pains
Includes all indications for induction that are carried out for the benefit of the mother including pains not in labour

Non medical reasons/Dates< 42 weeks
Includes all indications for inductions where there is no absolute medical indication or for dates but less than 42 weeks

Pathological Definitions

Thrombophilia screen

Prothrombin Time, INR, APTT, Thrombin Time, Fibrinogen, Lupus Anticoaguloant screen - (Lupus anticoagulant, anti-cardiolipin antibodies, beta-2 glycoprotein 1 antibody), Anti Thrombin Three, Protein C, Protein S Free, Modified APCR (FVLeiden mutation if appropriate).

Postmortem

The perinatal autopsy involves external examination of body, with appropriate photographs and X-ray. Internal examination includes inspection of cranial, thoracic and abdominal cavities with removal and weighing of organs: organs are retuned to the body before release. Samples are taken for subsequent processing and histologic examination. Extent of sampling of tissue such as spinal cord, nerve and muscle depends on clinical details and on the extent of maceration. The autopsy includes swabs for culture from body cavities and washings for virology. Tissue is frozen for fat stains and may be used for assessment of metabolites. Cytogenetic analysis and where indicated, microarray, may be performed on ether skin or placental tissue. The placenta is reported in conjunction with the autopsy, and maternal blood results are also evaluated in reaching a diagnosis. The quality of the report is benchmarked against standards set in the Faculty of Pathology, RCPI QA/QI programme.

A provisional anatomic diagnosis is issued within two working days (except in Coroner's cases, where it is not issued), and the final report is usually within 8 weeks. Occasional cases take longer due to complexity and/or the necessity for external consultations.

Placental pathology

A triage system is in place for placental examination. The entire placenta is submitted to the laboratory:

a) from cases of Caesarean section
b) from cases born in the delivery ward, where there is an abnormality of pregnancy, labour, delivery or the neonatal period.

In other cases, the placenta is kept refrigerated for seven days and retrieved if an indication for analysis becomes apparent.

Data from analysis of cases of Perinatal morbidity or mortality is returned in an anonymised fashion to the National Perinatal Epidemiology Centre, UCC, where it is pooled with data from other maternity units and national trends and benchmarks are published. The terminology used is the same consensus terminology as that used by NPEC (Khong TY et al). Some of these terms are expanded on below.

Maternal vascular malperfusion (MVM)

This is a spectrum: at the less severe end is mild accelerated villous maturation, then ischemic villous crowding and latterly infarction, also referred to as uteroplacental insufficiency (UPI). Increasingly, terms such as "shallow implantation" are being used to explain the pathogenesis.

Expected findings in a case of severe PET would be a small placenta with recent and old infarcts, located centrally and peripherally in the parenchyma. Atherosis is fibrinoid change in vessels, seen in about half of cases of PET and occasionally in other conditions eg connective tissue disease.

Hypoxic membrane lesions
Laminar decidual necrosis may be regarded as an acute hypoxic lesion, and microcystic change in the chorion as a chronic hypoxic lesion.

Meconium
When present in large quantities, meconium may cause necrosis of muscle cells in the walls of chorionic vessels and possibly lead to vasospasm and ischaemia.

Chorangiosis
More vessels than normal are seen in terminal villi. It may be present as a primary finding or as a reaction where adjacent villi have been destroyed by villitis, and is suggested to be a marker of chronic hypoxia.

PATTERNS OF INFLAMMATION

Chorioamnionitis
The terms "maternal inflammatory response" and "fetal inflammatory response are used with each being staged and graded according to consensus guidelines. There is an association between a severe fetal inflammatory response and brain damage in both term and pre-term infants.

Maternal-fetal immune interaction.
This may be manifest as any or all of villitis, intervillositis, chronic chorioamnionitis and deciduitis.

Villitis
Rare cases of villitis are due to infection eg CMV, but most are of unknown aetiology and are immunologically mediated. Villitis is graded as low-grade or high-grade. Overall, villitis is seen in 10% of placentas; high-grade villitis occurs in < 2% and is associated with an adverse perinatal outcome. Villitis may cause damage to fetal vessels in the placenta and this is associated with neurologic damage in term infants. It may recur in subsequent pregnancies.

Intervillositis
Chronic histiocytic intervillositis is relatively rare, but is over-represented in the cases in this report. It is associated with growth restriction and perinatal loss, with a mean gestation of loss of 25/40. It is more common in patients with immune dysregulation, and is likely to recur in subsequent pregnancies.

THROMBOSIS AND HAEMORRHAGE

Fetal vascular malperfusion (FVM)
Occlusions of the fetoplacental circulation are manifest by: extensive avascular villi, obliterated

stem arteries, haemorrhagic villitis, and occlusive thrombi. The term fetal thrombotic vasculopathy is also used. High-grade FVM, in particular, is associated with neonatal encephalopathy.

Non-occlusive mural fibrin thrombi
These are found in large fetal vessels in approx 10% of placentas. They are more common in cases with FTV and abnormal coiling; they reflect impaired fetoplacental flow, but the significance of isolated ones in smaller stem vessels is at present unclear.

Cord coiling
The cord normally has one coil per 5cm. Both hypo- and hypercoiled cords are associated with IUGR, fetal death, cord stricture, thrombosis and an abnormal response to labour.

Abruption and retroplacental haemorrhage (RPH)
RPH may be identified on pathologic examination of the placenta, but have been clinically silent. Conversely, dramatic clinical abruption may leave no changes in the placenta. In many cases RPH causes compression infarction of the placenta.

Diffuse chorioamniotic haemosiderosis (DCH)
This is diagnosed by the presence of haemosiderin-laden macrophages in the membranes and/or chorionic plate. Such placentas are more likely to show circumvallation, old peripheral blood clots and green discoloration. Clinically, DCH is associated with chronic vaginal bleeding, multiparity and smoking. Blood and breakdown products are released into the amniotic fluid. Oligohydramnios, IUGR and a lower gestational age at delivery have been found more commonly in cases with DCH. Persistent pulmonary hypertension and dry lung syndrome are more common in these neonates. DCH may represent chronic peripheral separation of the placenta, possibly from marginal venous bleeding (rather than the arterial bleed of abruption).

ABNORMAL PLACENTAL DEVELOPMENT

Delayed/abnormal villous maturation
This is where the placenta has failed to develop appropriately for gestational age, partially or completely. It is a poorly understood entity, and is associated with diabetes. It is associated with an increased risk of stillbirth. Some cases may receive a descriptive diagnosis eg abnormal maturation or variable villous maturation where there is a mixed picture, with some areas showing delayed maturation and other areas accelerated maturation. The term "distal villous immaturity" is also used.

Increased perivillous fibrin
Localised increases in fibrin are common, but a diffuse increase, sometimes in a pattern called "maternal floor infarction" is associated with an adverse outcome.

Placental weight
In general, the term placenta weighs between one sixth and one seventh of the infant's weight, but a wide range of placental weights is seen in normal infants. The weight is given in the cases discussed

where it is felt to be markedly abnormal. Fetoplacental weight ratio (median of around 7 at term) are sometimes used.

Khong T Yee, Mooney EE, Ariel I et al. Sampling and definition of placental lesions. Amsterdam Placental Workshop Group Consensus Statement. Arch Pathol Lab Med 2016;140:698-713.

Tyee Khong, EE Mooney, PGJ Nikkels, TK Morgan, SJ Gordjin, eds: Pathology of the Placenta: A Practical Guide. Springer Nature Switzerland 2019. ISBN 978-3-319-97213-8

Glossary

ABG	Arterial blood gas
AC	Abdominal circumference
ACA	Anticardiolipin antibodies
ACH	After coming head
aEEG	Amplitude integrated EEG
AFI	Amniotic fluid index
AFV	Amniotic fluid volume
AGA	Appropriate for gestational age
AKI	Acute kidney injury
ALT	Alanine aminotransferase
Anaemia	A haemoglobin level of less than 102% g/dl
ANC	Antenatal care
APCR	Activated protein C resistance.
APH	Antepartum haemorrhage Bleeding from the genital tract after 24 weeks gestation
APTT	Activated partial thromboplastin
ARM	Artifical rupture of the membranes to induce labour
ASD	Atrial septal defect
AST	Asparate aminotransferase
AVSD	Atrioventricular septal defect
BBA	Born before admission
BMI	Body mass index
BMV	Bag and Mask Ventilation
BPP	Biophysical profile
BP	Blood pressure
BPD	Biparietel diameter
BPD	Bronchopulmonary dysplasia
BPP	Bio physical profile
BSO	Bilateral salpingo oophorectomy
CCAM	Congenital cystic adenomatoid malformation
CHD	Congenital heart defect
CIN	Cervical intraepithelial neoplasia
CK	Creatine kinase
CLD	Chronic lung disease
CMV	Cytomegalovirus
CPAP	Continuous positive airway pressure
CPC	Choroid plexus cysts
CPD	Cephalopelvic disproportion
CPG	Capilliary blood gas
CPR	Cardiopulmonary resuscitation
CRP	C reactive protein
CSA	Childhood sexual abuse
CSF	Cerebro spinal fluid
CT	Computerised axial tomography
CTG	Cardiotocograph

CTPA	Computed tomography pulmonary angiogram
CVP	Central venous pressure
CVS	Cardiovascular system
CXR	Chest x-ray
D	Day
D/C	Dilatation and curettage
DIC	Disseminated intravascular coagulation
DNA	Did not attend
DOL	Day of life
Domino	Domicillary In Out
DR	Delivery room
DTR	Deep tendon reflex
DVT	Deep vein thrombosis
DWI	Diffusion-weighted images
EBL	Estimated blood loss
Echo	Echocardiogram
ECHO	Extracorpeal membrane oxygenation
ECV	External cephalic version
EDF	Enddiastolic flow
EDV	Enddiastolic volume
EFM	Electronic fetal monitoring
EFW	Estimated fetal birth weight
ELBW	Extremely low birth weight
ET	Endotracheal
ETT	Endotracheal tube
EUA	Examination under anaesthetic
FBS	Fetal blood sampling
FD	Fetal distress
FFP	Fresh frozen plasma
FHH/NH	Fetal heart heard/not heard
FM	Fetal movements
FMF	Fetal movement felt
FMNF	Fetal movements not felt
FSE	Fetal Scalp Electrode
FTA	Failure to advance
FVM	Fetal vascular malperfusion
FTND	Full term normal delivery
G and M	Grossly and microscopically
GA	General anaesthetic
GAD	Gestation at delivery
GBS	Group B Streptococcus
GCT	Glucose Challenge Test
GDM	Gestational diabetes mellitus
GIS	Gastrointestinal system
GP	General practitioner
GTT	Glucose tolerance test

GUS	Genitourinary system
Hb	Haemoglobin g/dl
HCG	Human chorionic gonadotrophin
HELLP	Haemolysis elevated liver enzymes low platelets
HFO	High frequency oscillation
HR	Heart rate
Hrs	Hours
HRT	Hormone replacement therapy
HSV	Herpes simplex virus
HVS	High Vaginal Swab
IA	Intermittent auscultation
IDDM	Insulin dependent diabetes mellitus
IHCP	Intrahepatic cholestasis of pregnancy
IMB	Intramenstrual bleeding
IMV	Intermittent mandatory ventilation
INR	International normalised ratio
IOL	Induction of labour
IPP	Intermittent positive pressure
IPPV	Intermittent positive pressure ventilation
ITP	Idiopathic thrombocytopenic purpura
IUCD	Intrauterine contraceptive device
IUD	Intrauterine death
IUGR	Intrauterine growth retardation
IUI	Intra uterine insemination
IUT	Intrauterine transfusion
IVDA	Intravenous drug abuser
IVH	Intra ventricular haemorrhage
IVIG	Intravenous immunoglobulin
L/S	Lecithin/Sphingomyelin
LA	Lupus anticoagulant
LBI	Liveborn infant
LDV	Lactate dehydrogenase
LFD	Large for dates
LFT	Liver function test
LGA	Large for dates
LLETZ	Large loop exision of transformation zone
LMP	Last menstrual period
LMWH	Low molecular weight heparin
LP	Lumbar Puncture
LSCS	Lower segment caesarean section
LSR	Lecithin/sphingomyelin ratio
LUS	Lower uterine scar
LVH	Left ventricular hypertrophy
LVS	Low vaginal swab
MCA	Middle cerebral artery
Mins	Minutes

MRA	Magnetic resonance angiogram
MRI	Magnetic resonance imaging
MROP	Manual removal of placenta
MSU	Mid-stream urinalysis
MSV	Mauriceau smellie veit
MVM	Maternal vascular malperfusion
ND	Normal delivery
NEC	Necrotising enterocolitis
NED	No evidence of disease
NER	Neonatal encephalopathy register
NICU	Neonatal intensive care unit
NIPPV	Nasal intermittent positive pressure ventilation
NND	Neonatal death
NO	Nitric oxide
NPO	nil by mouth
N/R	Not recorded
NRCTG	Non reassuring CTG
NS	Normal saline
NSAPH	Non substantial antepartum haemorrhage
NST	Non stress test
NT	Nuchal translucency
NTD	Neural tube defect
OCP	Oral contraceptice pill
OHSS	Ovarian hyperstimulation syndrome
OP	Occipital Posterior
PCB	Post coital bleeding
PCOS	Polycystic ovary syndrome
PCR	Polymerase chain reaction
PDA	Patent ductus arteriosis
PE	Pulmonary embolism
PET	Pre-eclamptic toxaemia
PFA	Plain film of the abdomen
PFC	Persistent fetal circulation
PFO	Patent foramen ovale
PGA	Post gestational age
PIE	Pulmonary interstitial emphysema
PLIC	Posterior limb of the internal capsule
PMB	Post menopausal bleeding
PNW	Postnatal ward
POM	Puncture of membranes to accelerate labour
POP	Persistent occipito posterior position
PPH	Post partum haemorrhage
PPHN	Persistent pulmonary hypertension
PPROM	Preterm pre-labour rupture membranes
PR	Pulmonary regurgitation
PROM	Preterm rupture of membranes

PTX	Pneumothorax
PVL	Periventricular leucomalacia
RBC	Red blood cell
RCC	Red cell concentrate
RDS	Respiratory distress syndrome
RLF	Retrolental fibroplasia
RPOC	Residual products of conception
RS	Respiratory system
RV	Right ventricle
RVH	Right ventricular hypertrophy
SA	Spinal analgesia
SBI	Stillborn infant
SCBU	Special care baby unit
SFD	Small for dates
SFD	Suspected fetal distress
SG	Social group
SGA	Small for gestational age
SIADH	Syndrome of inappropriate ADH secretion
SIDS	Sudden infant death syndrome
SIMV	Synchronized intermittent mandatory ventilation
SMR	Standardised mortality rate
SROM	Spontaneous rupture of membranes
SVC	Superior vena cava
SVD	Spontaneous vaginal delivery
TAH	Total abdominal hysterectomy
TAH & BSO	Total abdominal hysterectomy and bilateral salpingoopherectomy
TAPVD	Total anomalous pulmonary venous drainage
TAS	Thoracamniotic shunt
TC	True conjugate
TDS	Three times a day
TICH	Traumatic intracranial haemorrhage
TLD	Therapeutic loop diathermy
TOF	Tracheo oesophageal fistula
TR	Tricuspid regurgitation
TTN	Transient tachypnoea of the newborn
TTT	Twin to twin transfusion
TVT	Tension-free vaginal tape
U/S	Ultrasound

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