



Nutrition Among Infants with Hypoxic Ischaemic Encephalopathy and Treated with Therapeutic Hypothermia: A Retrospective Cohort Study

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INTRODUCTION

Hypoxic Ischaemic Encephalopathy (HIE) is a brain injury caused by oxygen or blood flow deprivation ⁽¹⁾, affecting 1-6/1000 live birthday and resulting in a 15-20% mortality rate ⁽²⁾. These infants are treated with Therapeutic Hypothermia (TH).

TH involves cooling the infant to 33-34 degrees Celsius for 72 hours to reduce brain damage and disability. After this, the infant is rewarmed to a normal body temperature (37 degrees C) over a 6-12 hr period ⁽³⁾.

While global trends suggest early initiation of enteral feeds during TH is safe and beneficial ⁽⁴⁾, clinical practices remain highly variable and Irish data on nutritional outcomes is limited.

The aim of this study is to evaluate inpatient and post-discharge nutrition-related factors and identify changes over time in infants with HIE treated with TH at a level 3 neonatal unit in Ireland.

METHODS

Study Design and Study Population: This is a single-centre retrospective cohort study and audit conducted at The National Maternity Hospital (NMH), Dublin which includes all infants diagnosed with HIE treated with TH at The NMH from 2020-2024 (n=66). Inborn HIE infants (n=34) were compared to case-matched controls (matched for gestation, birthweight and date of birth). Further analysis compared two time periods (Figure 1).

Data collection: Information on demographics, nutrition, growth and multidisciplinary team (MDT) consults during inpatient and outpatient follow up was extracted from the Maternity and Newborn Clinical Management System (MN-CMS).

Statistics: Analysis was performed using Microsoft Excel, SPSS (v29) and R Studio. T-tests, Mann-Whitney, Chi² and Fisher's Exact were used to identify statistical significance before the Benjamini-Hochberg correction for false discovery rate was applied to improve accuracy.

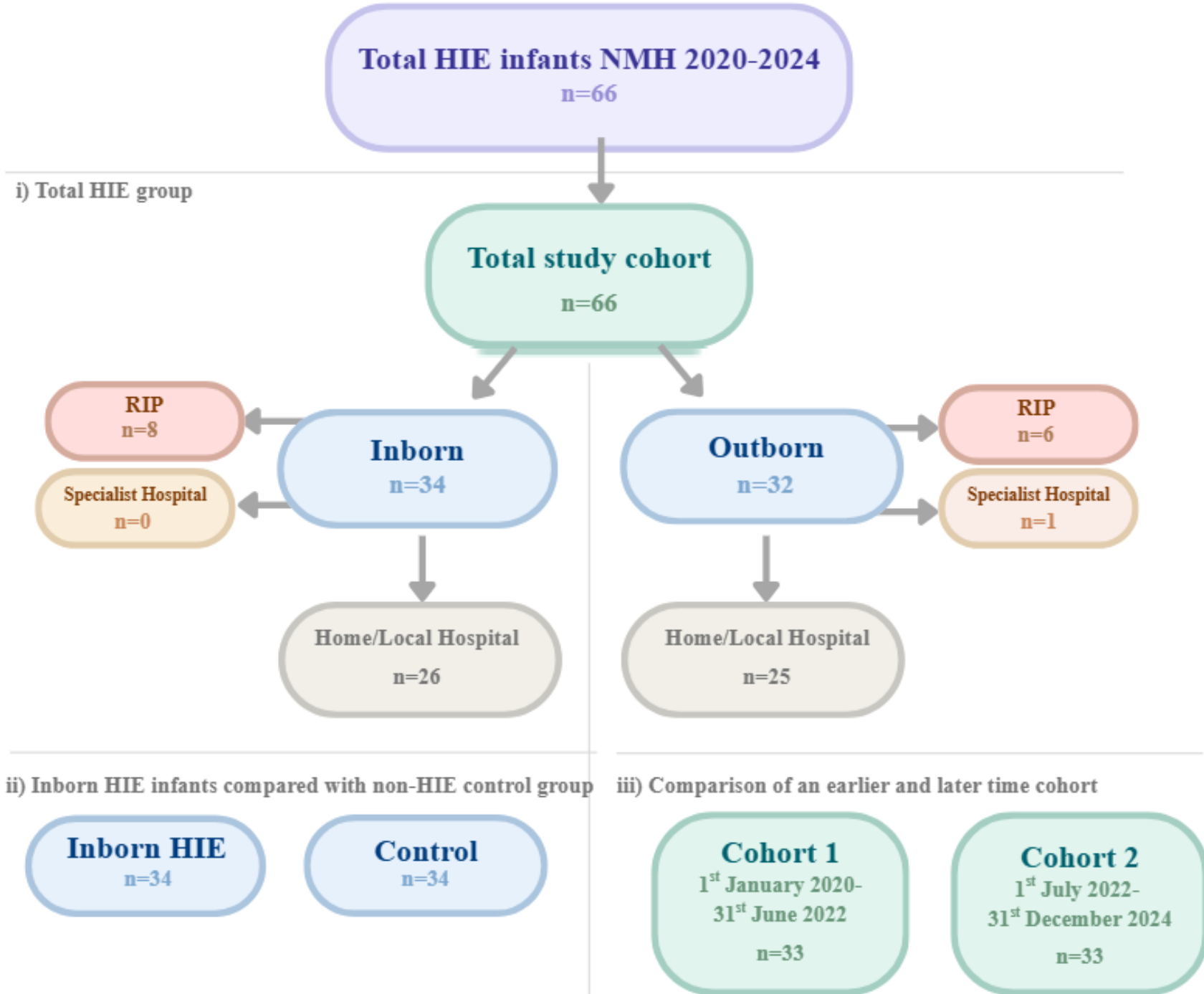


Figure 1: Flowchart of study population

RESULTS

Over the five-year study period (2020–2024), 66 infants with HIE treated with therapeutic hypothermia were identified at NMH. Of these, 34 (52%) were inborn, 39 (59%) were male, and mean birthweight was 3.43 kg. Fourteen infants (21%) died at NMH. Comparing cohorts, mortality was lower in cohort 2 (15% vs 27%), with more infants discharged home (85% vs 70%).

HIE infants took longer to initiate feeds compared to controls (24 vs 1 hour, p<0.05) and had markedly higher tube-feeding rates (93% vs 27%, p<0.05). Maternal milk (MM) feeding was high across both groups during inpatient stays (87% HIE vs 78% controls) (Table 1). Improvements were observed over time; cohort 2 showed higher MM rates (97% vs 81%), greater feeding during therapeutic hypothermia (65% vs 40%) (Figure 2), and higher MM rates at discharge (89% vs 70%).

Table 1: Comparison of inborn HIE group with case-matched non-HIE controls

	Variable	HIE Group	Non-HIE Group	P-Value
Demographics	Birthweight (mean (SD)) kg	3.51 (0.53)	3.51 (0.53)	1.00
	Gender (male)	22 (65%)	22 (65%)	1.00
	Gestational age (median (IQR)) weeks	40 (2.1)	40 (2.1)	1.00
	Delivery Method (vaginal)	15 (44%)	24 (71%)	0.44
	Admission to neonatal unit	34 (100%)	4 (12%)	0.00*
Discharge outcome	Home/ Local hospital	26 (76%)	33 (97%)	0.15
	Specialist hospital	0 (0%)	0 (0%)	1.00
	Death	8 (24%)	1 (3%)	0.05
Nutrition practices	Time to 1st feed (median (IQR)) (hrs)*	24 (44)	1 (2.35)	0.00*
	Maternal milk as inpatient ^a	26 (87%)	25 (76%)	1.00
	Tube-feeding as inpatient ^a	28 (93%)	9 (27%)	0.00*
	Breastfed as inpatient ^b	20 (67%)	24 (73%)	0.60
	Maternal milk 0-6 months ^c	20 (77%)	7 (88%)	0.00*
	Breastfed 0-6 months ^c	20 (77%)	7 (88%)	0.00*
Nutrition issues post-discharge**	Nutrition issues ^d	11 (42%)	0 (0%)	0.00*
	Growth concern ^e	4 (36%)		
	Irritability ^e	3 (27%)		
	Gastro oesophageal reflux (GOR) ^e	6 (55%)		
	Constipation ^e	2 (18%)		
Growth Faltering (GF)***	GF birth to discharge (moderate-severe) ^f	6 (19%)		
	GF 0-6 months (moderate-severe) ^g	2 (10%)		
Consults	Dietitian as inpatient any	6 (18%)	0 (0%)	0.05
	Dietitian as outpatient any ^d	6 (23%)	0 (0%)	0.03*
	Baby Clinic (medical consult) any ^d	26 (100%)	11 (33%)	0.00*

*Indicates a p value <0.05 representing significance;

Insufficient non-HIE infants attended post-discharge to include or compare; *Growth faltering moderate to severe defined as a drop in weight z-score ≥1.2

^aOf infants who received feeds as an inpatient (HIE n=30, Control n=33)

^bOf infants who received oral feeds as an inpatient (HIE n=30, Control n=33)

^cOf infants with a feed type and/or method recorded at 0-6 months as an outpatient (HIE n=26, Control n=8)

^dOf infants who survived to post-discharge (HIE n=26, Control n=33)

^eOf infants with nutrition or feeding issue recorded post-discharge (HIE n=11, Control n=0)

^fOf infants with a weight recorded at birth and discharge (HIE n=32, Control n=16)

^gOf infants with a weight recorded at discharge and 0-6 months (HIE n=21, Control n=1)

Moderate to severe growth faltering (GF) from birth to discharge occurred in 11% of the total HIE group. Encouragingly, this reduced over time, with cohort 2 showing lower rates of moderate to severe GF from birth to discharge (6% vs 16% in cohort 1), potentially reflecting earlier feeding initiation and greater multidisciplinary input.

HIE infants received significantly more specialist input than controls across all disciplines: dietitian (20% vs 0%), lactation consultant (70% vs 6%), and SLT (23% vs 0%). Input increased from cohort 1 to cohort 2, particularly LC (47% vs 87%) and SLT (7% vs 26%) (Figure 3). Despite this, 42% of HIE infants reported post-discharge nutrition issues, of whom fewer than one third received dietetic input.

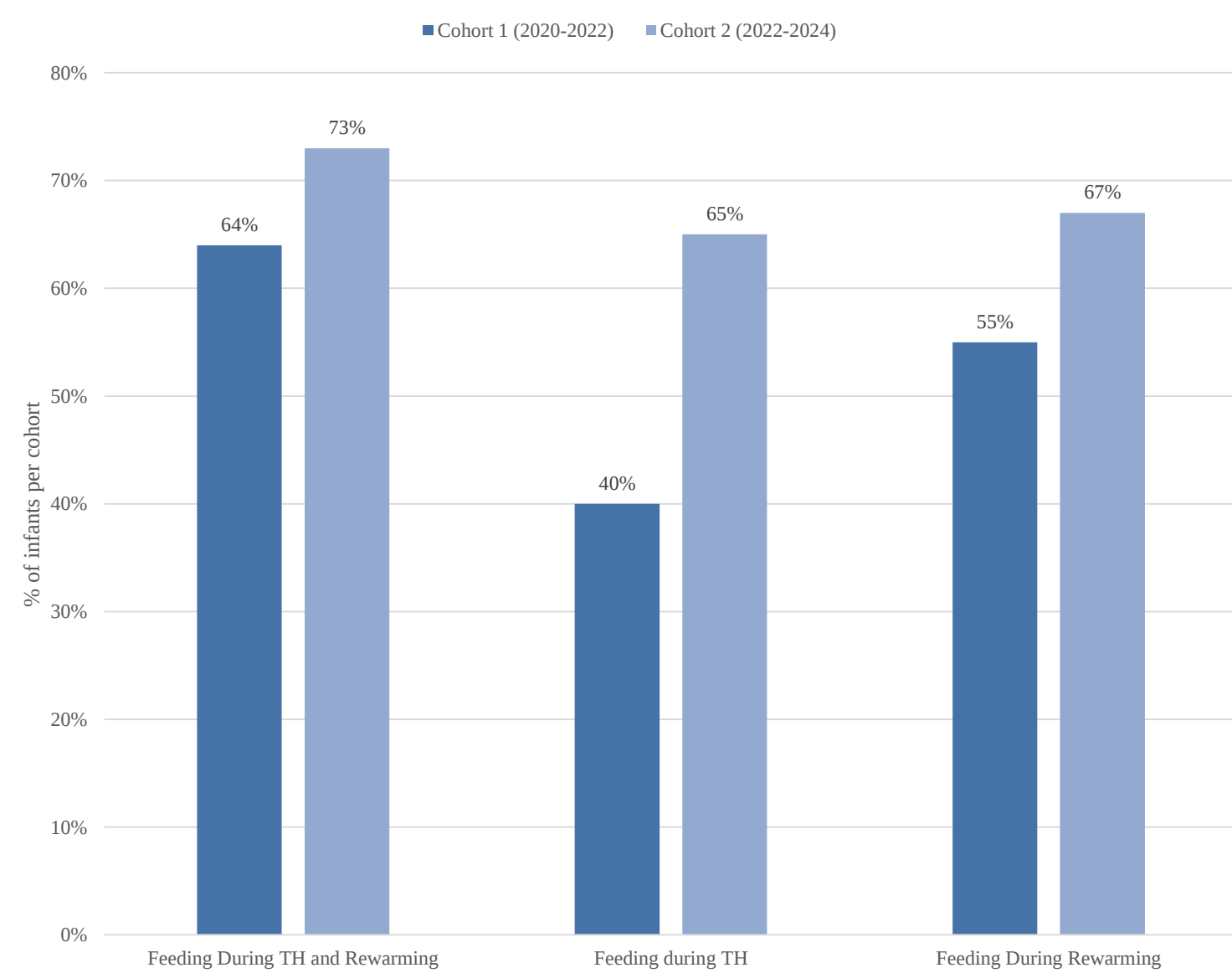


Figure 2: Comparison of feeding during TH and rewarming in cohort 1 and cohort 2

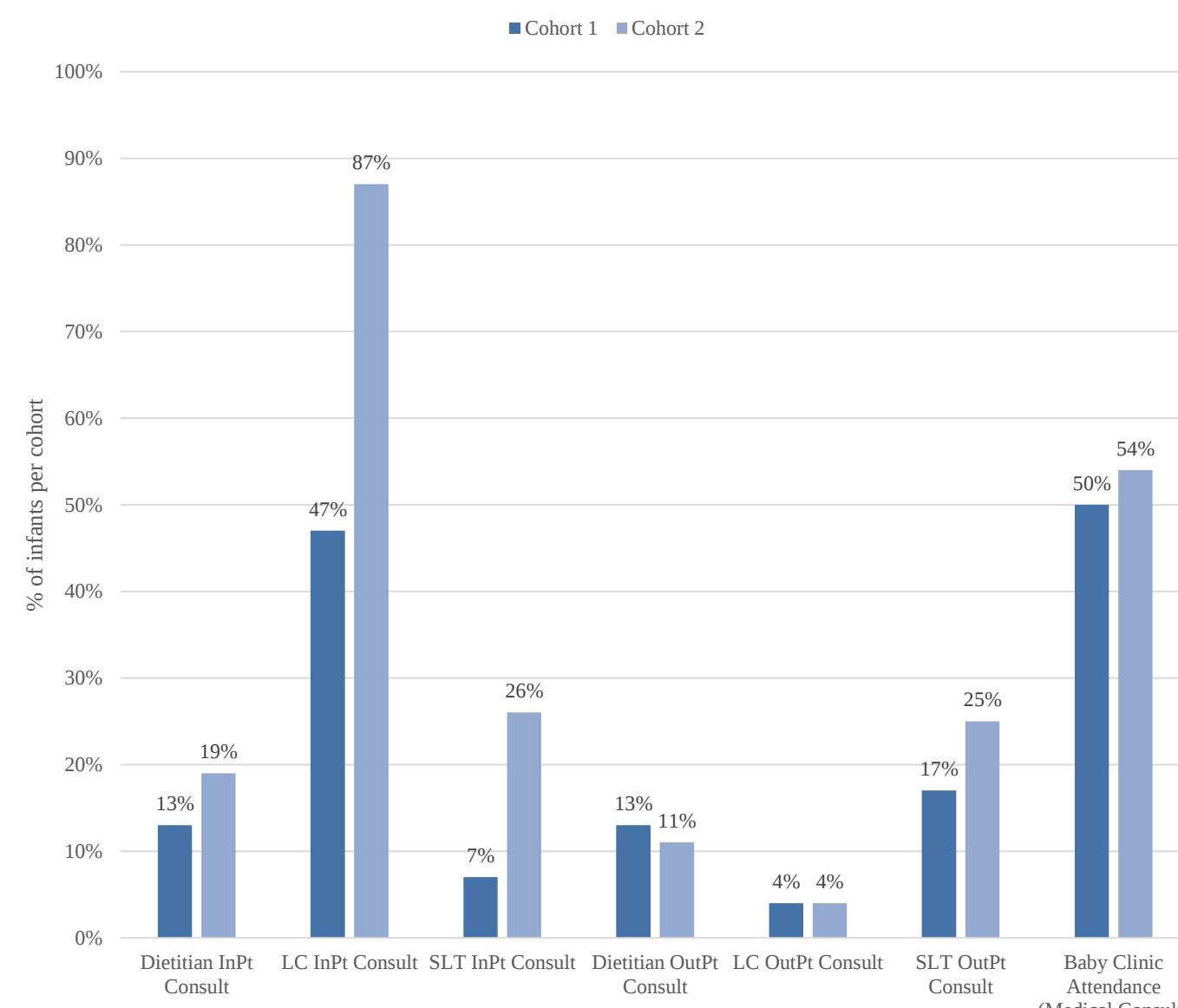


Figure 3: Comparison of health care professional input in cohort 1 and cohort 2

CONCLUSION

This study highlights and confirms that infants with HIE treated with TH face significantly greater nutritional challenges than matched controls, including delayed feeding (possibly associated with clinical caution ⁽⁴⁾) and high tube-feeding and neonatal unit admission rates. However, the data also shows a positive shift; feeding during TH increased from 40% to 65% and maternal milk receipt rate was 97% in the later cohort. The shift towards earlier feeding during TH and increased MDT involvement reflects growing clinical confidence and alignment with with emerging international evidence that early enteral feeding during TH is safe ⁽⁵⁾.

Despite these improvements, there is a persistent gap in dietetic provision. While 42% of inborn HIE infants experienced nutrition related issues post-discharge such as reflux and growth concerns, less than one third of those infants received dietetic input. This represents a missed opportunity for specialised intervention during early life. To optimise long-term outcomes, the NMH is exploring the development of a standardised, multidisciplinary nutritional pathway that incorporates routine dietitian assessment from inpatient admission through to outpatient follow-up.

References:

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