Title

Increasing availability of active therapeutic hypothermia for neonatal hypoxic ischaemic encephalopathy in the UK

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Neonatal hypoxic ischaemic encephalopathy (HIE) is the largest contributor of term birth-related brain injury globally.(1) Therapeutic hypothermia (TH), started within 6-hours of birth, improves survival without disability with a number needed to treat of seven.(2) The optimal method for delivering TH is servo-controlled devices (active-TH) mostly provided by tertiary cooling centres.(1) Almost 50% of infants with HIE in the UK are born in centres without active-TH and are less likely to have seizure-free survival compared to infants born in centres with active-TH.(3)

In 2018, 39% of UK births occurred in centres that do not provide active-TH and were reliant on transport teams or tertiary cooling centres to initiate active-TH, with significant regional variation.(1) The 2020 British Association of Perinatal Medicine (BAPM) national HIE framework recommended initiation of active-TH in all neonatal units.(4) We provide an update of active-TH provision across UK births and regional networks following the implementation of the BAPM national HIE framework.

The NIC-Tech survey was disseminated via the NeoTrips trainee research network (http://neotrips.org) to maternity/neonatal centres between April and December 2023 to establish availability of active-TH, these data were verified by UK-Neonatal transport Research Collaborative. Each centres active-TH access was mapped to their 2022/23 birth numbers obtained from national birth databases, reported April-March of each year. Freestanding midwifery-led centres births were not included. Centres were combined into their neonatal networks for regional analyses and 2022/23 data were compared to 2011/12 and 2018/19 data previously reported.(1)

From 2018 to 2023, the number of UK births and maternity centres have reduced (Table 1). By 2020, all 15 UK transport teams provided active-TH during transfer. In 2023, 459,004 (71%) of UK births had access to active-TH at birth compared to 426,536 (61%) births in 2018. The greatest uptake was observed by local neonatal units (level 2), increasing access to their births by a further 20% compared to only a 6% increase in centres with special care

baby units (level 1). In 2023, 10 of 13 regional networks had increased their active-TH provision at birth, with three regions in the north and east of England with the lowest coverage remaining relatively unchanged (Figure 1).

The incidence of HIE is 1-2/1000 live births,(1) we estimate the 10% increase in active-TH availability in birth centres in 2023 has enabled an additional 63-127 infants with HIE to access active-TH in their birth centre, permitting timely TH initiation. Expansion of transport active-TH allows earlier initiation of TH, with infants no longer waiting for arrival in a centre with active-TH.

Despite the improving access to active-TH, disparities with immediate access in some regions and across neonatal unit care levels remain with an estimated 189-377 infants with HIE potentially receiving suboptimal early management. Active-TH provision at birth-centre could provide better neuroprotection through earlier initiation of TH and reduce pressure on transport teams.(1) Further investment in equipment provision, training and skill maintenance, especially in centres with fewer cases, could ensure optimal TH delivery with the potential for better neuroprotection and improved outcomes in this high-risk population.

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Author contributions

AM and DS made substantial contributions to the concept, planning, design of the study and acquisition of data. RS created the NIC-Tec survey and provided data on availability of servocontrolled active-TH devices. AM collated all the data and performed the analysis. The first draft was written by AM; RS SO and DS edited and reviewed. All authors approved the final version for publication. DS is the guarantor of the study.

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Competing interests

No conflicts of interest to declare.

Ethical approval

No ethical approval was required for data reported

Data availability statement

All National birth statistics were obtained from publicly available databases. All NIC-Tech survey data was contributed freely and under consent of each neonatal centre.

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Year	2011/12	2018/19	2022/23
Number of UK maternity centres	194	192	187
Immediate-TH, n (%)	75 (39)	95 (49)	111 (59)
Transport-TH, n (%)	52 (27)	95 (49)	76 (41)
Tertiary-TH, n (%)	67 (34)	2 (1)	0 (0)
Neonatal units with Immediate-TH [a]			
NICU (Level 3), n (%)	53/57 (93)	55/56 (98)	55/55 (100)
LNU (Level 2), n (%)	22/91 (24)	35/91 (38)	48/83 (58)
SCBU (Level 1), n (%)	0/46 (0)	5/45 (11)	8/49 (16)
Number of UK Births	771,176	702,794	649,937
Births with Immediate-TH			
Total Births, n (%)	376,334 (49)	426,536 (61)	459,004 (71)
NICU (Level 3), n (%) [b]	285,856 (94)	277,321 (98)	260,862 (100)
LNU (Level 2), n (%) [b]	90,478 (26)	135,780 (42)	177,205 (62)
SCBU (Level 1), n (%) [b]	0 (0)	13,435 (14)	20,937 (20)

Table 1 Provision of therapeutic hypothermia (TH) in 2011/12, 2018/19 and 2022/23, by UK maternity/neonatal centres, neonatal unit level and birth rate across level of neonatal units. Birth data was obtained from each UK countries national birth databases.(1)

Abbreviations:

Immediate-TH: Active-TH available at birth centre for initiation, Transport-TH: reliant on transport team to initiate Active-TH, Tertiary-TH: reliant on tertiary cooling centre to initiate Active-TH.

NICU=Neonatal Intensive Care Unit; LNU=Local Neonatal Unit; SCBU=Special Care Baby Unit; [a]=Percentage based on total number of neonatal units within each level, [b]=Percentage based on total births at each level of neonatal unit.

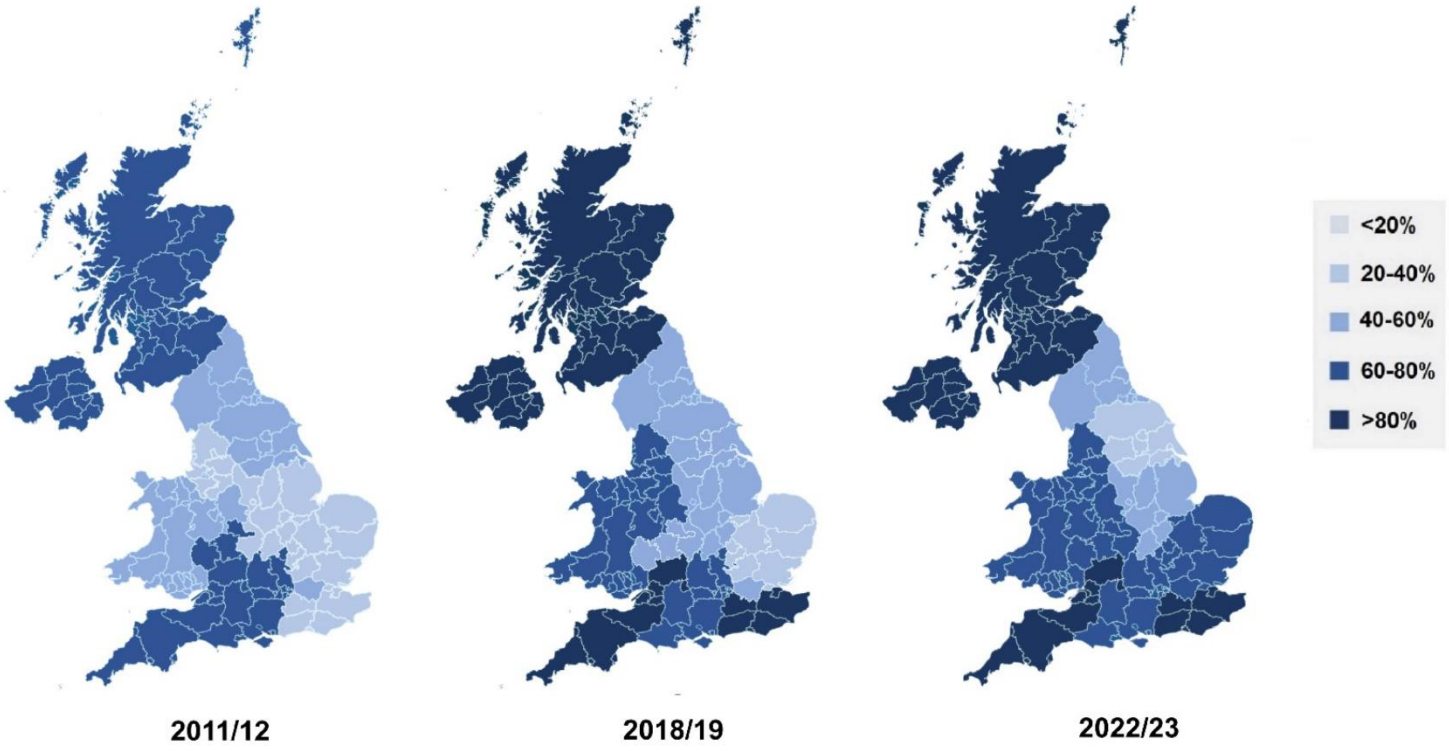

Figure 1 Heat map showing the percentage of births within UK regions, based on neonatal operational delivery networks, with active-TH access at birth in 2011/12, 2018/19 and 2022/23 using birth data obtained from each UK countries national birth databases.(1) The scale is presented as quintiles of the percentage of regional births with active-TH access. Powered by Bing © Microsoft Open Spaces. TH, therapeutic hypothermia