周產期分級照護：南北區域觀點與經驗分享

國立成功大學附設醫院
新生兒科
林毓志

內容

- 周產期醫療的重要性
- 轉診的規劃
- 轉診準備、過程面臨的議題
- 資料收集與品管
- 指引與訓練

內容

- **周產期醫療的重要性**
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指育齡婦女（一般是指15至49歲之間）依照目前的年齡別生育水準，一生中所生育之子女數。

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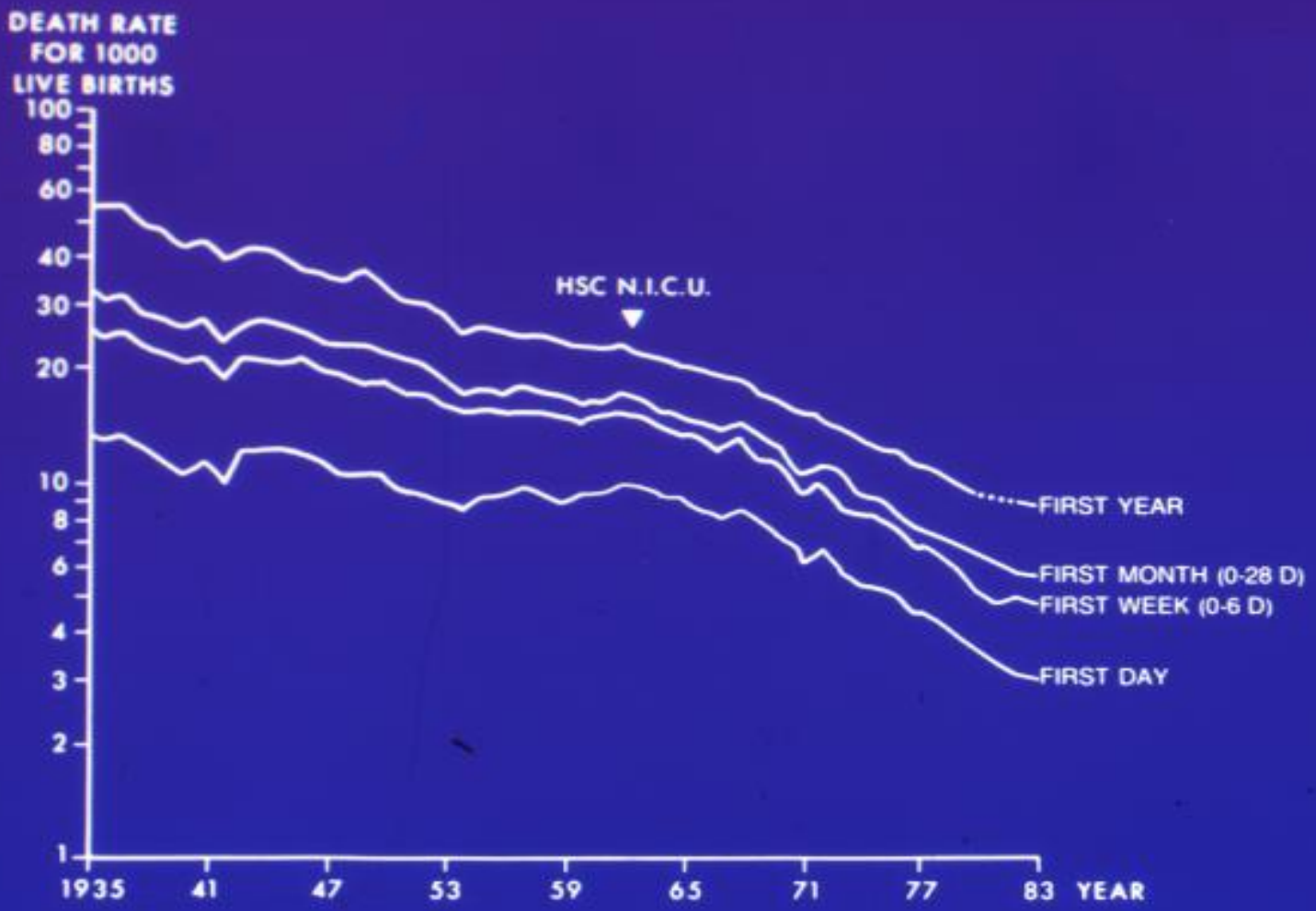

Fig. 3-3. Ontario mortality rates, 1935 to 1983 (first day, week, month, year). HSC N.I.C.V. = Hospital for Sick Children Neonatal Intensive Care Unit.

世界衛生組織於 2015 年統計，新生兒死亡率占 5 歲以下兒童死亡率的 45.1%

早產與窒息等周產期併發症是前兩大主因。

新生兒出生 7 天內的早期死亡更占新生兒死亡總數的一半以上。

Key facts

- Although the **global number of newborns deaths declined from 5 million in 1990 to 2.4 million in 2019**, children face the greatest risk of death in their first 28 days.

- In 2019, **47% of all under-5 deaths occurred in the newborn period with about one third dying on the day of birth and close to three quarters dying within the first week of life.**
世界衛生組織於 2019年統計，新生兒死亡率占 5 歲以下兒童死亡率的 47% (1/3出生當天死亡;約3/4出生一周內死亡)

- Children who die within the first 28 days of birth suffer from conditions and diseases associated with **lack of quality care at birth or skilled care and treatment immediately after birth and in the first days of life**.

ELSEVIER

SEMINARS IN PERINATOLOGY

Preventing Preterm Birth and Neonatal Mortality: Exploring the Epidemiology, Causes, and Interventions

LaVone E. Simmons, MD,* Craig E. Rubens, MD, PhD,† Gary L. Darmstadt, MD, MS,‡ and Michael G. Gravett, MD*,†

Semin Perinatol 34:408-415

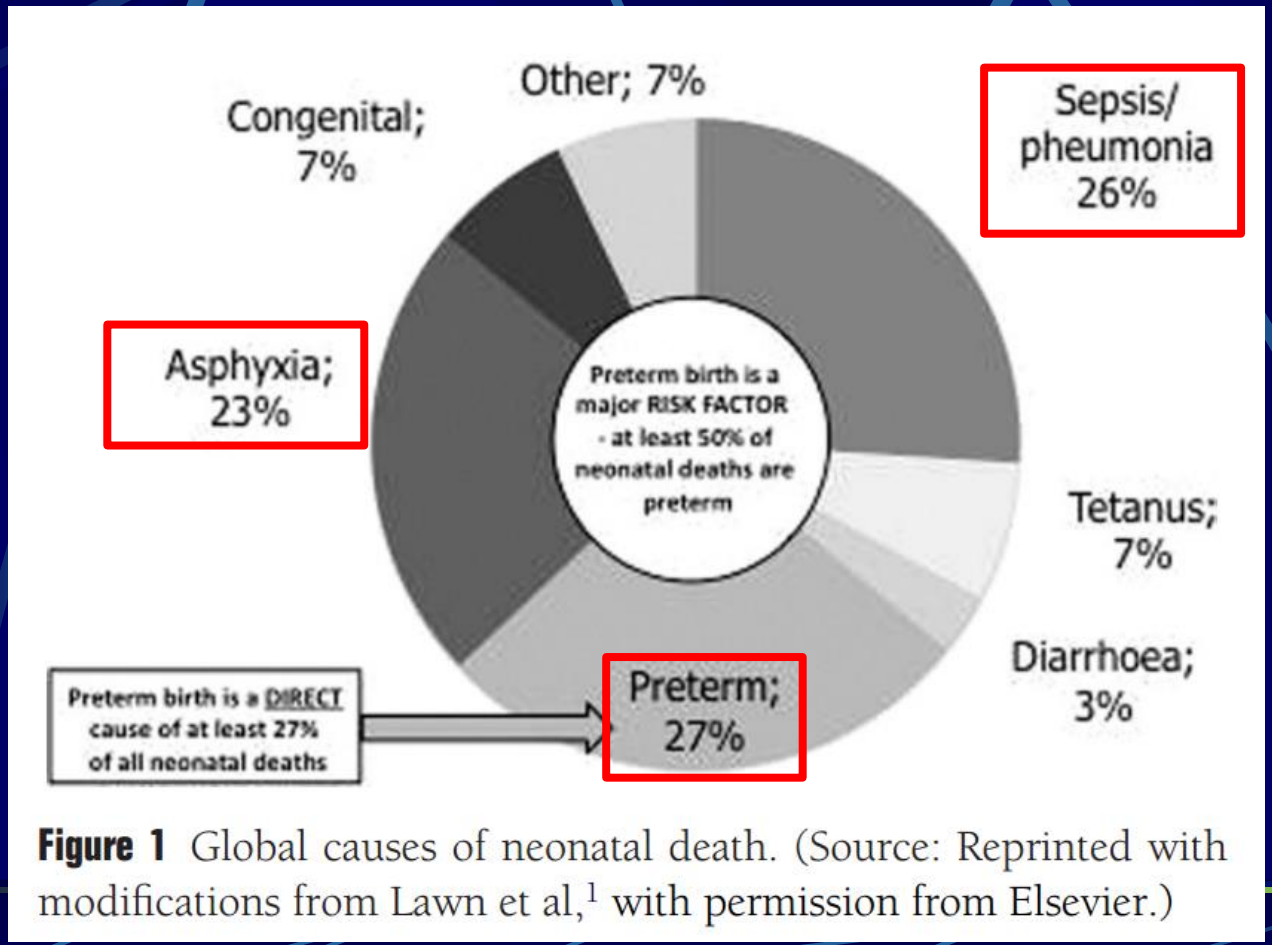

Figure 1 Global causes of neonatal death. (Source: Reprinted with modifications from Lawn et al,[1] with permission from Elsevier.)

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Table 1 Regional Variation in the Estimated Preterm Birth Prevalence Rates

Region	Preterm Births (×1000)	Preterm Birthrate (%)	95% Confidence Intervals
World total	12,870	9.6	9.1-10.1
More-developed regions	1014	7.5	7.3-7.8
Less-developed regions	7685	8.8	8.1-9.4
Least-developed regions	4171	12.5	11.7-13.3
Africa	4047	11.9	11.1-12.6
Asia	6907	9.1	8.3-9.8
Europe	466	6.2	5.8-6.7
Latin America and the Caribbean	933	8.1	7.5-8.8
North America	480	10.6	10.5-10.6
Oceania (Australia/New Zealand)	20	6.4	6.3-6.6

Source: reprinted from Beck et al[4] with permission from WHO Press.

表7.2　民國93至109年出生通報活產新生兒出生體重

Table 7.2　Live Births by Birth Weight, 2004-2020

出生年 Year of Birth	合計 Total		出生體重(公克) Birth Weight (Gram)							
			<1500		1500-2499		2500-3999		≧4000	
	人數 Number	百分比 Percentage	人數 Number	百分比 Percentage	人數 Number	百分比 Percentage	人數 Number	百分比 Percentage	人數 Number	百分比 Percentage
93年	217,386	100.00	1,659	0.76	14,365	6.61	196,307	90.30	5,055	2.33
94年	206,925	100.00	1,551	0.75	13,771	6.66	187,274	90.50	4,329	2.09
95年	205,026	100.00	1,526	0.74	13,503	6.59	185,544	90.50	4,453	2.17
96年	203,377	100.00	1,591	0.78	13,858	6.81	183,906	90.43	4,022	1.98
97年	196,373	100.00	1,562	0.80	13,472	6.86	177,645	90.46	3,694	1.88
98年	192,465	100.00	1,511	0.79	13,513	7.02	174,021	90.42	3,420	1.78
99年	166,630	100.00	1,411	0.85	12,427	7.46	149,933	89.98	2,859	1.72
100年	198,387	100.00	1,785	0.90	14,530	7.32	178,721	90.09	3,351	1.69
101年	234,575	100.00	1,922	0.82	17,799	7.59	211,005	89.95	3,849	1.64
102年	195,251	100.00	1,664	0.85	15,141	7.75	175,638	89.95	2,808	1.44
103年	211,734	100.00	1,826	0.86	16,242	7.67	190,672	90.05	2,994	1.41
104年	213,714	100.00	1,941	0.91	17,366	8.13	191,473	89.59	2,934	1.37
105年	207,837	100.00	1,934	0.93	17,505	8.42	185,783	89.39	2,615	1.26
106年	195,115	100.00	1,802	0.92	16,892	8.66	173,825	89.09	2,596	1.33
107年	181,084	100.00	1,734	0.96	15,891	8.78	161,254	89.05	2,205	1.22
108年	176,006	100.00	1,667	0.95	16,353	9.29	155,967	88.61	2,019	1.15
109年	162,455	100.00	1,664	1.02	14,853	9.14	144,076	88.69	1,862	1.15

資料來源：中華民國109年版出生通報統計年報

表7.3 民國93至109年出生通報活產新生兒懷孕週數

Table 7.3 Live Births by Weeks of Pregnancy, 2004-2020

出生年 Year of Birth	合計 Total		懷孕週數(週) Weeks of Pregnancy									
			<37		37-38		39-40		41		≧42	
	人數 Number	百分比 Percentage	人數 Number	百分比 Percentage	人數 Number	百分比 Percentage	人數 Number	百分比 Percentage	人數 Number	百分比 Percentage	人數 Number	百分比 Percentage
93年	217,386	100.00	19,400	8.92	88,025	40.49	100,702	46.32	8,564	3.94	695	0.32
94年	206,925	100.00	17,759	8.58	83,362	40.29	97,047	46.90	8,188	3.96	569	0.27
95年	205,026	100.00	17,366	8.47	83,157	40.56	96,049	46.85	8,006	3.90	448	0.22
96年	203,377	100.00	17,670	8.69	83,974	41.29	94,121	46.28	7,210	3.55	402	0.20
97年	196,373	100.00	17,632	8.98	83,691	42.62	88,783	45.21	6,019	3.07	248	0.13
98年	192,465	100.00	16,899	8.78	81,962	42.59	87,395	45.41	5,957	3.10	252	0.13
99年	166,630	100.00	15,557	9.34	72,398	43.45	73,797	44.29	4,703	2.82	175	0.11
100年	198,387	100.00	18,108	9.13	84,987	42.84	89,603	45.17	5,484	2.76	205	0.10
101年	234,575	100.00	21,236	9.05	102,518	43.70	104,819	44.68	5,836	2.49	166	0.07
102年	195,251	100.00	17,665	9.05	84,467	43.26	88,413	45.28	4,588	2.35	118	0.06
103年	211,734	100.00	18,940	8.95	92,876	43.86	95,159	44.94	4,651	2.20	108	0.05
104年	213,714	100.00	20,033	9.37	93,892	43.93	95,434	44.66	4,250	1.99	105	0.05
105年	207,837	100.00	20,307	9.77	93,856	45.16	90,111	43.36	3,481	1.67	82	0.04
106年	195,115	100.00	18,910	9.69	87,739	44.97	85,436	43.79	2,956	1.52	74	0.04
107年	181,084	100.00	18,027	9.96	82,241	45.42	78,263	43.22	2,502	1.38	51	0.03
108年	176,006	100.00	18,296	10.40	80,882	45.95	74,604	42.39	2,185	1.24	39	0.02
109年	162,455	100.00	17,113	10.53	77,358	47.62	66,333	40.83	1,616	0.99	35	0.02

資料來源：中華民國109年版出生通報統計年報

新生兒轉送團隊專業教育訓練

- 為配合110年衛生福利部推動「周產期照護網絡計畫」，由重點醫院建立新生兒外接團隊，強化高危險妊娠轉診與處置能力及新生兒加護照護。
- 建立及提升新生兒外接團隊能力。

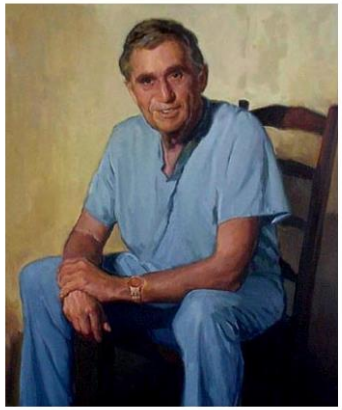
- 周產期分級照護：南北區域觀點與經驗分享
- 常見新生兒轉送原因與注意事項
- 新生兒轉送團隊與轉送作業流程
- 新生兒轉送成功的因素與新生兒轉送特殊考量

Concepts

- "Golden Hour" of neonatal life is defined as the **first hour of post-natal life in both preterm and term neonates. (evidence based intervention)**

Dr. Donald Trunkey have summarized the "Golden Hour" by 3R rule i.e Getting the

Right Patient to
Right Place at
Right Time



Adopted from **adult trauma**

理想周產期區域醫療網應該

To assure that the right patient receives the right service at the right time, in the right place and by the right care giver.

Rodwin (1984)


早期發現高風險狀況


急診處

- **In-Utero Transfer**: Best mode of transfer for the baby

Table 1 Main indications and contraindications of intrauterine transport to a tertiary care hospital.

Indications	Contraindications
Risk of preterm birth before 32 weeks' gestation with or without premature rupture of membranes	Placental abruption
Multiple birth before 34 weeks' gestation	Significant bleeding
Severe IUGR < 34 weeks' gestation	Imminent birth
Congenital anomalies requiring immediate treatment	Clinical instability or maternal need of intensive care that can be delivered at the sending hospital
Severe blood type incompatibility	Nonreassuring foetal status
Hydrops fetalis	Cord prolapse or breech presentation
Polyhydramnios or severe oligoamnios	
Severe preeclampsia or HELLP syndrome	
Prenatal diagnosis of metabolic disease requiring immediate management	
Severe maternal disease or complications of pregnancy (heart disease, insulin-dependent diabetes, infection)	

HELLP, haemolysis, elevated liver enzymes, low platelet count; IUGR, intrauterine growth restriction.
Adapted from Moreno et al.[6]

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內容

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- 指引與訓練

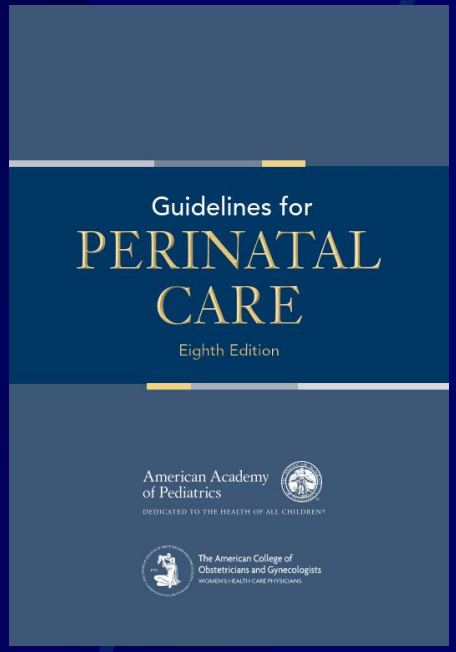
Issues

- Why transport of sick neonates is necessary?
- What is the difference between self transport and organized transport?
- Which babies need transport?
- What are different types of transports?
- How to organize a Neonatal Transport System?
- What special care needs to be given for a sick neonate requiring transport?
- What are the different modes of transport?
- What are the situations which need special precautions during transport?
- How should one communicate for neonatal transport?
- What are the medico-legal issues related to neonatal transports?
- How the family should be supported while transport?
- What are the alternative transport modalities?

Health Care Delivery System

A regionalized system of perinatal care with integrated delivery of services should address the care received by the woman before and during pregnancy, the management of labor and delivery, postpartum care, and neonatal care. A health care system that is responsive to the needs of families, and especially women, requires strategies to:

- ensure access to services
- identify risks early
- provide linkage to the appropriate level of care
- ensure adherence, continuity, and comprehensiveness of care
- promote efficient use of resources



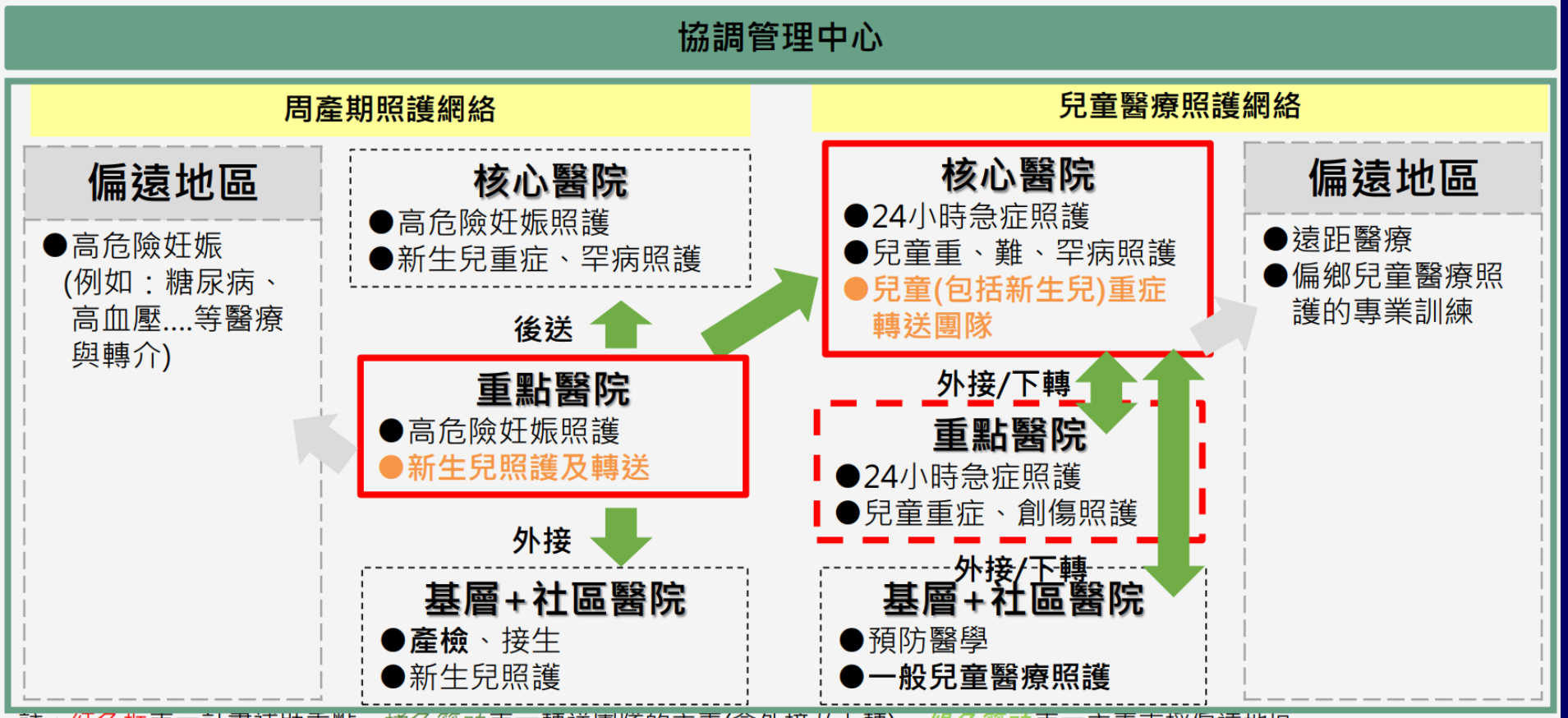
醫療照護網絡: 一種規劃性醫療制度
提供有效率、合宜的醫療作業
周產期醫療照護網絡:其目的係為提供醫療網地區內產婦與新生兒所需之醫療服務

具體目標: 達到其就醫之方便性、早期發現高風險狀況、便於提供適當層級醫療之連結、提供持續性的完整照護、有效益的應用區域內醫療資源。

WORKLOAD

- Planning for a **centralised transport** service has several appreciable tensions.
- If the **area or population** being covered is **too large**, transfers may be delayed for several hours until the team becomes available.
- Conversely, the workload for a team covering **too small** a population will render it **cost ineffective**.

優化兒童醫療照護計畫架構草案(衛福部)



註：紅色框表示計畫補助重點、橘色箭頭表示轉送團隊的主責(含外接及下轉)、綠色箭頭表示主責支援偏遠地區

列標籤	中區	北區	台北區	東區	南區	高屏區	總計
中度級	6	3	10	2	5	6	32
重度級	10	8	17	2	6	6	49
總計	**16**	**11**	**27**	**4**	**11**	**12**	**81**

中區			中區 合計
南投縣	彰化縣	臺中市	
2	1	3	6
	3	7	10
2	**4**	**10**	**16**

北區				北區 合計
苗栗縣	桃園市	新竹市	新竹縣	
1			2	3
3	2	2	1	8
4	**2**	**2**	**3**	**11**

台北區					台北區 合計
宜蘭縣	金門縣	基隆市	新北市	臺北市	
2	1	1	4	2	10
1		1	5	10	17
3	**1**	**2**	**9**	**12**	**27**

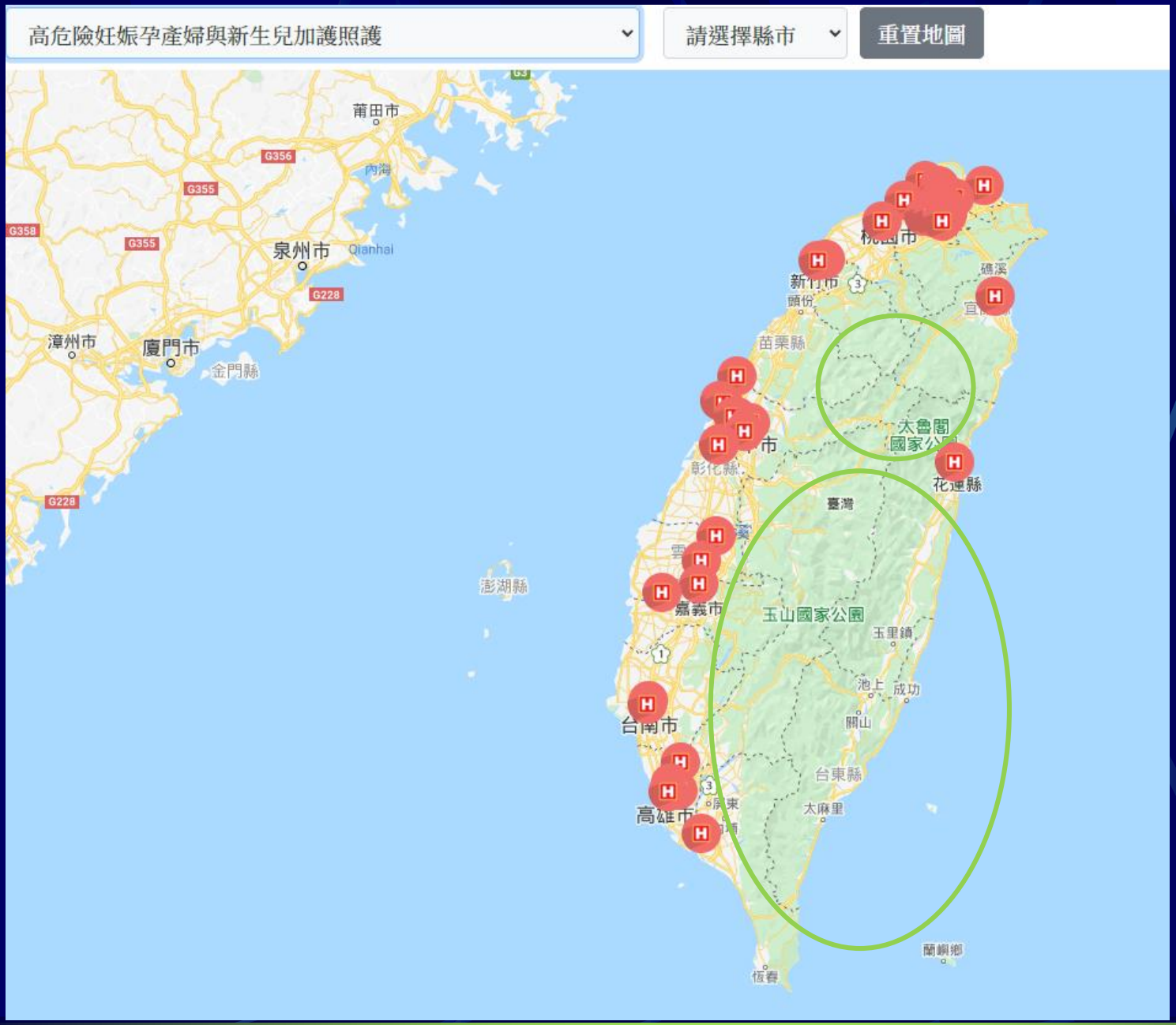
東區		東區 合計
花蓮縣	臺東縣	
2		2
1	1	2
3	**1**	**4**

南區				南區 合計
雲林縣	嘉義市	嘉義縣	臺南市	
1	1		3	5
1	1	2	2	6
2	**2**	**2**	**5**	**11**

高屏區			高屏區 合計
屏東縣	高雄市	澎湖縣	
3	3		6
1	4	1	6
4	**7**	**1**	**12**

全國重度級急救責任醫院與兒童醫院急診即時訊息

- 資料來源：醫事司
- 建檔日期：105-11-21
- 更新時間：110-11-22



高危險妊娠孕產婦與新生兒加護照護-重度級急救責任醫院，資料來源醫事司。

- 衛生福利部統計顯示，**花蓮縣、臺東縣、屏東縣、高雄市**等 4 縣市近四年嬰兒死亡率均高於全臺平均數，亟待改善。
- 醫療網絡分級應依據人力資源、人口比例等建置，佐以時間、距離、交通路線等規劃範圍，需特別著重偏遠地區或資源缺乏區域。

- 應配合地方政府衛生局規劃之周產期網絡運作，與合作之醫療院所訂定周產期轉診合作協議。
- **提供 24 小時高危險妊娠、新生兒加護照護**的相關醫療照護服務，並設立外接團隊出勤機制。(**包含產前轉診、新生兒外接服務**)
- **高危險孕產婦需在 24 至 32 週前轉至能妥適安置產婦及具新生兒科之加護醫療機構**

通過 109 年緊急醫療能力分級評定「第 5 章高危險妊娠及新生兒醫療」中度級以上能力之醫院家數 4 家以下之縣市一覽表

附件三

縣市	急救責任醫院數	通過第 5 章節醫院數
新竹縣	6	1
苗栗縣	6	4
南投縣	6	2
雲林縣	7	2
嘉義市	5	2
屏東縣	14	3
宜蘭縣	7	3
基隆市	4	2
台東縣	5	1
澎湖縣	2	1
金門縣	1	1
連江縣	1	0
總計	64	22

備註：

一、 該縣市無醫學中心或僅 1 家重度級急救責任醫院

二、 110 年度「周產期照護網絡計畫」以該縣(市)通過分級評定第 5 章節高危險及新生兒醫療之醫院於 4 家以下為優先。

Required information

- Daily telephone enquiry for transfers
- Current numbers of transfers
- Severity of illness
- Timing of transfers
- Geography of transfers.

新生兒外接團隊出勤條件 符合下述條件者，得由新生兒外接團隊出勤外接之標準	
送至重點醫院	送至核心醫院 (醫學中心或兒童醫院)
1.出生體重不足 2Kg 或胎齡不足 34 周	1.出生體重不足 1Kg 或胎齡不足 28 週
2.新生兒罹患呼吸窘迫症	2.新生兒罹患呼吸窘迫症需高頻呼吸器輔助者
3.疑似周產期窒息	3.罹患周產期窒息需低溫治療
4.新生兒抽搐	4.新生兒持續性抽筋
5.先天性異常(需觀察或開刀者)	5.先天性異常需立即開刀者
6.新生兒貧血症	6.嚴重之新生兒貧血症
7.先天性心臟病	7.危急性發紺型先天性心臟病
8.新生兒感染如敗血症,腦膜炎	8.新生兒感染如敗血症,腦膜炎
9.生理狀況不穩定者,如低血壓,發紺	9.生理狀況不穩定者,如休克
10.新生兒持續性肺高壓	10.嚴重之新生兒持續性肺高壓需葉克膜使用者
11.新生兒戒斷症候群	11.頑固形新生兒戒斷症候群
12.其他經醫師判斷可能危及新生兒生命安全之狀況	12.其他經醫師判斷可能危及新生兒生命安全之狀況

Table 2 Main indications for neonatal transfer.

Preterm birth or low birth weight
Frequent episodes of apnoea or bradycardia
Congenital anomalies, especially those that compromise the stability of the infant (diaphragmatic hernia, oesophageal atresia, airway malformations)
Moderate-severe respiratory distress that cannot be managed in sending hospital
Severe pulmonary hypertension
Congenital heart defects
Cardiovascular disorders (cardiac arrest, arrhythmia, heart failure)
Neurologic disorders (moderate-severe perinatal asphyxia, hypoxic-ischaemic encephalopathy, neonatal seizures)
Metabolic disorders (persistent hypoglycaemia, severe metabolic acidosis, fluid and electrolyte disorders, hydrops fetalis, haemodynamically significant dehydration, kidney failure)
Infectious disease (septic shock, meningitis or encephalitis)
Gastrointestinal disorders (intestinal obstruction, necrotising enterocolitis, acute abdomen)
Haematological disorders (thrombocytopenia, haemolytic disease, acute neonatal anaemia)
Neonatal surgical disease
Any condition or disease requiring intensive care or complex treatment that is not available in the sending hospital (peritoneal dialysis, ventricular, chest or abdominal drainage, ECMO, pericardiocentesis, total or partial exchange transfusion, veno-venous haemofiltration, HFOV)
Insidious neonatal disease
Lack of beds in sending hospital

Anales de Pediatría 94 (2021) 420.e1---420.e11

5.2.2訂有新生兒(含早產兒)處置流程

- 【重度級】 1.應訂有新生兒(含早產兒)處置流程，定期更新，確實執行，並備有資 料可查。 2.應能提供： (1)缺氧缺血性腦病變之新生兒低溫治療之處置。 (2)給予新生兒正壓換氣之處置。 (3)使用吸入性一氧化氮之處置。(108 年試評)
- 【中度級】 應訂有新生兒(含早產兒)處置流程，定期更新，確實執行，並備有資料 可查。

5.3.3

- 【重度級】能於假日及夜間執行急重症新生兒(含早產兒)手術或介入性治療，達成 率需符合 80%以上。

周產期區域醫療網

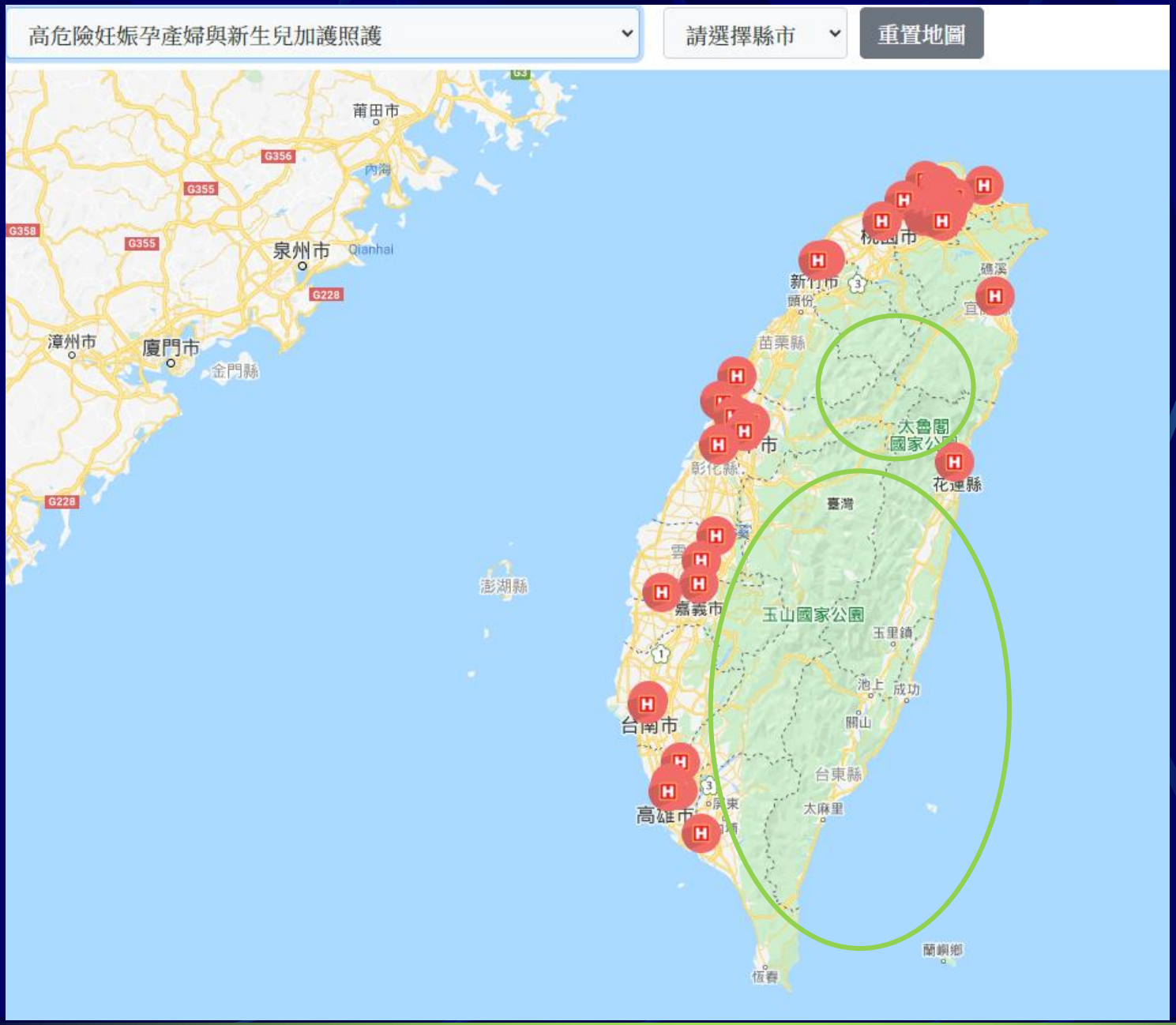
層級	位置	人員	功能
第三層	醫學中心	包括第二層及完整產科及兒科次專科；小兒外科、神外、心外、 眼科	包括第二層，區域成果之收集與分析、教育。醫療網之規劃。
第二層	區域醫院	婦產科兒科及次專科醫師	包括第一層， 高危險產婦及新生兒之處理， 孕婦、新生兒之轉送。
第一層	地區醫院	婦產科或兒科醫師	正常生產與新生兒照顧，危險病患之急救，資料收集。
基層	衛生所、診所	基層醫師	社區婦幼保健

Table 1-3. Definitions, Capabilities, and Health Care Provider Types: Neonatal Levels of Care* *(continued)*

Level of Care	Capabilities	Health Care Provider Types†
Level II special care nursery	Level I capabilities plus: Provide care for infants born at 32 weeks of gestation or later and weigh 1,500 g or more who have physiologic immaturity or who are moderately ill with problems that are expected to resolve rapidly and are not anticipated to need subspecialty services on an urgent basis Provide care for infants convalescing after intensive care Provide mechanical ventilation for brief duration (less than 24 hours) or continuous positive airway pressure or both Stabilize infants born before 32 weeks of gestation and weigh less than 1,500 g until transfer to a neonatal intensive care facility	Level I health care providers plus: Pediatric hospitalists, neonatologists, and neonatal nurse practitioners

Level III neonatal intensive care unit	Level II capabilities plus: Provide sustained life support Provide comprehensive care for infants born before 32 weeks of gestation and weigh less than 1,500 g and infants born at all gestational ages and birth weights with critical illness Provide prompt and readily available access to a full range of pediatric medical subspecialists, pediatric surgical specialists, pediatric anesthesiologists, and pediatric ophthalmologists Provide a full range of respiratory support that may include conventional ventilation and/or high-frequency ventilation and inhaled nitric oxide Perform advanced imaging, with interpretation on an urgent basis, including computed tomography, magnetic resonance imaging, and echocardiography	Level II health care providers plus: Pediatric medical subspecialists‡, pediatric anesthesiologists‡, pediatric surgeons, and pediatric ophthalmologists‡

圖：本醫療區域內大規模醫院所在圖



高危險妊娠孕產婦與新生兒加護照護-重度級急救責任醫院，資料來源醫事司。

台南地區新生兒出生醫院分佈

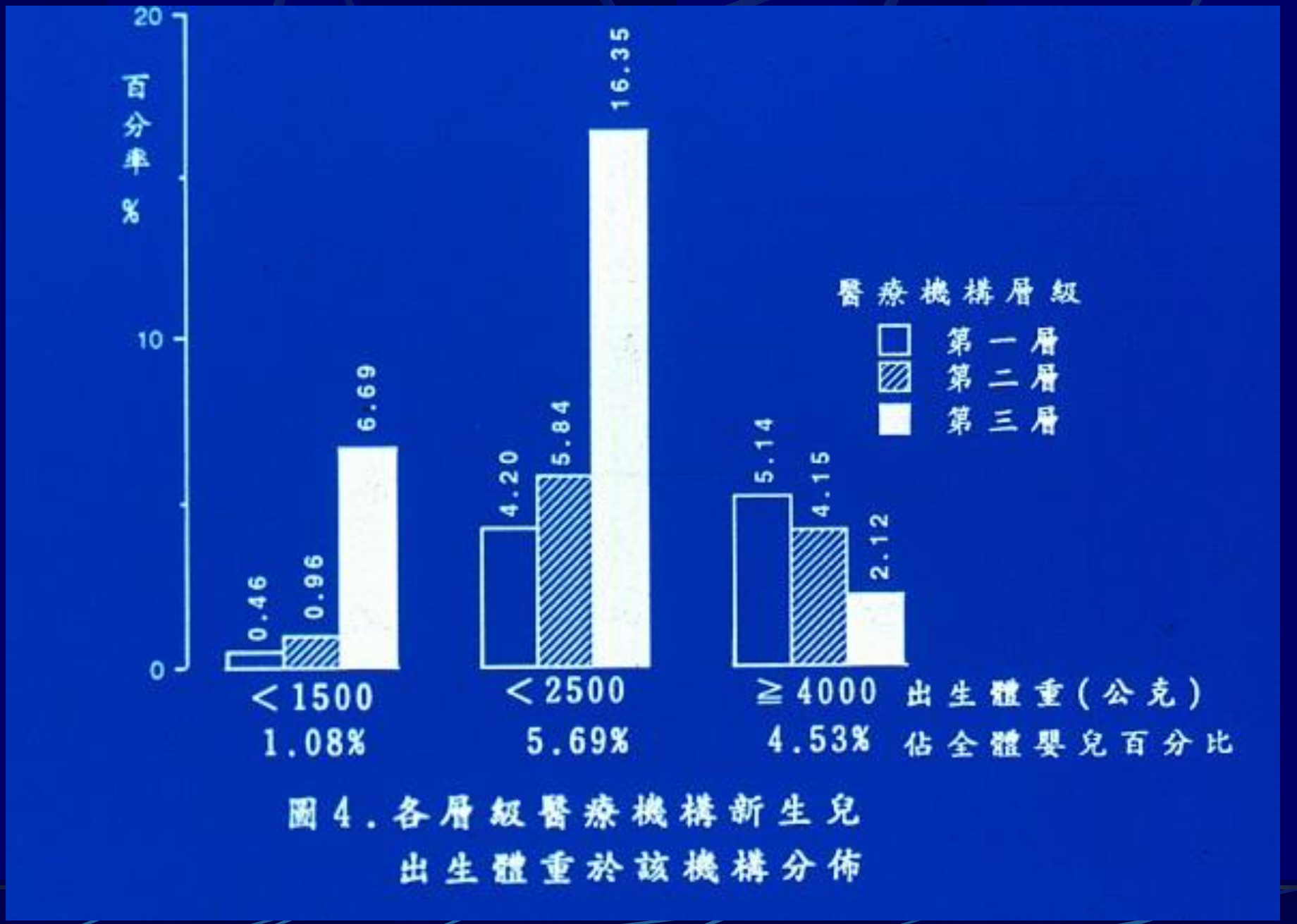


圖4.各層級醫療機構新生兒出生體重於該機構分佈

台南地區新生兒特殊醫療床之需求量

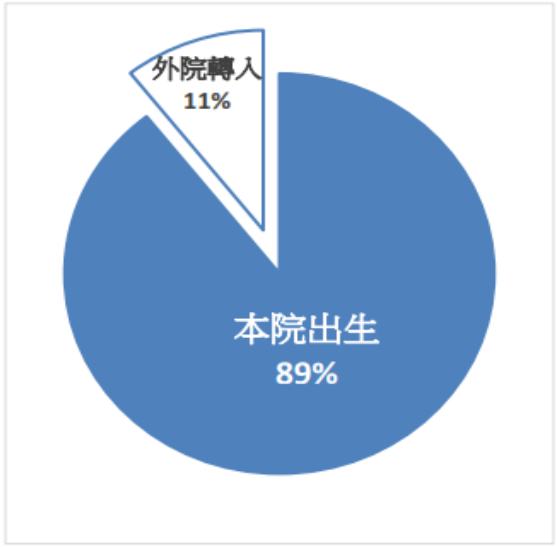
出生體重(g)	(A) 加護床(日) (Intensive Care)	(B) 觀察床(日) (Intermediate Care)
< 1500		
A:28225× 1.08%× 10.8(日)=	3292.2	
B:28225× 1.08%× 52.4(日)× 75%*=		11979.8
1500-2499		
A:28225× (5.65-1.08)%× 23%× 6.2(日)=	1839.4	
B:28225× (5.65-1.08)%× 23%× 19.2(日)× 96.4%*=		5491.1
B:28225× (5.65-1.08)%× 18%× 19.2(日)=		4457.8
≧ 2500		
A:28225× (100-5.65)%× 1.5%× 5.0(日)=	1997.3	
B:28225× (100-5.65)%× 1.5%× 6.9(日)× 96.6%*=		2662.5
B:28225× (100-5.65)%× 3.2%× 6.9(日)=		5880.0
合計	7128.9	30471.2
一年365日佔床率約75%計算所需床數 ：	26床	111床

計算公式為：年活產新生兒×比率×佔床率×佔床日×存活率*

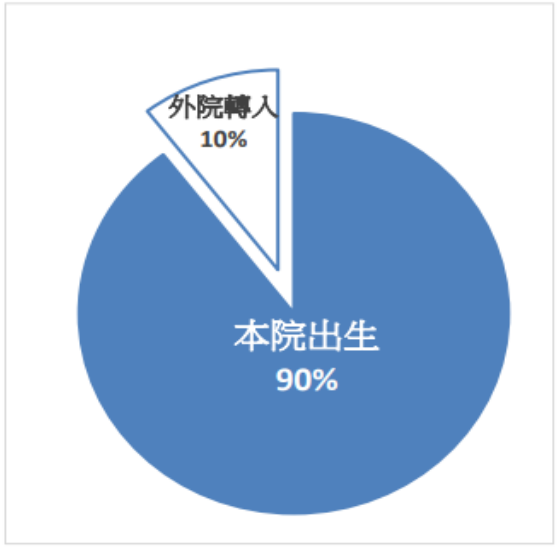
TNN 2017-2019

出生地點（Place of birth）

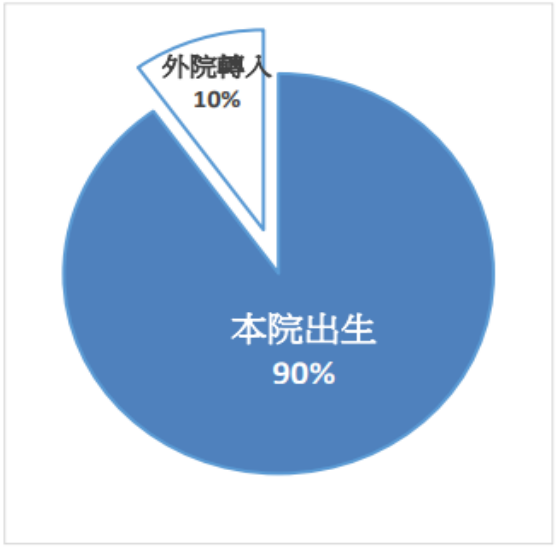
2017 年



2018 年



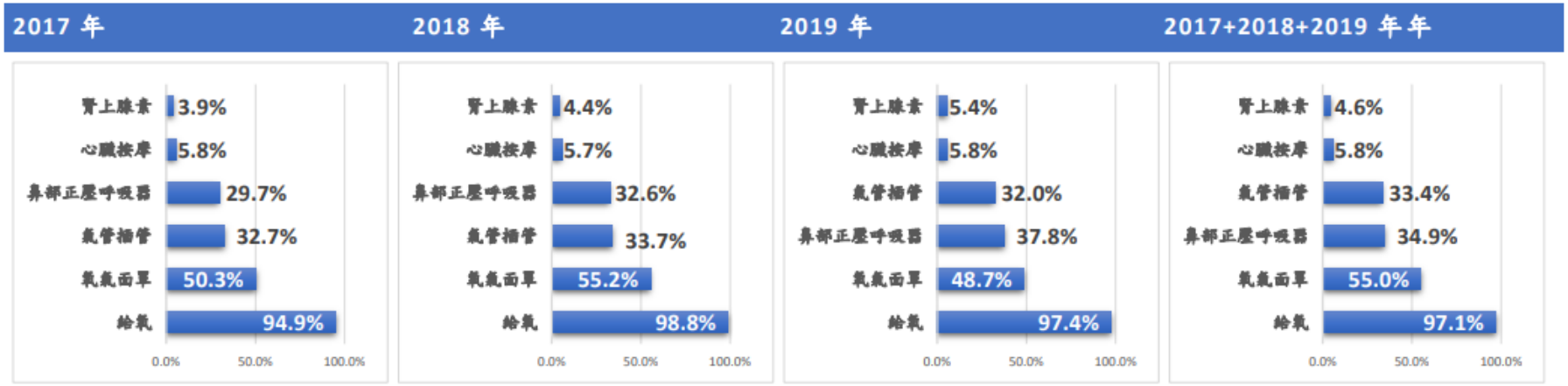
2019 年



出生地點（Place of birth）	2017 年		2018 年		2019 年	
	比率	人數	比率	人數	比率	人數
本院出生(Inborn status)	89.4%	1077	89.6%	1050	90.1%	1108
外院轉入(Outborn status)	10.6%	128	10.4%	122	9.9%	122
收案總數(Total)		1205		1172		1230

初始復甦（Any resuscitation）

初始復甦處置人次率(Initial resuscitation items)



初始復甦處置 (Initial resuscitation items)		給氧 (oxygen)		氧氣面罩 (face mask vent)		氣管插管 (endotracheal tube ventilation)		鼻部正壓呼吸器 (nasal CPAP)		心臟按摩 (Cardiac Compression)		腎上腺素 (epinephrine)	
行初始復甦總人數 (Total number of initial resuscitation needed)		比率	人數	比率	人數	比率	人數	比率	人數	比率	人數	比率	人數
2017 年	1148	94.9%	1090	50.3%	577	32.7%	375	29.7%	341	5.8%	67	3.9%	45
2018 年	1124	98.8%	1111	55.2%	621	33.7%	379	32.6%	366	5.7%	64	4.4%	50
2019 年	1186	97.4%	1155	48.7%	577	32.0%	380	37.8%	448	5.8%	69	5.4%	64
2017+2018+2019 年	3458	97.1%	3356	55.0%	1903	34.9%	1206	33.4%	1155	5.8%	200	4.6%	159

TNN 2016-2020

轉院率 = 院外出生/總數

體重	區域 北部 區總數	北部 區 轉院數	北部 區 轉院率	中部 區總數	中部 區 轉院數	中部 區 轉院率	南部 區總數	南部 區 轉院數	南部 區 轉院率	東部 區總數	東部 區 轉院數	東部 區 轉院率	區總數 的加總	區 轉院數 的加總	區 轉院率 的加總
≦500克	85	1	1.2%	37	3	8.1%	59	3	5.1%	0	0	#DIV/0!	181	7	3.9%
501-750克	488	26	5.3%	237	16	6.8%	278	20	7.2%	3	0	0.0%	1006	62	6.2%
751-1000克	615	39	6.3%	375	40	10.7%	343	22	6.4%	16	3	18.8%	1349	104	7.7%
1001-1250克	690	54	7.8%	399	55	13.8%	402	39	9.7%	9	1	11.1%	1500	149	9.9%
1251-1500克	935	109	11.7%	543	82	15.1%	625	96	15.4%	8	1	12.5%	2111	288	13.6%
>1500克	40	6	15.0%	29	0	0.0%	15	2	13.3%	1	1	100.0%	85	9	10.6%
總計	**2853**	**235**	**8.2%**	**1620**	**196**	**12.1%**	**1722**	**182**	**10.6%**	**37**	**6**	**16.2%**	**6232**	**619**	**9.9%**

TNN 2016-2020

死亡率 = 死亡個案數/總數

體重	區域 北部 區總數	死亡人數	區死亡率(%)	中部 區總數	死亡人數	區死亡率(%)	南部 區總數	死亡人數	區死亡率(%)	東部 區總數	死亡人數	區死亡率(%)	區總數 的加總	死亡人數 的加總	區死亡率(%) 的加總
≦500克	85	66	77.6	37	23	62.2	59	48	81.4	0	0	#DIV/0!	181	137	75.7
501-750克	488	152	31.1	237	65	27.4	278	103	37.1	3	3	100.0	1006	323	32.1
751-1000克	615	71	11.5	375	28	7.5	343	42	12.2	16	4	25.0	1349	145	10.7
1001-1250克	690	33	4.8	399	18	4.5	402	19	4.7	9	3	33.3	1500	73	4.9
1251-1500克	935	25	2.7	543	16	2.9	625	22	3.5	8	1	12.5	2111	64	3.0
>1500克	40	2	5.0	29	2	6.9	15	2	13.3	1	0	0.0	85	6	7.1
總計	**2853**	**349**	**12.2**	**1620**	**152**	**9.4**	**1722**	**236**	**13.7**	**37**	**11**	**29.7**	**6232**	**748**	**12.0**

早期死亡率(院外) =院外早期死亡個案數/院外出生總數

轉院 早期死亡率	欄標籤				
列標籤	中部	北部	東部	南部	總計
>1500克	#DIV/0!	0.0%	0.0%	0.0%	0.0%
≦500克	0.0%	0.0%	#DIV/0!	33.3%	14.3%
1001-1250克	0.0%	1.9%	0.0%	7.7%	2.7%
1251-1500克	1.2%	0.0%	0.0%	0.0%	0.3%
501-750克	0.0%	3.8%	#DIV/0!	10.0%	4.8%
751-1000克	0.0%	0.0%	33.3%	4.5%	1.9%
總計	**0.5%**	**0.9%**	**16.7%**	**3.8%**	**1.8%**

REFERRAL PROCESS

- Clear referral pathways and protocols should be established
- Ideally requiring a **single call** to the transfer service
- A simple solution is to establish a dedicated **telephone "hotline"** within a region through which the transfer service may be **immediately accessed 24 hours a day**.

內容

- 周產期醫療的重要性
- 轉診的規劃
- **轉診準備、過程面臨的議題**
- 資料收集與品管
- 指引與訓練

REFERRAL PROCESS

- The initial care of a sick infant is a key factor in its long term outcome. (**Golden time**)
- It therefore follows that the transfer process really begins with the recognition by referring hospital staff that a particular infant is unwell and may require treatment that is unavailable at that hospital. (**Early detection**)
- It is, however, essential that the referring hospital is able to provide an appropriate standard of care from birth up to the point of transfer. (**Stable before transfer**)

Stabilization

Babies become most unstable during transport

- **STABLE** (**S**ugar, **T**emperature, **A**rtificial breathing, **B**lood pressure, **L**aboratory work, **E**motional support)
- **SAFER** (**S**ugar, **A**rterial circulatory support, **F**amily support, **E**nviroment, **R**espiratory support)
- **TOPS** (**T**emperature, **O**xygenation, **P**erfusion, **S**ugar)

CLINICAL ISSUES

Table 1 Outline of key issues in stabilising neonates for transfer[19]

Airway/breathing

- Should the baby be intubated before transfer? A lower threshold for intubation should be used than on the neonatal intensive care unit, to minimise the need to intervene in transit. In an infant > 30 weeks gestation, if the vital signs (pulse, blood pressure, respiratory rate, temperature) have been consistently stable in oxygen < 50% and if the $PaCO_2$ is normal, it may be acceptable to move the baby without intubation. If the infant is:
  unstable
  has a rising oxygen requirement > 50%
  has a rising $PaCO_2$
  has recurrent apnoea
  is < 30 weeks gestation

then intubation and respiratory support is highly likely to be required, at least for the duration of the journey.

- If already intubated, the endotracheal tube (ETT) must be correctly positioned and secure. ETTs must be secured to a high standard, to avoid accidental extubation in transit.
- Adequate respiratory support must be given.
- Surfactant must be administered if indicated.

Circulation

- Arterial access, if not already established, should be considered in infants who require repeated blood gas analysis or accurate blood pressure measurement. If siting a line will not influence practice before or during the journey, then it may be acceptable to delay this until after the transfer.
- Correct positioning and security of the catheter must be checked.
- Circulation with fluids and/or inotropes should be supported early, as indicated.

Temperature

- Assess temperature and consider the support required for transfer.
- Use temperature maintenance adjuncts, such as chemical gel mattresses.[20 21]

Blood glucose

- Measure and stabilise blood glucose.
- Secure intravenous access.

Infection

- Screen for infection as indicated.
- Start treatment.

Parents' information and wishes

- Discuss plans with parents. Ascertain their plans about travelling to referral unit. Liaise with midwifery staff about maternal transfer.

Information

- Ensure the team at the referral unit will have all the necessary information to advance the care of the baby.

Safety

- **Loading and unloading equipment** is potentially hazardous, and, once loaded, all equipment must be **adequately secured**.
- **Protective clothing** should be made available for staff, both to allow them to be **seen at night** and to protect them from **temperature extremes**.

AMBULANCE SERVICE

- A key element of transfers
- The ability to put a **transport incubator** system in an ambulance with **appropriate staff and ancillary equipment** and convey them to and from the referring unit.
- European Committee for Standardization (CEN) regulations (**CEN 13976-2**):
  - maximum weights of equipment
  - standards for locking incubator trolleys in road vehicles
  - many other aspects of transfer equipment systems

Equipment

- Inhaled nitric oxide (iNO)
- High frequency oscillatory ventilation
- Continuous positive airways pressure (CPAP)
- Blood gas measurement in transit

- Ensure power and gas (O2) supplies

Table 4 Equipment and supplies for neonatal transport.

- Transport incubator with a cabinet for the NB, with a certified fixation system and clear sections that allow observation of the infant and provide a safe, protected and temperature-controlled environment. It must allow medical intervention in transit. It must meet the basic safety and function standards established by the UNE-EN 60601-2-20:2010, 2018 revision
- Vital signs monitor including at minimum the HR, RR, ECG, NIBP, IBP, CVP, SpO_2 and body temperature. Point-of-care blood testing and glucose meter. Point monitoring of $EtCO_2$ (verification of ETT placement after intubation and in CPR) and $PtCO_2$ are desirable. Visual alarms are preferable over audio alarms
- Disposable supplies for vascular access and intravenous infusion, necessary drugs and fluids. Large volume pumps and continuous infusion pumps
- Refrigerator for drugs
- Supplies for enteral nutrition. Human milk storage system
- Supplies for airway management. Neonatal self-inflating bag with PEEP valve. Portable suction system. Transport ventilator with assist-control mode. Humidifier. Noninvasive ventilatory support. If available, high-frequency oscillatory ventilation and high-flow oxygen therapy
- Portable oxygen, medical air and iNO canisters with quick connect adapters, sufficient supply to cover double the longest expected duration
- Supplies for CPR, defibrillator
- Urinary drainage system, catheters and bags
- Servo-controlled active cooling system
- Point-of-care ultrasound system: desirable
- System to load and unload the incubator without lifting
- Light for diagnosis
- Seats for at least 3 providers/family members. At least 450 mm distance between seats and incubator to allow easy access to the NB. A certified restraint system must be used for the safety of the patient and the crew
- Dependable power supply to power medical equipment in the vehicle without using the battery of the incubator. The electric system must be designed so that the vehicle will not use the power of the transport incubator or its interface system
- Communication systems for communication between the medical team and vehicle operators and between the medical team and the unit's base location

內容

- 周產期醫療的重要性
- 轉診的規劃
- 轉診準備、過程面臨的議題
- **資料收集與品管**
- 指引與訓練

Table II. TRIPS—model regression, items, physiologic ranges, score points

TRIPS variable	β-Coefficient	95% CI		TRIPS score points
Temperature (°C)				
<36.1 or >37.6	0.83	1.01	5.22	8
36.1-36.5 or 37.2-37.6	0.08	0.44	2.65	1
36.6-37.1				0
Respiratory status				
Severe (apnea, gasping, intubated)	1.44	1.91	9.35	14
Moderate (RR >60/min &/or SpO_2 <85)	0.50	0.43	6.37	5
None (RR <60/min & SpO_2 >85)				0
Systolic BP (mm Hg)				
<20	2.56	2.88	57.67	26
20-40	1.63	2.31	11.30	16
>40				0
Response to noxious stimuli				
None, seizure, muscle relaxant	1.74	2.46	13.30	17
Lethargic response, no cry	0.64	0.72	5.01	6
Withdraws vigorously, cries				0

Variables are significant if 95% CIs do not cross 1.0.
RR, Respiratory rate; *SpO_2,* pulse oximetry; *BP,* blood pressure.

J Pediatr 2001;139:220-6

Scoring

- Mortality Index for Neonatal Transportation (MINT)
- Score for Neonatal Acute Physiology-Perinatal Extension II (SNAP-PE-II)
- Transport Related Mortality Score (TREMS).

Transport Run Indicators

Team configuration	Was it appropriate? Should a physician have attended?	**Delay in mobilization time (>30 min)**
Mode of transport	Was most efficient mode chosen? Check response time	awaiting EMS
Delay in dispatch or reaction time	awaiting blood products	awaiting lift assist
arranging transportation	awaiting equipment	**Delay in stabilization time**
team unavailable	awaiting fellow	waiting for paperwork; xray; bed
triaging calls	awaiting bed	patient acuity; procedures
awaiting more information	other; specify	trainee education
Clinical: physiologic	Temp <36.0; <35.0	bradycardia with non-physiologic HR <100
pneumothorax	need for intubation	cardiac arrest
unexpected desaturation	resp arrest requiring resus	MBP <GA and clinical signs
resp arrest during transport		glucose <2.6 under ACTS care
clin deter req return to referral	clin deterioration requiring vehicle stoppage	unable to transfer due to clinical instability
Clinical complications		
difficult IV access	number of attempts for PIV	number of attempts for ABG
dislodged ETT	malpositioned ETT	number of attempts for ETT
dislodged UAC, UVC, PAL	iatrogenic injury to patient	medication error
For GA <32 wks	FiO2 >30%	seizures, decreased tone
at 1 hour: for Golden Hour Apgar	pCO2 <40	pCO2 >60
	MAP <GA	decreased perfusion
HIE	time to passive cooling	time to active cooling
	time to target temp 34.0	eligible and not cooled
		reason not cooled
iNO commenced at what time	**OI at iNO initiation**	
Post transport clinical deterioration		
urgent intervention within 1 h of handover to receiving hospital: e.g. increased resp support, iNO, CPR		
patient died within 24 hours of transport		
unplanned transfer to higher level of care within 24 hours of transport		
Equipment complication		
supplies not available	defective supplies	not enough equipment (IV pump), supplies depleted
vehicle malfunction	no electrical power available	
amb/air equipment incompatible	amb mechanical: need to change vehicles	
ventilator malfunction	loss of compressed gas	no additional compressed gas available
loss of power	incubator heater failure	IV pump failure
System complication	helicopter not available	fixed wing not available
delay >30 min for bed with Criticall	delay >30 min departure waiting for bed	
weather	traffic congestion	vehicle crash
arrive at wrong destination	injury to patient	injury to team member

Figure 6 Metrics reviewed during daily run reviews at SickKids.

Team configuration	Was it appropriate? Should a physician have attended?
Mode of transport	Was most efficient mode chosen? Check response time
Delay in dispatch or reaction time	awaiting blood products
arranging transportation	awaiting equipment
team unavailable	awaiting fellow
triaging calls	awaiting bed
awaiting more information	other; specify

Delay in mobilization time (>30 min)
awaiting EMS
awaiting lift assist
Delay in stabilization time
waiting for paperwork; xray; bed
patient acuity; procedures
trainee education

Clinical: physiologic	Temp <36.0; <35.0	bradycardia with non-physiologic HR <100
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	time to target temp 34.0	eligible and not cooled
		reason not cooled
iNO commenced at what time	**OI at iNO initiation**	

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System complication	helicopter not available	fixed wing not available
delay >30 min for bed with Criticall	delay >30 min departure waiting for bed	
weather	traffic congestion	vehicle crash
arrive at wrong destination	injury to patient	injury to team member

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- 轉診準備、過程面臨的議題
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- **指引與訓練**

STAFFING

- a nurse
- a doctor at specialist registrar level or above OR advanced neonatal NP
- Ambulance personnel- minimal role

- Reductions in numbers of and hours worked by pediatricians in training

Human resources & skills

- Theoretical knowledge and clinical skills
- Technical skills
- Communication and social skills
- Skills related to the means of transport
- Continuing education

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Recommendations on the skills profile and standards of the neonatal transport system in Spain

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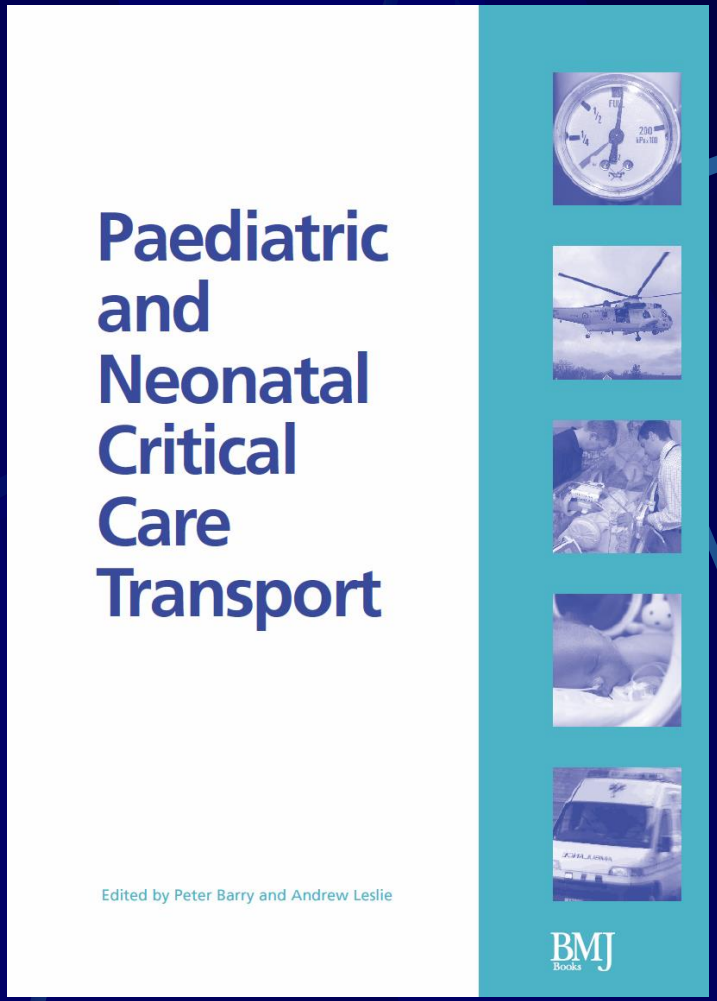

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