



台灣新生兒科醫學會
TAIWAN SOCIETY OF NEONATOLOGY

Current Status of Neonatal Transfer in Taiwan

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President, Taiwan Society of Neonatology

NOVEMBER 17
WORLD PREMATURETY DAY

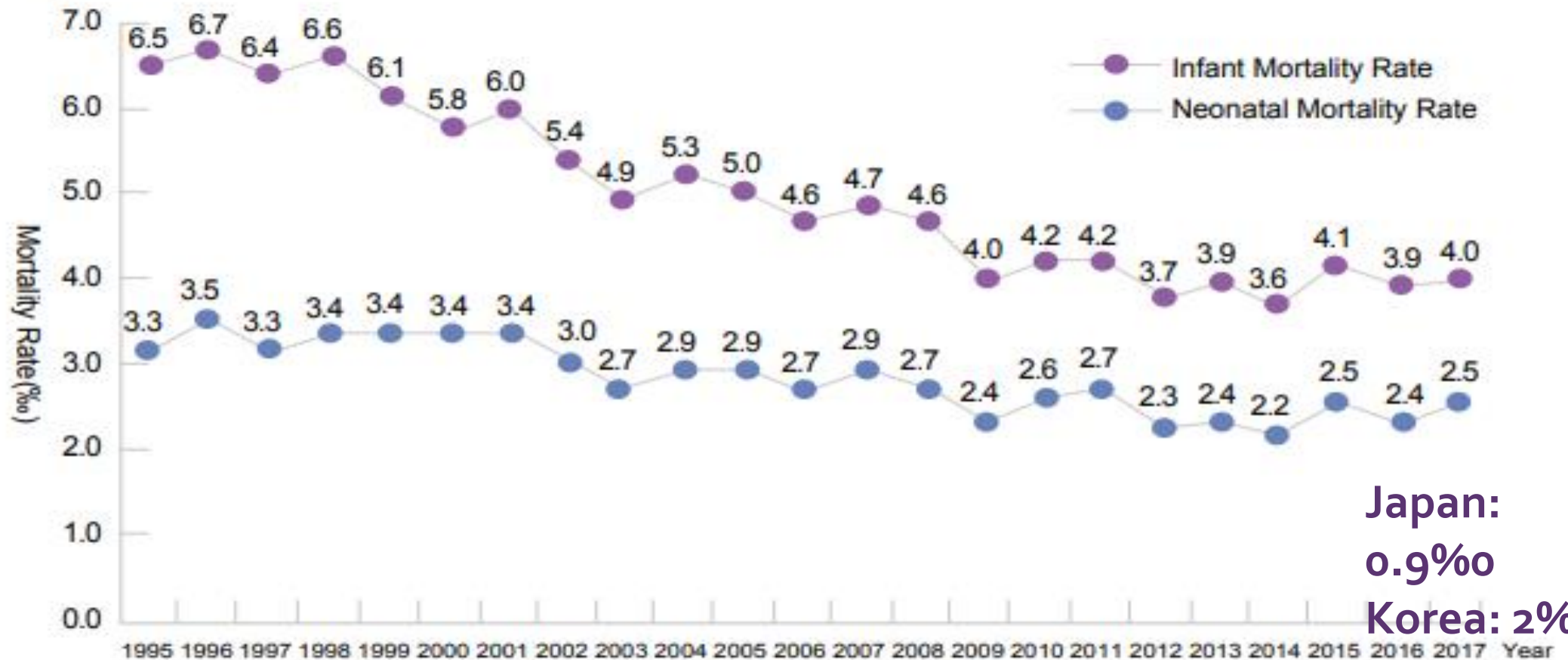


Introduction

- ▶ **Perinatal mortality and neonatal mortality** are important measurable outcome in a healthcare service.
- ▶ Advances in **neonatal critical care** has resulted in **improved outcome** for high risk neonates.
- ▶ In Taiwan, the leading cause of neonatal death is **perinatal events** .
- ▶ Perinatal care should be reinforced in order to reduce the neonatal mortality rate.

Trend in neonatal mortality rate

Figure 2-8 Neonatal and Infant Mortality Rates in Recent Years



Japan:
0.9‰
Korea: 2‰

Neonatal mortality rate and causes in different city/county in Taiwan during 2009-2018

2009-2018年新生兒死因別死亡數與百分比

死因別		台北市	新北市	桃園市	台中市	台南市	高雄市	基隆市	新竹市	嘉義市	宜蘭縣	南投縣	苗栗縣
周產期病況	死亡數	476	629	267	374	245	491	47	89	34	65	55	99
	%	74.4	78.4	68.8	69.9	76.1	72.6	83.9	82.4	75.6	69.1	61.1	72.8
先天性疾病	死亡數	148	142	102	138	60	148	7	15	9	26	31	32
	%	23.1	17.7	26.3	25.8	18.6	21.9	12.5	13.9	20.0	27.7	34.4	23.5
惡性腫瘤	死亡數					1							
	%					0.3							
傷害外因	死亡數	2	8	4	4	3	3	1	2			2	
	%	0.3	1.0	1.0	0.7	0.9	0.4	1.8	1.9			2.2	
其他	死亡數	14	23	15	19	13	34	1	2	2	3	2	5
	%	2.2	2.9	3.9	3.6	4.0	5.0	1.8	1.9	4.4	3.2	2.2	3.7
總計	死亡數	640	802	388	535	322	676	56	108	45	94	90	136
	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Neonatal mortality rate and causes in different city/county in Taiwan during 2009-2018

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	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Perinatal events remain the most common cause for neonatal mortality

Background

- ▶ The Committee of the Regional Network for Medical Care has organized the **Perinatal Care Subcommittee** on 1997 to improve perinatal care in Taipei, Tainan, Taichung, and Kaohsiung.

Background

- ▶ The **five-year plan** for the Perinatal Care Subcommittee formulated by the Department of Health of the Executive Yuan in Taiwan in 2000 includes:
 1. The establishment of a **perinatal care system**
 2. The establishment of **neonatal transport system**
 3. The establishment of the **network information system**

Background

- ▶ The Perinatal Care Subcommittee had developed **classification of levels of perinatal and neonatal care institutions**, established perinatal and neonatal **referral indications** and transport equipment, personnel and procedures.

Establishment of the network information system

- ▶ **Centralization of neonatal transport** needs a considerable financial injections into existing transport teams.
- ▶ One must invest in mechanisms that ensure close **partnership** with local or smaller hospitals, as networking is about collaboration.
- ▶ Eventually, the centralization network was not established.

Classification of Neonatal Care Levels

- ▶ **Level I:** Abilities to evaluate and provide postnatal care to **stable term infants**; to provide **neonatal resuscitation** at every delivery

Classification of Neonatal Care Levels

- ▶ **Level II:** Additional abilities to provide care for infants who have **physiologic immaturity** or who are **moderately ill** with problems that are expected to resolve rapidly, and are not anticipated to require sub-specialty services in an urgent setting. The ability to handle and transfer neonates.
 - ▶ **Level IIA:** There is a **special care unit** for newborns
 - ▶ **Level IIB:** There is a **NICU**

Classification of Neonatal Care Levels

- ▶ **Level IIIA:** Additional capability to diagnose and treat **heart diseases** with medical methods and can perform **general pediatric surgeries**.
- ▶ **Level IIIB:** Additional capability to operate **more difficult pediatric surgeries** (e.g. CDH, T-E fistula, etc)
- ▶ **Level IIIC:** Additional capability to perform **cardiac catheterization, cardiac surgeries,** and **neurosurgeries**.

Election of responsible hospitals

1. Hospitals classified into IIB , IIIA, B, and C according to the neonatal levels of care criteria.
2. Hospitals willing to cooperate with this transfer system.

Neonatal levels of care Institutions in Taipei city

- ▶ **IIIC:** NTUH 、 TVGH 、 TMMH 、 TSGVH 、 Cathay General Hospital 、 Shin Kong Hospital.
- ▶ **IIIB:** CGMH, Taipei 、 Taipei City Hospital.
- ▶ **IIIA:** Yonghe Cardinal Tien Hospital 、 Cardinal Tien Hospital.
- ▶ **IIB:** Taipei Municipal Wanfang Hospital 、 TMUH

Indications for transport

Neonatal conditions

- ▶ Prematurity
GA <33 weeks or birth weight below 1800g
- ▶ Respiratory distress or apnea
- ▶ Perinatal asphyxia
- ▶ Sepsis
- ▶ Congenital heart disease (antenatal diagnosis or suspected)
- ▶ Suspected intestinal obstruction
- ▶ Congenital anomaly

Indications for transport

Maternal conditions

- ▶ Prematurity: gestational age < 33wks
- ▶ PPRM >18 hours
- ▶ Severe preeclampsia, eclampsia, hypertension
- ▶ Multiple pregnancy
- ▶ APH
- ▶ Severe heart disease
- ▶ Severe infection
- ▶ GDM

Indications for transport

Maternal and fetal conditions

- ▶ Hyperthyroidism
- ▶ Renal disease with insufficiency or hypertension
- ▶ Drug abuse
- ▶ Acute abdomen
- ▶ Trauma
- ▶ Surgical conditions
- ▶ Hydrops fetalis
- ▶ IUGR
- ▶ Congenital anomaly

Standardization of equipment for neonatal transfer

- **Transport incubator** (with constant radiant heating on standby)
- Respirator, optional
- **Portable oxygen cylinder**, at least 400 ml
- At least one **IV pump**
- Respiratory rate, heart beat, blood pressure **monitor**, and a **pulse oximeter**
- **Portable first aid kit** (containing emergency medicine, endotracheal tube, intubation equipment, umbilical vein catheter, chest tube)

Current neonatal transfer process emphasizing acute postnatal transfer

Obstetrics and Gynecology Hospital or Clinic
(Level IIA and Level I) recognizes babies with
clinical conditions requiring emergency referral

Referral physician or nurse contacts the
receiving unit via a phone call, to confirm the
availability of emergency transfer

If bed not available, physician/nurse contacts
another hospital

Current neonatal transfer process emphasizing acute postnatal transfer

➤ Transfer services are provided centrally

Telephone call 119 to the **emergency medical services center**

Nurse in the emergency medical services center decides the appropriate responsible hospital

Emergency medical services center notifies the **responsible hospital**

	出生人數(人)	男出生人數 (人)	女出生人數 (人)	出生人口 性比例 (%)	粗出生率 (0/00)	男粗出生 率(0/00)	女粗出生 率(0/00)
	區域別總計	區域別總計	區域別總計	區域別總 計	區域別總 計	區域別總 計	區域別總 計
97年	198,733	103,937	94,796	109.64	8.64	8.95	8.33
98年	191,310	99,492	91,818	108.36	8.29	8.55	8.02
99年	166,886	87,213	79,673	109.46	7.21	7.50	6.93
100年	196,627	101,943	94,684	107.67	8.48	8.76	8.20
101年	229,481	118,848	110,633	107.43	9.86	10.19	9.53
102年	199,113	103,120	95,993	107.42	8.53	8.83	8.23
103年	210,383	108,817	101,566	107.14	8.99	9.31	8.67
104年	213,598	111,041	102,557	108.27	9.10	9.49	8.72
105年	208,440	108,133	100,307	107.80	8.86	9.23	8.50
106年	193,844	100,477	93,367	107.62	8.23	8.57	7.89
107年	181,601	93,876	87,725	107.01	7.70	8.01	7.39

Decrease in birth rate

Bed occupancy rate in NICU

➔ NICU beds are adequate

		2016年	2017年	2018年
醫院	床位數	佔床率	佔床率	佔床率
北榮	12	73.2	72.1	85
台大	25	80.3	85.1	90.89
馬偕	23	87.37	85.93	82.24
新光	10	79.97	79	
國泰	10	51.2	47.8	70.8
林口	47	97.8	96.3	95.6
中國醫	24	91.8	95.4	88.7
中榮	18	94.6	87.7	83.5
中山醫	20	97.16	97.63	
彰基	21	83.9	86.8	85.6
成大	20	87	85.6	87
奇美	8	64.99	76.94	85.2
高醫	15	90.7	93	93.22
高榮	12	90.8	84.38	83.61
耕莘-新店	5	44.4	51	30.9
耕莘-永和	4	49.11	33.7	23.4
義大	13	70.3	79.26	86.49
高長	30	95.3	94	
亞東	8	80.6	82.1	

Neonatal transfer process

- If bed available at the receiving unit
- ➔ **Parents are verbally informed** by healthcare professionals about the transport of their Infant
- ➔ The **accepting physician acquires the most updated information** about the infant, understanding of the natural history of the presenting problem, in addition to the effect that a transfer may have on the patient's condition
- ➔ **Advices given to the referring clinician**, then the transfer team mobilizes

Neonatal transfer process

- ▶ In general, owing to the **relatively short distances between hospitals** in most regions, with the potential exception of the more remote units in Taiwan, **transfer response time should not be a major issue.**

High risk newborn referral flow chart

Referral physician calls to **NICU leader-nurse**

Calls **ambulance company** and neonatal transfer-trained **physician and nurse**

Asks the most **updated information** about the infant;
advices given to the referring clinician

Checks **equipments** for neonatal transfer

Response time <30 minutes

High risk newborn referral flow chart

Referral physician calls to **NICU leader-nurse**

Calls **ambulance company** and neonatal transfer-trained **physician and nurse**

Asks the most **updated information** about the infant;
advices given to the referring clinician

Checks **equipments** for neonatal transfer

Response time <30 minutes



Staff checking transport equipment



Toolbox containing
respiratory/circulatory/
monitoring kits

Staff checking transport equipment



High risk newborn referral flow chart

Transfer team mobilizes and arrives at the **transferring facility**

Stabilization before transfer

Parents are verbally informed by transfer physician about the transport of their Infant

Call the NICU to prepare for the requirement of respiratory support

Transfer the patient and **record all vital signs** on the way to NICU

High risk newborn referral flow chart

Transfer team mobilizes and arrives at the **transferring facility**

Stabilization before transfer

Parents are verbally informed by transfer physician about the transport of their Infant

Call the NICU to prepare for the requirement of respiratory support

Transfer the patient and **record all vital signs** on the way to NICU



Equipment on transit

High risk newborn referral flow chart

Transfer team mobilizes and arrives at the **transferring facility**

Stabilization before transfer

Parents are verbally informed by transfer physician about the transport of their Infant

Call the NICU to prepare for the requirement of respiratory support

Transfer the patient and **record all vital signs** on the way to NICU



Transport physician informs the parents about the infant's condition and transport procedure

High risk newborn referral flow chart

Transfer team mobilizes and arrives at the **transferring facility**



Stabilization before transfer



Parents are verbally informed by transfer physician about the transport of their Infant



Call the NICU to prepare for the requirement of respiratory support



Transfer the patient and record all vital signs on the way to NICU



The transport team returns to the special care nursery/NICU
Transport physician makes briefings to the receiving pediatrician

Transport vehicles:

Ambulances, airplanes, helicopters

For Airplanes and helicopters

Emergency transport protocols

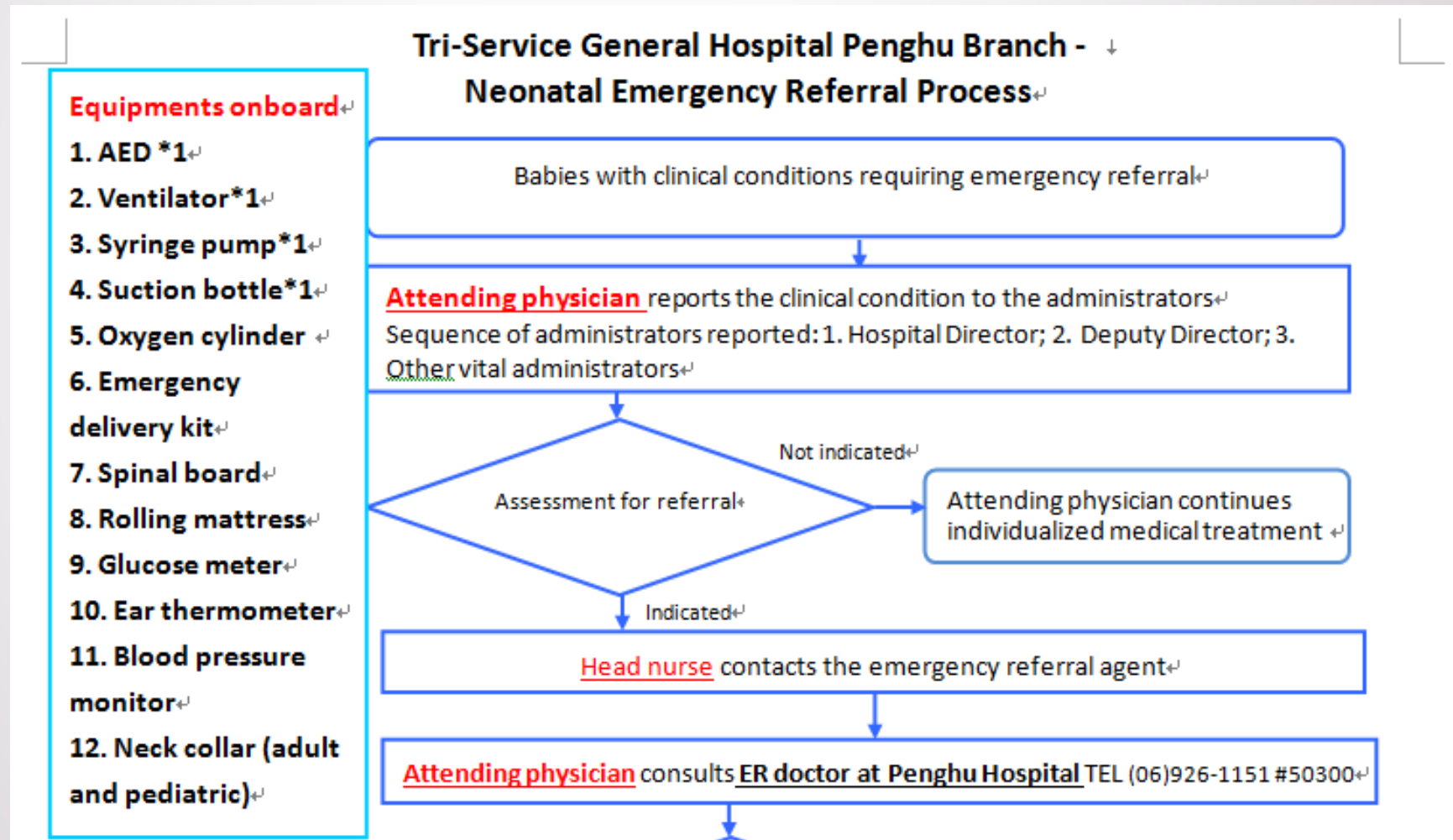
- ▶ According to the protocol for referral of critically ill patients, the **emergency transfer system of helicopter** established, and the relevant regulations were followed to secure the priority for stabilization of patients and the necessary treatment for the offshore islands (Penghu, Kinmen and Matsu)

The hospital is equipped with a helipad to provide emergency transfer



Transport vehicles

Airplane and helicopters



**Air Medical Service
Operation Center**

TEL:

02-81959119

6809

6910

02-89114119

On-call doctor

0938919197

FAX:

02-81966740

02-81966741

**Emerald Pacific
Airlines**

06-9216478

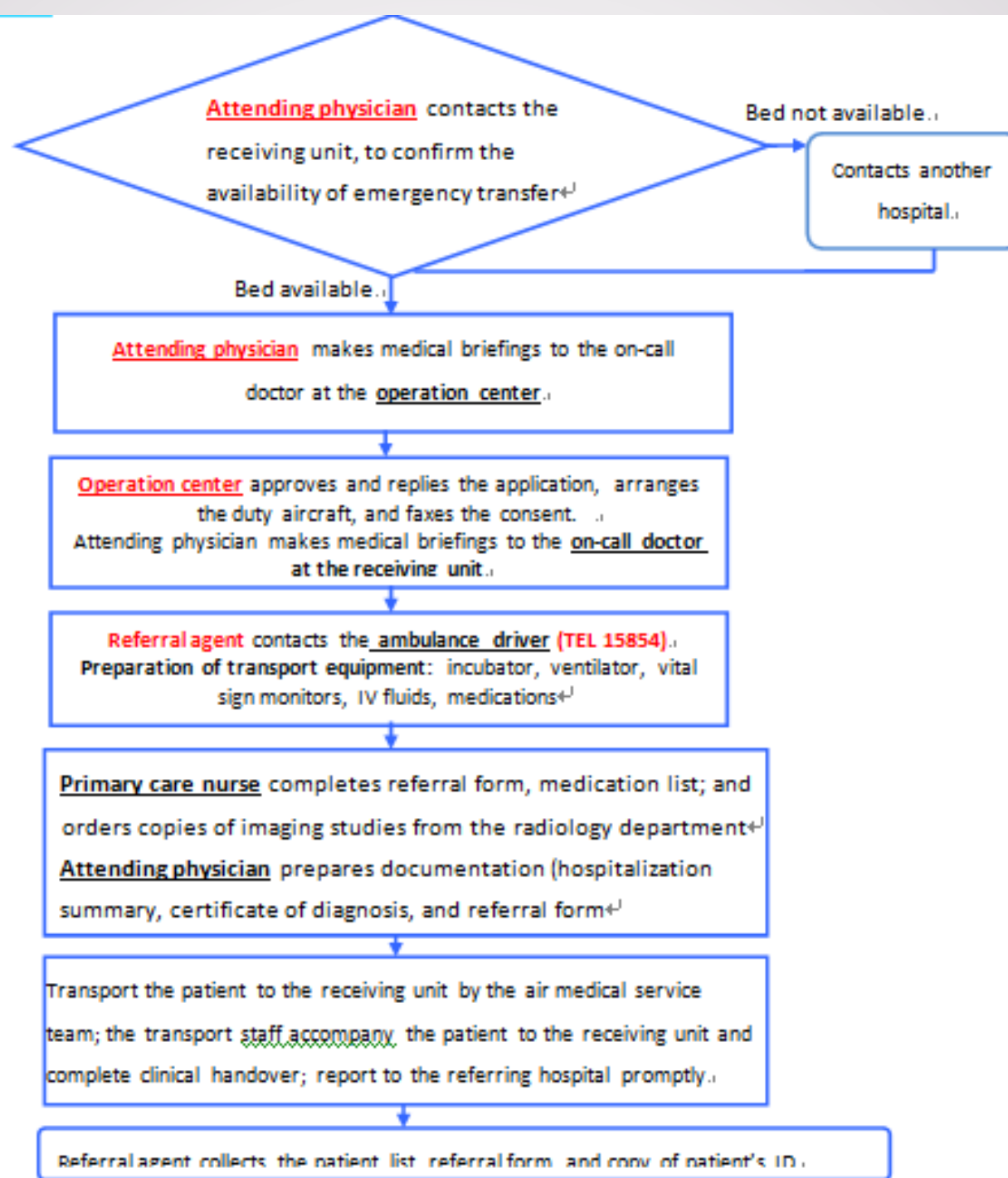
Referral line :

0933188857

**Penghu Airport
Director**

0934051697

FAX: **9216406**



Receiving Hospitals

**1. Kaohsiung Veterans
General Hospital**

07-3422121 # 7009

**2. Tri-Service General
Hospital**

02-87923311#88045

(PICU)

**3. Kaohsiung Chang Gung
General Hospital**

07-7317123 # 2203

**4. Kaohsiung Medical
University Hospital**

07-3121101 # 7559

5. E-Da Hospital

07-6150011 # 3131

Taiwan Joint Commission on Hospital Accreditation and Quality Improvement

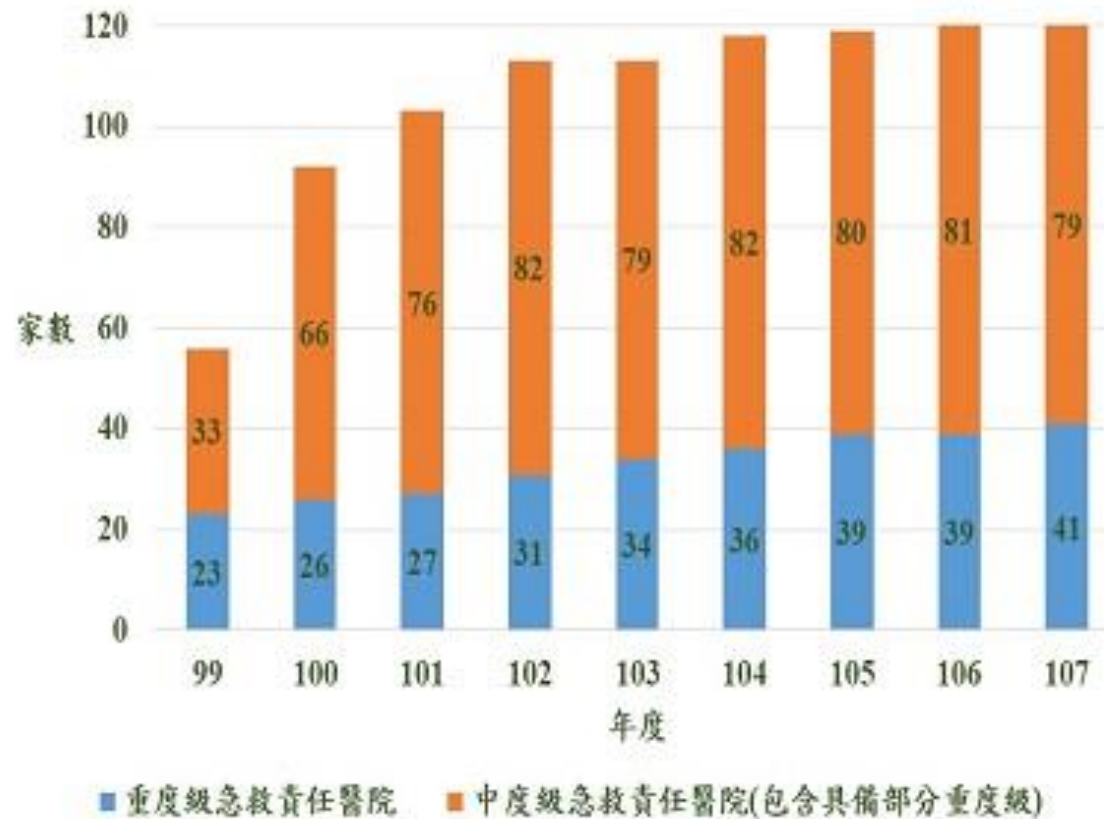
- ▶ Reformation the **hospital accreditation** system in **2003** to **improve** health care **quality** with emphasis on patient-centeredness and safety. Over the years, the **accreditation** system has improved the hospital structure significantly.
- ▶ Implanting the **perinatal and neonatal care evaluation** and setup of the **hospital emergency medical ability grading system** in **July 2009**.

Taiwan Joint Commission on Hospital Accreditation and Quality Improvement

- ▶ Until 2018, there are **47 hospitals** with **level II** and **level III** neonatal and perinatal care abilities.
- ▶ **Neonatologists are unevenly distributed**, and there remains a shortage of neonatologist in remote areas in western Taiwan and the east coast.

Institutions classified into level II and III of perinatal and neonatal care

歷年中、重度級急救責任醫院家數



Maternal vs neonatal transfer

- ▶ According to the data analysis from the Premature Baby Foundation of Taiwan, on average, **85% of very low birth weight preterm infant** (birth weight $\leq 1500\text{gm}$) are delivered by mother with high risk pregnancy.
- ▶ It is **not always predictable** if such infants require intensive care after birth.
- ▶ Where antenatal transfer is not possible, **postnatal transfer is essential** for sick infants born in hospitals without appropriate facilities for continuing intensive care.

Maternal vs neonatal transfer

- ▶ The Taiwan Premature Infant Follow-up Network
1997-2018 VLBW

	1997-2001	2002-2006	2007-2011	2012-2016	2017-2018
Maternal transfer	22.6%	29.9%	40.8%	47.2%	48.4%
Neonatal transfer	27.1%	26.0%	13.7%	10.8%	10.0%

	Neonatal transfer rate (transfer cases/total cases)		
	2016	2017	2018
Northern Taiwan	8.3%(55/663)	6.7%(39/583)	7.0%(39/559)
Central Taiwan	10.2%(38/372)	9.6%(31/332)	11.9%(39/327)
Southern Taiwan	11%(43/391)	12.2%(41/334)	12.1%(42/347)
Total 22 hospitals	9.5%(136/1426)	8.9%(111/1239)	9.7%(120/1233)

- ▶ North Taiwan: Ilan, Keelung, Taipei, Hsinchu, New Taipei, Taoyuan
 - ▶ TPFN participants: NTUH, MCH, CGMH-L, YCTH, SKH, TSGH, NCGGH, TGVH, TPMMH, CMH
- ▶ Middle Taiwan: Miaoli, Changhua, Nantou, Yunlin, Taitung, Taichung
 - ▶ TPFN participants: CMUH, TCVGH, CSMUH, CCH
- ▶ South Taiwan: Chiayi, Tainan, Kaohsiung
 - ▶ TPFN participants: NCKUH, CMMC, SLH, KGH, KVGH, CGMH-K, KMUH, E-Da H

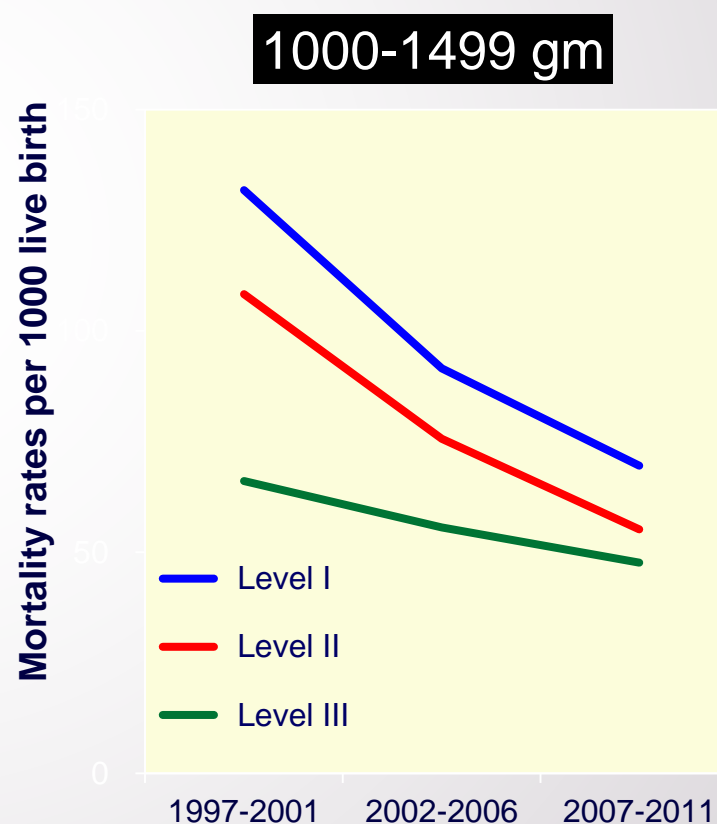
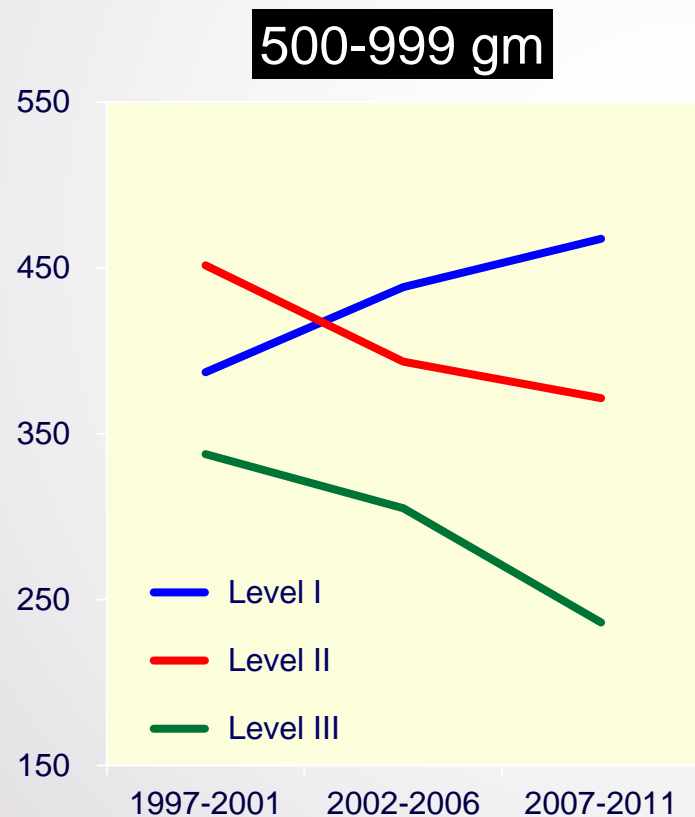
Neonatal transfer rate

Taiwan Neonatal Net work, 2016-2018

	Neonatal transfer rate (transfer cases/total cases)		
	2016	2017	2018
Northern Taiwan	60/630 (9.5%)	52/555 (9.4%)	40/507 (7.9%)
Central Taiwan	39/362 (10.8%)	38/314 (12.1%)	38/324 (11.7%)
Southern Taiwan	39/410 (9.5%)	38/329 (11.6%)	44/333 (13.2%)
Eastern Taiwan	3/11 (2.7%)	0/7	0/7
Total 22 hospitals	141/1413 (9.97%)	128/1205 (10.6%)	122/1171 (10.4%)

- Northern area: Ilan, Keelung, Taipei, Taoyuan, and Hsinchu. **TNN participants** NTUH, MCH, CGMH-L, YCTH, SKH, TSGH, NCGGH, TGVH, **TPMMH**, CMH
- Central area : Miaoli, Taichung, Changhua,, Nantou.
TNN participants: CMUH, TCVGH, CSMUH, CCH
- Southern area : Chiayi, Yunlin, Tainan, Kaohsiung, and Pingtung. TNNparticipants : **NCKUH, CMMC, SLH, KGH, KVGH, CGMH-K, KMUH, E-Da H**
- Eastern area : Taitung and Hualien.
TNN participants : HCH

The mortality of VLBW neonates in Taiwan



Clinical issues of neonatal transfer in Taiwan

Staffing

- ▶ Transfers require **a nurse and a physician trained for neonatal care**, and may affect standard working hours.
- ▶ The **quality and efficiency** of transfer is inconsistent; transfers are occasionally performed by staffs with less experiences in transfer setting, operating unfamiliar equipment.
- ▶ The hospitals are not organized, without consistency in **information exchange** and **communication**.
- ▶ There is **lack of classification and regionalization** of the transfer hospital.

Clinical issues of neonatal transfer in Taiwan

Stabilization before transfer

- ▶ Local staffs at the referring institutions, usually obstetric clinics, are **not qualified NRP providers**; therefore, the first aid to these high risk newborns are not always optimal, and it could even potentially worsen the babies' prognosis.
- ▶ Most hospitals rely on contract with **private ambulance companies** for transfer.
- ▶ Traffic jam will extend the referral time.

Scenario

**Prenatal and Birth Histories

- ▶ G2P2 mother admitted to XX OBS clinic due to uterine contraction, where OS was full then progress to delivery 5 minutes after admitted to delivery room.
- ▶ Born at 18:51 at GA 29+5weeks, BW:1376gm
- ▶ APGAR score 0/4 at 1 and 5 minutes respectively
- ▶ At birth, patient was no heart beat so the patient was intubated and received CPR, then HR >100/min
- ▶ The transfer was performed by a general pediatrician
- ▶ The endotracheal tube slipped of, while moving the baby into incubator
- ▶ Then the pediatrician transport the baby with Neopuff bagging, SPO2 was 50%-60% on the way to NICU, the transport drive time was about 10 minutes
brain echo cystic PVL

Clinical issues of neonatal transfer in Taiwan

Equipment

- No specific guidelines are available for the **standard setting of neonatal ambulances**. It may be important to standardize transport equipment.
- To achieve this, we need **multidisciplinary discussion and working groups** with wide representation (including ambulance service companies).

Clinical issues of neonatal transfer in Taiwan

Safety

- ▶ **Safety and welfare of transfer staff** is of importance. The transfer environment is hostile, and staff should be trained in working under such conditions.
- ▶ All equipment must be adequately **secured** and **crash-proof**.
- ▶ Considerable improvements have been made in recent years in fixation systems for trolleys.

The Neonatal Transport Service Fee in Taiwan

Healthcare Institution	Payment of Ambulance Fee	Payment of Medical Expense	Insurance Product Provided By Institution	Amount Insured
MacKay Children's Hospital, MacKay Memorial Hospital, Hsinchu Branch Shin Kong Memorial Wu Ho-Su Hospital Cathay General Hospital Taipei Tzu Chi Hospital China Medical University Hospital, Pingtung Christian Hospital	Hospital fund	free	Ambulance passenger accident insurance	

The Neonatal Transport Service Fee in Taiwan

Healthcare Institution	Payment of Ambulance Fee	Payment of Medical Expense	Insurance Product Provided By Institution	Amount Insured
MacKay Memorial Hospital, Taitung Branch	Hospital fund around NTD 20400 (7800+ for ambulance)	Hospital fund: NTD 700/hr for ventilator, NTD1500 for EMT, NTD3000 for nurse, NTD6000 for doctor	Ambulance passenger accident insurance	
National Taiwan University Hospital	Patient's family	Patient's family 4000-16000	Ambulance passenger accident insurance	
Chang-Gung Memorial Hospital	Patient's family	Patient's family Doctors:NTD 1200 Nurses :NTD 800	Ambulance passenger accident insurance	Maximum NTD 5,000,000

The Neonatal Transport Service Fee in Taiwan

Healthcare Institution	Payment of Ambulance Fee	Payment of Medical Expense	Insurance Product Provided By Institution	Amount Insured
Chang-Gung Memorial Hospital, Kaohsiung Branch	Patient's family NTD 2500-5000	Patient's family, Doctors NTD 620 Nurses NTD 620	Occupational accident or accidental death insurance	Maximum NTD 5,000,000
E-Da Hospital	Patient's family	Patient's family, Doctors NTD 650 Nurses NTD 650	Occupational accident or accidental death insurance	NTD 2,240,000+2500/day if admission
Mennonite Christian Hospital	Patient's family 900-20076	Patient's family, Doctors NTD1000/hr Nurses NTD 600/hr,	Ambulance passenger accident insurance	

The Neonatal Transport Service Fee in Taiwan

Healthcare Institution	Payment of Ambulance Fee	Payment of Medical Expense	Insurance Product Provided By Institution	Amount Insured
Tung's Taichung Metro-harbor Hospital	Patient's family	Patient's family, Doctor NTD 1500/hr, Nurse NTD 600/hr		
Taipei, Taichung Kaohsiung Veterans General Hospital	Patient's family	free	Ambulance passenger accident insurance	
Chung Shan Medical University Hospital	Patient's family; distance-based pricing	Patient's family; distance-based pricing Doctors: NTD 900-4500 Nurses: NTD 450-1650	Occupational accident or accidental death insurance	Maximum NTD 500,000 for doctors and nurses

The Neonatal Transport Service Fee in Taiwan

Healthcare Institution	Payment of Ambulance Fee	Payment of Medical Expense	Insurance Product Provided By Institution	Amount Insured
Chunghua Christian Hospital	Hospital fund and patient's family (except Chunghua City)	Patient's family Doctors: NTD1200-8000 Nurses: NTD500-3500	Occupational accident or accidental death insurance	Maximum NTD 2,000,000 for doctors and nurses
National Cheng Kung University Hospital	Patient's family NTD1900-4800-6700	Transfer fee NTD1900-4800-6700	Ambulance passenger accident insurance NTD 1,200,000	Transfer accident insurance NTD 12,000,000
Kaohsiung Medical University Hospital	Patient's family NTD1300-3150	Patient's family transfer fee NTD 1500 additional hospital budget for doctors 500 nurses 300)	Occupational accident or accidental death insurance	Maximum NTD 5,000,000

Prenatal referral is preferred over neonatal transfer for high-risk newborns

- **Most high-risk newborns can be identified before delivery**, and the mother can be referred to a hospital with a neonatal intensive care unit before delivery.
- **Prenatal referrals** for high-risk pregnancies can **reduce infant mortality, morbidity, and shorten the hospitalization duration** compared to postpartum referrals.

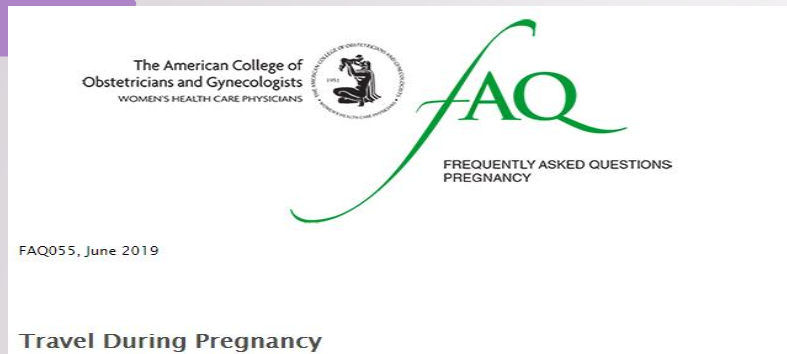
Perinatal demographics

The Taiwan Premature Infant Follow-up Network

	1997-2001	2002-2006	2007-2011	P value	2012-2013	Total
High risk pregnancy	74.3%	86.4%	89.5%	<0.001	93.7%	84.7%
In vitro fertilization	11.4%	10.8%	21.0%	<0.001	22.0%	18.3%
Multiple births	21.2%	27.8%	31.3%	<0.001	30.4%	27.2%
First live born	48.9%	50.2%	55.5%	<0.001	60.0%	52.8%
Prenatal steroid use ≥ 2 doses	27.7%	35.5%	43.9%	<0.001	47.6%	37.9%
Cesarean section	54.7%	60.6%	69.4%	<0.001	69.9%	62.8%
Maternal transfer	22.6%	29.9%	40.8%	<0.001	47.8%	33.7%

Enhance prenatal referral programs

- **Outreach education must primarily focus on the early detection of the high risk fetus and maternal referral to a tertiary center**



Is travel safe during pregnancy?

When is the best time to travel during pregnancy?



返台醫療專機200萬旅平險來幫忙|好...
pnew.tw



遊日跌倒破水「要生得花千萬」她嚇砸145萬...
health.ettoday.net

Newborn emergency transport with special equipments

International medical transfer service FORMOSA SOS



There are portable respirators that can be used in aircraft, and have flight certification!

Transport incubator

Certificate **HAMILTON-T1**

Mechanical stability and Electromagnetic Compatibility with respect to Helicopters, fixed wing aircraft and ambulances

HAMILTON-T1

is in full compliance with the following standards / clauses:

Standard	Clause / Section
RTCA/DO-160F-2007 Environmental Conditions and Test Procedures for Airborne Equipment. Equivalent to ETSI EN 60870-14	Section 7: Power and Safety and Cabin Safety, test: 31, Section 8: Vibration, test: 33, Fixed wing aircraft (and Helicopters) Section 16: Seat Air, Voltage fluctuations, ripple voltage, Section 17: Air, Air, voltage spikes, Section 18.3.1: test: 41, Aircraft: Airline Susceptibility, DC power input, Section 18.3.1: test: 41, Aircraft: Red caused by the aircraft 480Hz power system in aircraft: Hardware, Section 20: Radio Frequency Susceptibility (RFS) and/or EMC, test: 35, Section 21: Emission of Radio Frequency Energy, test: 35, Section 25: Electrostatic Discharge (ESD)
IEC 60601-1-2:2007, Medical electrical equipment - Part 1-2: General and common to basic safety and essential performance - Colateral standard: Electromagnetic compatibility - Requirements and tests	All clauses
EN13718-1:2008, Medical vehicles and their equipment - ambulances - Part 1: Requirements for medical vehicles used in air ambulances	All clauses
EN 1789:2007, Medical vehicles and their equipment - road ambulances	All clauses
EN 794-3:1998+A2:2009, Life support ventilators - Part 3: Portable respiratory for emergency and transport ventilators equal to EN 60626-2, 25, 4, 6d	All clauses

Bonaduz, March 26th, 2012
HAMILTON MEDICAL AG
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Jens Haltek
 Jens Haltek
 Vice President & COO

Intelligent Ventilation

HAMILTON MEDICAL



To improve perinatal and neonatal mortality

Improvement measures should be initiated in

1. Training of **medical personnel** for perinatal care, the development of neonatal intensive care, and regionalization of care
2. Classification of facilities according to the **neonatal levels of care**
3. Enhance **prenatal referral programs**

To improve perinatal and neonatal mortality

4. The referring clinic or hospital is able to provide an **appropriate standard of care from birth to the point of transfer**; subsequent care should be stabilizing the infant until the arrival of the transfer team, which will provide transport incubator in an ambulance with appropriate staff and ancillary equipment

Transport of ill neonates

Summary

- ▶ The development of **efficient transport systems** is crucial to the implementation of regionalizing perinatal care.
- ▶ Transportation of the sick or preterm babies to a center with expertise and facilities for the provision of **multi-organ intensive care** improves outcomes.
- ▶ Neonates needing special or intensive care should preferably be transported by a **skilled transport team** through an **organized teamwork**.

Transport of ill neonates

Summary

- ▶ **Appropriate equipment and vehicles** customized for neonates should be available for safe transport.
- ▶ **Pre-transport stabilization** is the most vital step in the whole process of transport.
- ▶ Adequate and timely **communication** with the family, referring hospital and the support group is essential.

The key components of a **Neonatal Transport System**

- ▶ Most transport teams have **physicians and nurses** trained specifically for neonatal care
 - ▶ Work load, safety, insurance
- ▶ **Vehicles and equipment**
- ▶ **Communication** and **stabilization** before transfer
- ▶ **Family support**
- ▶ Documentation and consent form
- ▶ **Feedback** to referring unit



Thank you for listening!