PEDIATRIC EMERGENCY CARE DELIVERY IN CHINA

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Background and History
Mortality in different emergency care delivery

Arreola-Risa C: J Trauma 1995
Pre-hospital CPR

From Shanghai Medical Emergency Centre (2006)

N=233

Survival: 8.2%

Death: 91.8%
PICU Admission and Morbidity

From Children’s Hospital of Fudan University
History of EMSS in China

- EMSS started at 1950s from large and middle cities
- Primary EMS centres were set up: first aid, emergency transport
- In 1970s, hospital based ICU founded; and 1980s in pediatrics
- 1983, the Ministry of Health demonstrated the program of setting up emergency department in city hospital
- 1986, the Chinese People Congress set up the laws on emergency medical care
- 1987, the Chinese Association of Emergency Medicine (CAEM) founded
- 1989, CAEM became a member of IFEM
- “120” emergent calling system was founded

EMSS Emergency Medical Services System
IFEM International Federation for Emergency Medicine
Academy and Organization Responsible for EM
International Organization responsible for EM

IFEM – International Federation for Emergency Medicine
founded in 1989

It now consists of 24 country and district memberships

IFEM endorses the principles:

• All countries should provide unrestricted access to emergency health care.

• Emergency medicine encompasses a unique and specified body of knowledge and should be recognized as a specialty in all countries.
Academy and Organization Responsible for EM in China

- Chinese Association of Emergency Medicine (CAEM)
- Pediatric Emergency Branches of CAEM
- Local Emergency Branches of Chinese Medical Association
- Local Pediatric Emergency Branches of Chinese Medical Association
Emergency Medical Service System (EMSS)

Composition of emergency care delivery system

- Bystander care (or community medical care)
- Emergency transport care (ambulance care)
- Hospital based critical care
- Corporation nationally and globally
Emergency Medical Centre (EMC)

- EMC is a medical unit for emergency care
- EMC: hospital based or universal (general)
- Computer system network:
  - access from victim
  - communication: consulting, supervising, information providing
  - emergency care and transport plan making
  - corporation: bystander, ambulance, referred ED
- Medical facility: ED, ICU, Ambulance, Equipments
- Staff team: Doctor, Nurse, Assistant or driver
- Staffs: on call (24hrs) in the EMC
EMSS

Emergency calling

Emergency access

Computer based central system

ambulance

EMC/hospital

OP/ICU

First resuscitator

communication

Ambulance staff

specialist
# The Features in Various Pediatric EMC

<table>
<thead>
<tr>
<th>Hospital-based EMC</th>
<th>Universal EMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Operated by hospital</td>
<td>• Operated by EMC</td>
</tr>
<tr>
<td>• Has both tasks of care</td>
<td>• Universal pre-hospital care for all ages</td>
</tr>
<tr>
<td>• Universal pre-hospital care</td>
<td></td>
</tr>
<tr>
<td>• Pediatric pre-hospital care</td>
<td></td>
</tr>
<tr>
<td>• In-hospital care</td>
<td></td>
</tr>
<tr>
<td>• Has good quality of care (neonates, prematures)</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Other hospital-EMC</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Operated by hospital</td>
</tr>
<tr>
<td>• Pre-hospital care is not as frequent as the others</td>
</tr>
<tr>
<td>• Has more special feature (neonatal, pediatric, cardiac)</td>
</tr>
</tbody>
</table>
EMC in Shanghai

- Universal EMC
- The only EMC for all ages in Shanghai
- Pre-hospital care
- The main part of transportation in Shanghai
- Government funding

SMEC

www.sh120.gov.cn

SMEC—Shanghai Medical Emergency Centre
Pre-hospital Emergency Care
Pre-hospital Emergency Care Compositions

- **First aid:** need a quick, effective help to save life
- Bystander or witness
- Resuscitator skill of CPR
- Calling for help
- Emergency Network
- Transportation
First aid

- First aid is a developing part of EM in China, especially in countryside with low density of population.
- The CPR training program has started, but the ratio of populations who have got training is lower than expecting.
- The EMSS is well developed in urban districts, but is not satisfied in rural areas that cause the medical support could hardly arrive in time.
Mortality in different districts

From the Ministry of Health of PRC
Victims Who Needs the Pre-hospital Emergency Care

From SMEC in Shanghai 2006
Pre-hospital Emergency Care Compositions

- First aid: need a quick, effective help to save life
- **Bystander or witness**
- **Resuscitator skill of CPR**
- Calling for help
- Emergency Network
- Transportation
Bystander and Witness

- The proportion of bystanders who can do CPR correctly in emergent case is low in China.
- Training programs in big city is more frequently than rural areas.
- Increasing the number of skilled bystander-rescuer will improve the quality of pre-hospital emergency care
CPR Training

- BLS/ALS training programs
  - BLS/ALS course in large and middle cities
  - International life support program
  - Internet resource for instruction
- Trainee candidates:
  - Junior medical staff, policeman, civil servant
  - Soldier, volunteer, driver, teacher
- The total number of trainee couldn’t meet the need that we expected
- Training in countryside and poor educated district should be enhanced
Pre-hospital Emergency Care Compositions

- First aid: need a quick, effective help to save life
- Bystander or witness
- Resuscitator skill of CPR
- **Calling for help**
- **Emergency Network**
- Transportation
Calling for help

- “120” emergency calling
  - Mobile phone dials 120
  - Public telephone dials 120
  - Family telephone dials 120
- Emergency station nearby responses
- Community emergency network corporation
Pre-hospital Emergency Care Compositions

• First aid: need a quick, effective help to save life
• Bystander or witness
• Resuscitator skill of CPR
• Calling for help
• Emergency Network
• Transportation
Emergency Transport Programming

• Every district/county have 4~5 emergency care station for first aid and transportation
• 20 ambulance/EMC  
  (average 1 ambulance per 50 thousand population)
• Wireless communication  
mobil-phone, wireless data transmission, radiostation, GPS,
• Emergency officers and staffs 24 hrs on call
• Keeping close touch between different stations and EMC
• National and international net work.  (International SOS)
EMC setting in Shanghai (2005)

- Service radius for rescuing:
  3~10 km ➔ access to arriving time 10~20 min
- Transport team in EMC (3 staffs/team)
  doctors, nurses, and drivers with rescuing experience
- At least 20 ambulances in one station
- More than 5~6 ambulances on call and 2 for backup
- 1 ambulance for 50,000 population
- Up to now, most pre-hospital care services are for all-ages
Emergency Transport Carrier

- Ambulance is the main carrier for emergency transport in China (most located in EMC)

- Other carriers:
  - city: taxi, truck, bus, car
  - countryside: cart, tractor
  - fishing or sailing: ship/boat
  - long distance transportation: aircraft, (no helicopter)
  - chattered flight

- Long distance transport is performed in special cases and usually associated with international transport
  - Shanghai-Taiwan, Shanghai-Tokyo,
  - Guangzhou-Germany, Beijing-Hong Kong
Pediatric Emergency Transportation

- Usually share with the adult transport system
- Pediatric transport system is improving
- Facilities in transport carrier:
  - First-aid kit
  - Portable vital monitor
  - Intubation kit
  - O₂ supply
  - Suction unit
  - Portable ventilator
  - Defibrillator
  - IV infusion system
  - Dry blood gas analyzer
  - Communication mobile
- Neonate transport unit
The Causes of Children with Emergency

- Traffic accident
- Near drown
- Pneumonia
- Perinatal emergency
- Poisoning
- Aspiration
- Cardiopulmonary arrest
- Sepsis
- Hypoxemia

- Status convulsion
- Arrhythmia
- Wounded
- Bites
- Fracture
- Electric shock
- Suicide
- Abuse
Morbidity in Emergency Transport

From SMEC in Shanghai 2006
from the Children's Hospital of Fudan University in Shanghai
Premature: 48.4%
Resp: 28.9%
CNS: 16.3%
CVS: 1.7%
Others: 2.6%
Congenital: 2.1%

Shanghai (2005–2006)
Hospital based transport of children
In-hospital Emergency Care
Emergency Room (ER)

- Emergency room for all ages (general hospital)
- Emergency room for children (pediatric hospital)
- Resuscitating Room in ER
- Observation room in ER
- In-hospital staff emergency calling system
- EICU for children is not popular in china
- Staffs from pediatrician, or from specialist, or physician after training

EICU - Emergency ICU
Intensive Care Unit

- The final transport destination of unstable patient
- ICU divided according to different categories

  Neonates: NICU
  Children: PICU
  Pediatric Surgery: SICU
  Emergencies: EICU
  Cardiology: CICU (CCU)
Staffs in PICU

EICU → physician
PICU → pediatrician
SICU → surgeon
CCU → anaesthetist
CCU → cardiologist
Emergency Care
Quality Assurance
Quality Assurance System

- Updated Guideline of CPR in China
- Evaluating the quality of emergency medical centre/station annually
- Quality evaluating system is supervised by CAEM
Criteria for Quality Measurement

- Response time
- Practice skills performance
- Customer service
- Equipment maintenance
- Continuing education
- Prehospital Care Evaluation Score
Emergency Professional Training Promotion

- Professional training in ED, ICU
- ALS / BLS Training course
- Emergency medicine academic conference
- International academic exchange

Academic conference
Fellow visitor
Clinical training
Prospect of EM
Hot Topics on Emergency Care Delivery

- Improving pre-hospital emergency care
- Expanding the community emergency network
- Public emergency education
- Informal EMSS?
- Finance and fund for emergency care service
Chain of resource necessary for comprehensive care

Bystander care

Prehospital care

ED care

Rehabilitation

Notification dispatch and response

Transportation

Definitive Care (surgery, crit care)
Thanks for Atentions!
CAEM — Chinese Association of Emergency Medicine
ED — Emergency department
EM — Emergency Medicine
EMC — Emergency Medical Centre
IFEM — International Federation for Emergency Medicine
PICU — Pediatric Intensive Care Unit
SMEC — Shanghai Medical Emergency Centre
Emergency Care Delivery

- Provide first aid whenever or wherever it is needed
- Initial cardiopulmonary support and transport
- Advanced emergency care in hospital
- The coverage of care should be as wide as possible
- Rehabilitation assistance
## Emergency Transportation

<table>
<thead>
<tr>
<th>(n=59)</th>
<th>Cases</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Failure</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>Asthma</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Stroke</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Premature baby</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Trauma/Poison</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>59</td>
<td>12</td>
</tr>
<tr>
<td><strong>Survivals</strong></td>
<td></td>
<td>79.7%</td>
</tr>
</tbody>
</table>

* SMEC 2006
*Community Emergency Network*

- Community emergency network is developing in cities
- Emergency branch station is located in community
- There are training course for community residents
- The branch is equipped and stands by for EM calling
  - Serves as the first emergency responder
  - Emergency calling system between family and station
  - Staff workers assisting emergency care and transport
  - Simple medical kits for first aid:
    - $O_2$, splint, stretcher, bandage, first-aid kit
## Emergency Transport

<table>
<thead>
<tr>
<th>City</th>
<th>Shanghai</th>
<th>Tokyo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Areas / km²</td>
<td>6340</td>
<td>1759</td>
</tr>
<tr>
<td>Population £ 10⁴£ ©</td>
<td>1349</td>
<td>1147</td>
</tr>
<tr>
<td>Times of transport</td>
<td>105,364</td>
<td>511,000</td>
</tr>
<tr>
<td>Ambulance on call</td>
<td>56</td>
<td>198</td>
</tr>
<tr>
<td>Emergency stations</td>
<td>23</td>
<td>198</td>
</tr>
<tr>
<td>Responding time (min)</td>
<td>11.3</td>
<td>5</td>
</tr>
</tbody>
</table>
In-hospital Emergency Care

- Emergency care is more developed in urban district
- There are pediatric emergency departments in every center hospital of different cities or counties
- Each hospital and each ward are equipped with facilities for resuscitation and staffs on-call
- Pediatric intensive care units are located in referred hospital or children’s hospital in moderate or big cities
- Pediatric in-hospital emergency care is better than pre-hospital care
**Ambulance Equipments**

<table>
<thead>
<tr>
<th>Intensive care ambulance</th>
<th>General ambulance</th>
</tr>
</thead>
<tbody>
<tr>
<td>• first-aid kit</td>
<td>• first-aid kit</td>
</tr>
<tr>
<td>• Oxygen cylinder</td>
<td>• Oxygen cylinder and bag</td>
</tr>
<tr>
<td>• Anaesthetic laryngoscope</td>
<td>• Resuscitation mask</td>
</tr>
<tr>
<td>• Automatic respirator</td>
<td>• ECG equipment (12 leads)</td>
</tr>
<tr>
<td>• Resuscitation mask</td>
<td>• Cervical gear</td>
</tr>
<tr>
<td>• Suction unit</td>
<td>• Splint</td>
</tr>
<tr>
<td>• Pulse oxymeter</td>
<td>• Soft stretcher</td>
</tr>
<tr>
<td>• ECG equipment (12 leads)</td>
<td>• wheel stretcher</td>
</tr>
<tr>
<td>• Defibrillator</td>
<td></td>
</tr>
<tr>
<td>• Portable blood sugar detector</td>
<td></td>
</tr>
<tr>
<td>• Electric thermometer</td>
<td></td>
</tr>
<tr>
<td>• Cervical gear; Splint</td>
<td></td>
</tr>
<tr>
<td>• Soft stretcher</td>
<td></td>
</tr>
<tr>
<td>• wheel stretcher</td>
<td></td>
</tr>
</tbody>
</table>
*Critical Care in PICU*

- Life support as the main task and multi-specialty involved
- Vital signs monitoring for critical cases and post-operation
- Invasive monitoring: hemodynamics, ICP
- Emergent imaging scan: echo, CT
- ALS equipments
- Mechanical ventilation: CMV, HFOV,
- Special treatment: NO, surfactant,
- Extracorporeal life support: CRRT, TPE, ECMO
- In-hospital calling system for emergencies
*EM Developing in China*

- National and international emergency network system
- Setting up the chain of comprehensive care
- Improve the quality of emergency care in each field and expand the coverage of emergency care
- Improve the quality and quantity of research in the field of emergency care
## Prehospital Care Evaluation Score

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Result</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>first CPR success rate (%)</td>
<td>i</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>2.5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2.0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1.5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>&lt;1</td>
<td>0</td>
</tr>
<tr>
<td>Response to present (min)</td>
<td>i</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>≤6</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>&gt;16</td>
<td>0</td>
</tr>
<tr>
<td>Delayed (£ ¥)</td>
<td>i</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>&gt;16</td>
<td>0</td>
</tr>
<tr>
<td>Emergencies / Population (£ ¥)</td>
<td>i</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>0.8</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>0.6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>&lt;0.4</td>
<td>0</td>
</tr>
</tbody>
</table>

### Score evaluation
- 16  Excellent
- 12  Good
- 8   Pass
- ≤ 8 Unsatisfied

### Performance in Emergency
- excellent 4
- good 2
- unsatisfied 0

### Satisfaction from patient (£ ¥)
- ≤ 95 4
- 90 2
- <90 0