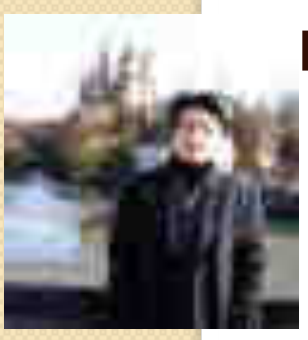
Emergency Medical Service System in Taipei City



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Department of Emergency Medicine

National Taiwan University Hospital

IN THIS TALK…

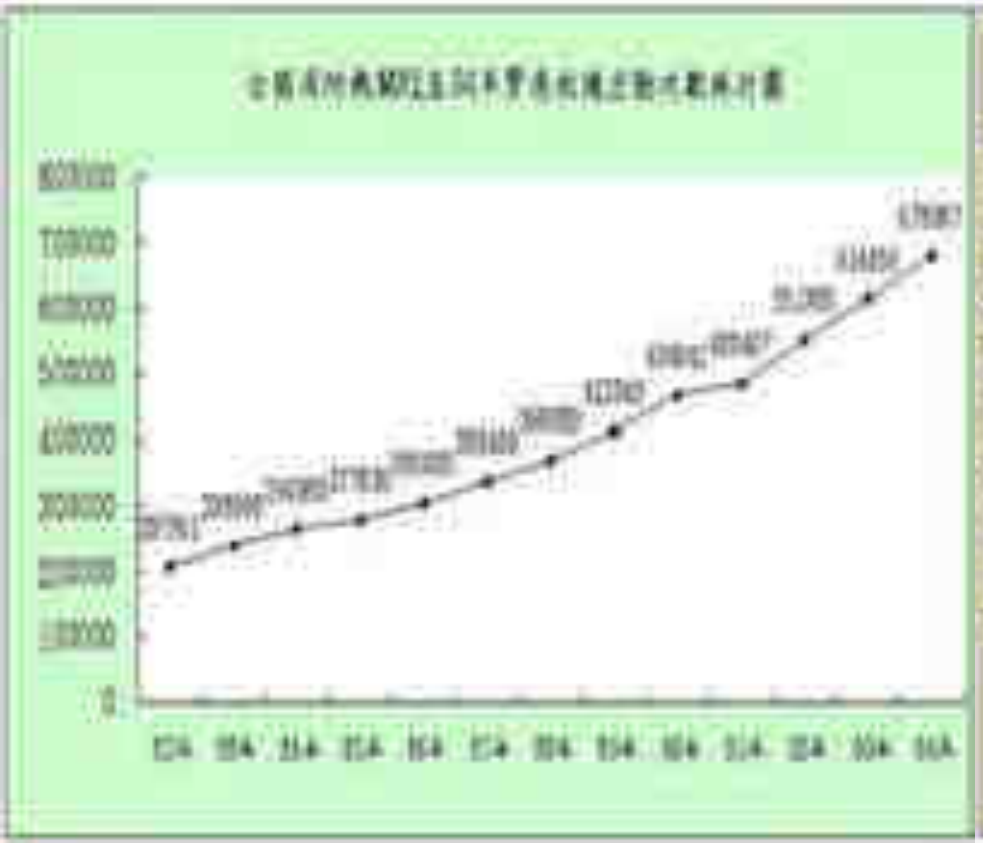
- Milestones of Taipei City EMSS
- System configuration and optimization
- Some examples of previous research

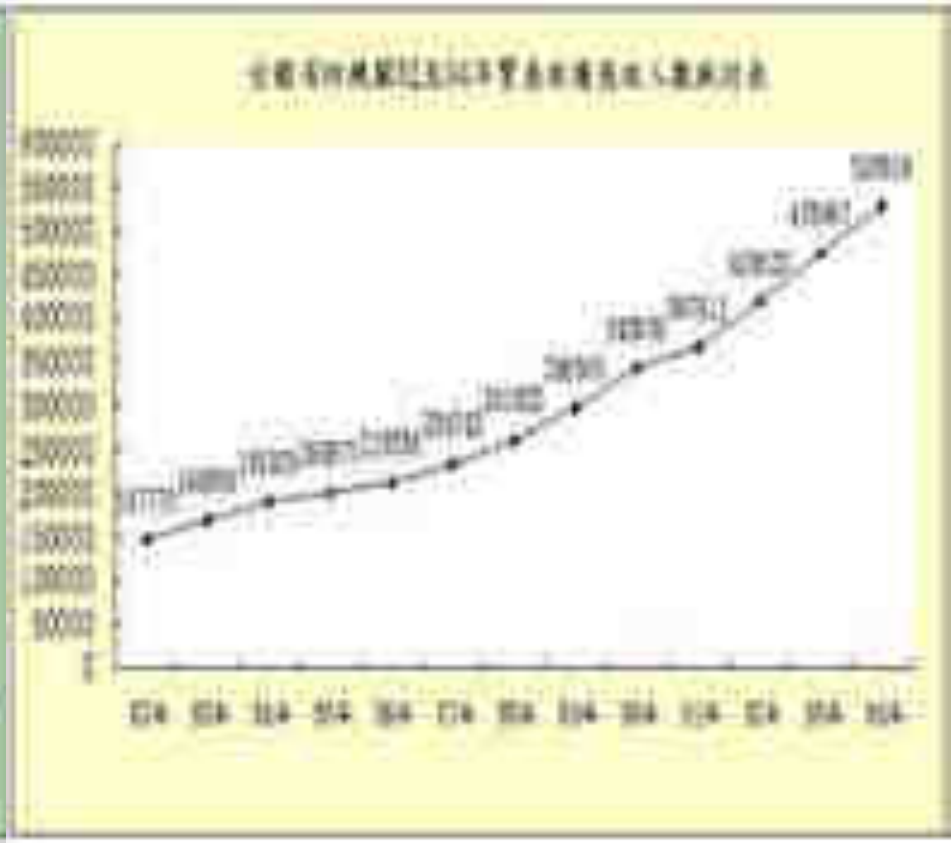
RESUSCITATION

EMS in Taiwan: Past, present, and future?

Public Demand, Taiwan EMS

Annual growth at 10%





1.1 call per 10,000 per day

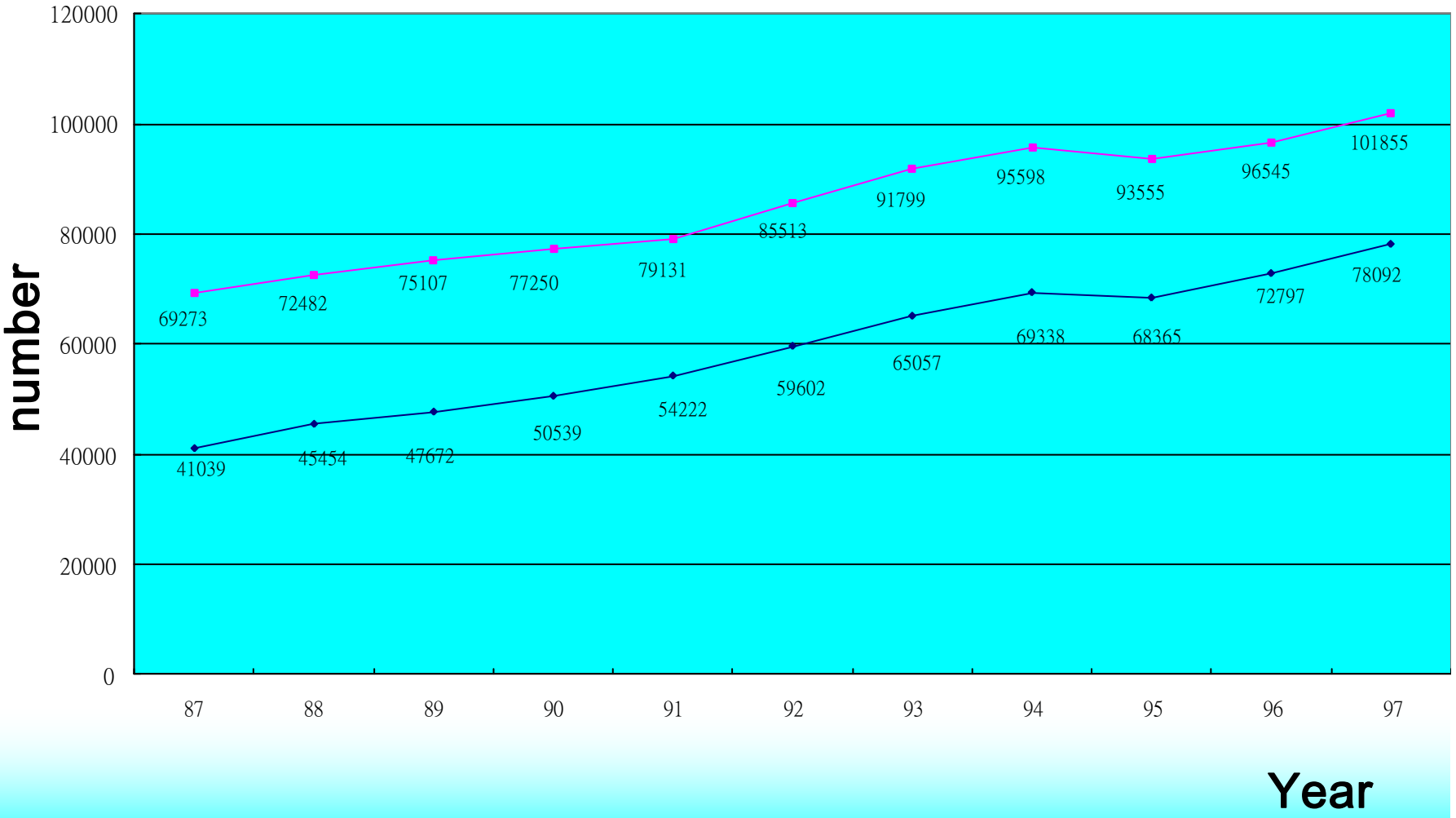
Area: 271.8 km^2
Population: 2.62 M
Density: 9,639.2 /km^2

12 districts

Area: 2,052.6 km^2
Population: 3.85 M
Density: 1,872.7 /km^2

Calls / Services

Demands-
Taipei City EMS



1.05 call per 10,000 per day

Modern EMS : Milestones (I)

- 1990
  - first official EMT training curriculum (SECCM)
- 1995
  - *The Emergency Medical Service **Act***
  - *2000, 2007*
- 1998
  - Emergency Medicine as a medical specialty
- 1998
  - Hospital-based ALS and Fire-based BLS team (Taipei City)
  - EMT-only EMS squads (Taipei City)

Modern EMS : Milestones (II)

- 1999-2000
  - Medical Direction (TPE)
  - AED use by EMT (Taipei City)
- 2002
  - Trauma system pilot (Taipei City)
- 2003
  - Fire-based ALS team (Taipei City)
- 2007
  - Medical oversight
- 2008
  - Public Access Defibrillation

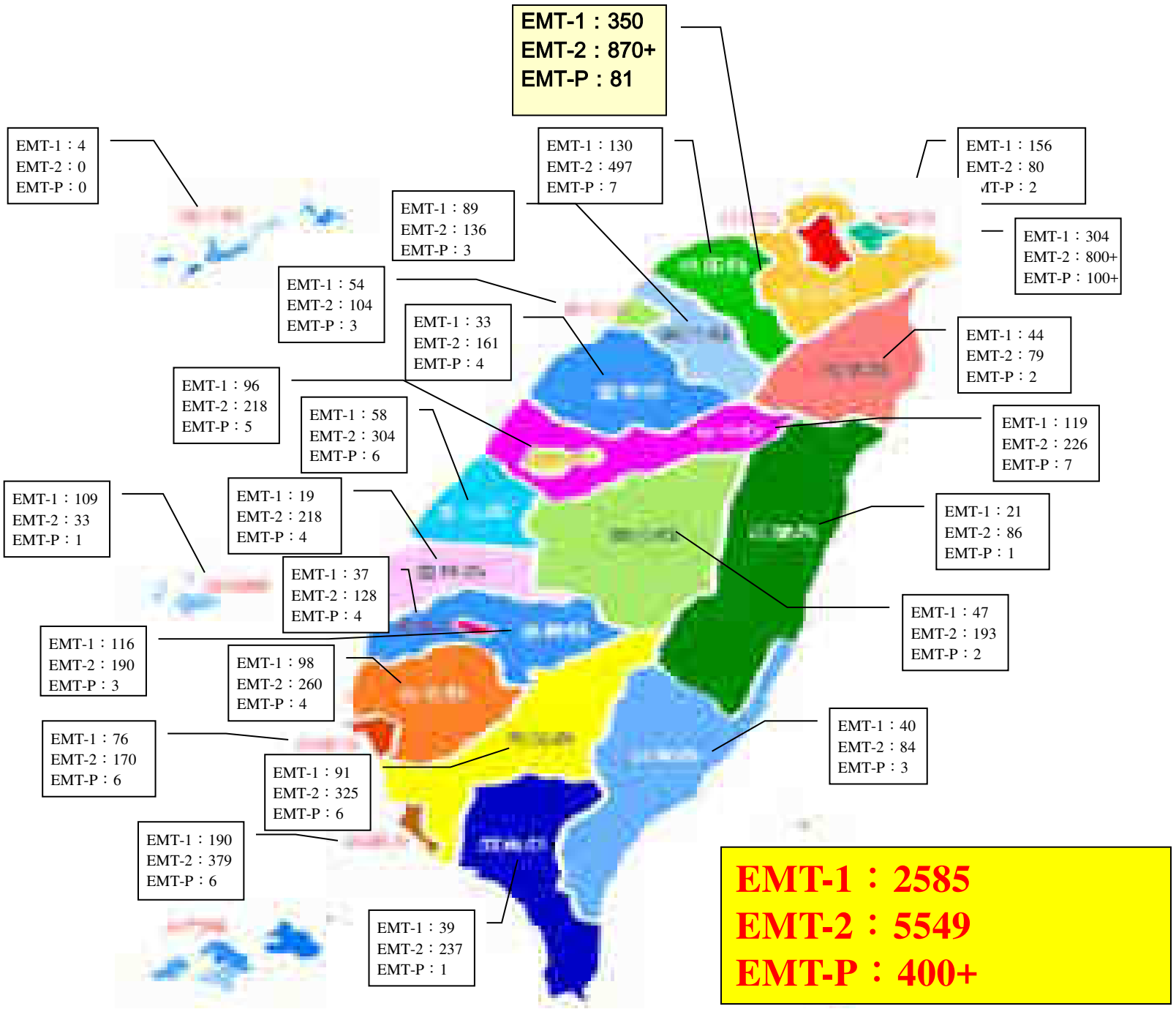
Taipei City EMS

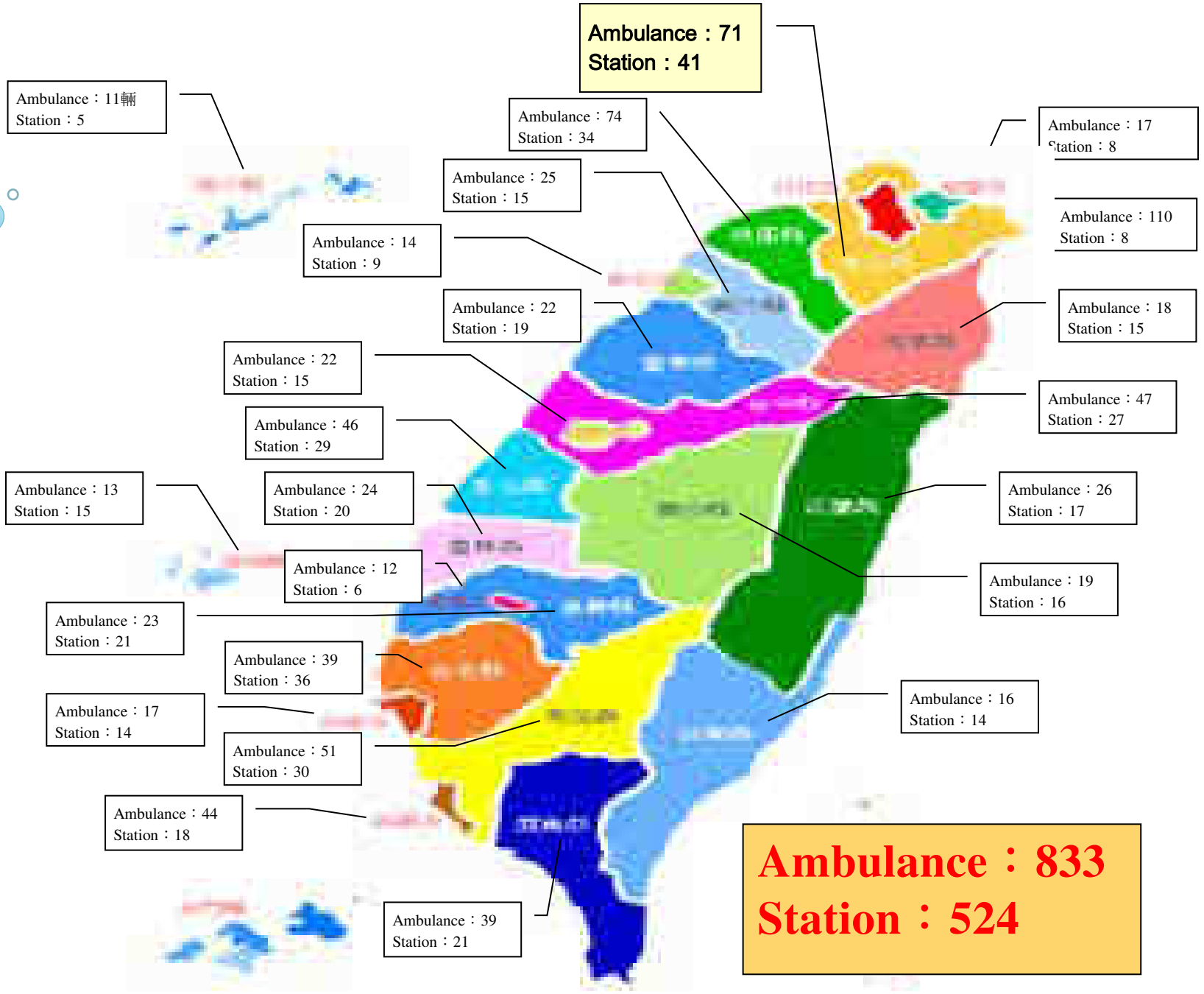
The money comes from Charities & Temples

Sources & Types of Providers

- All prehospital EMSS in Taiwan are fire-based
- Degree of voluntary involvement varies

Provider	Training (hours)	Training	Scope of Practice
EMT-I	40	Fire Dept Fire Academy	First responder, BLS-D
EMT-II	280	Fire Dept Fire Academy	BLS-D, LMA, Fluids
EMT-paramedic	1280	Tertiary Medical Centers	Advanced life support (intubation, Rx)
Dispatcher	40	Fire Dept	Priority Dispatch


EMT-1：350
EMT-2：870+
EMT-P：81
EMT-1：4
EMT-2：0
EMT-P：0
EMT-1：130
EMT-2：497
EMT-P：7
EMT-1：156
EMT-2：80
EMT-P：2
EMT-1：89
EMT-2：136
EMT-P：3
EMT-1：304
EMT-2：800+
EMT-P：100+
EMT-1：54
EMT-2：104
EMT-P：3
EMT-1：33
EMT-2：161
EMT-P：4
EMT-1：44
EMT-2：79
EMT-P：2
EMT-1：96
EMT-2：218
EMT-P：5
EMT-1：58
EMT-2：304
EMT-P：6
EMT-1：119
EMT-2：226
EMT-P：7
EMT-1：109
EMT-2：33
EMT-P：1
EMT-1：19
EMT-2：218
EMT-P：4
EMT-1：21
EMT-2：86
EMT-P：1
EMT-1：37
EMT-2：128
EMT-P：4
EMT-1：47
EMT-2：193
EMT-P：2
EMT-1：116
EMT-2：190
EMT-P：3
EMT-1：98
EMT-2：260
EMT-P：4
EMT-1：76
EMT-2：170
EMT-P：6
EMT-1：40
EMT-2：84
EMT-P：3
EMT-1：91
EMT-2：325
EMT-P：6
EMT-1：190
EMT-2：379
EMT-P：6
EMT-1：39
EMT-2：237
EMT-P：1
EMT-1：2585
EMT-2：5549
EMT-P：400+


Ambulance：71
Station：41
Ambulance：11輛
Station：5
Ambulance：74
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Station：36
Ambulance：16
Station：14
Ambulance：17
Station：14
Ambulance：51
Station：30
Ambulance：44
Station：18
Ambulance：39
Station：21
Ambulance：833
Station：524

119 Access to EMSS

- Universal number of 119 (Fire & EMS)
- Central and horizontal dispatch
- Location identification capability(enhanced 119 system) in urban cities
- No triage to alternative source of care; almost all request resulted in ambulance transport

Early Defibrillation- Fire BLS-D, since 2000

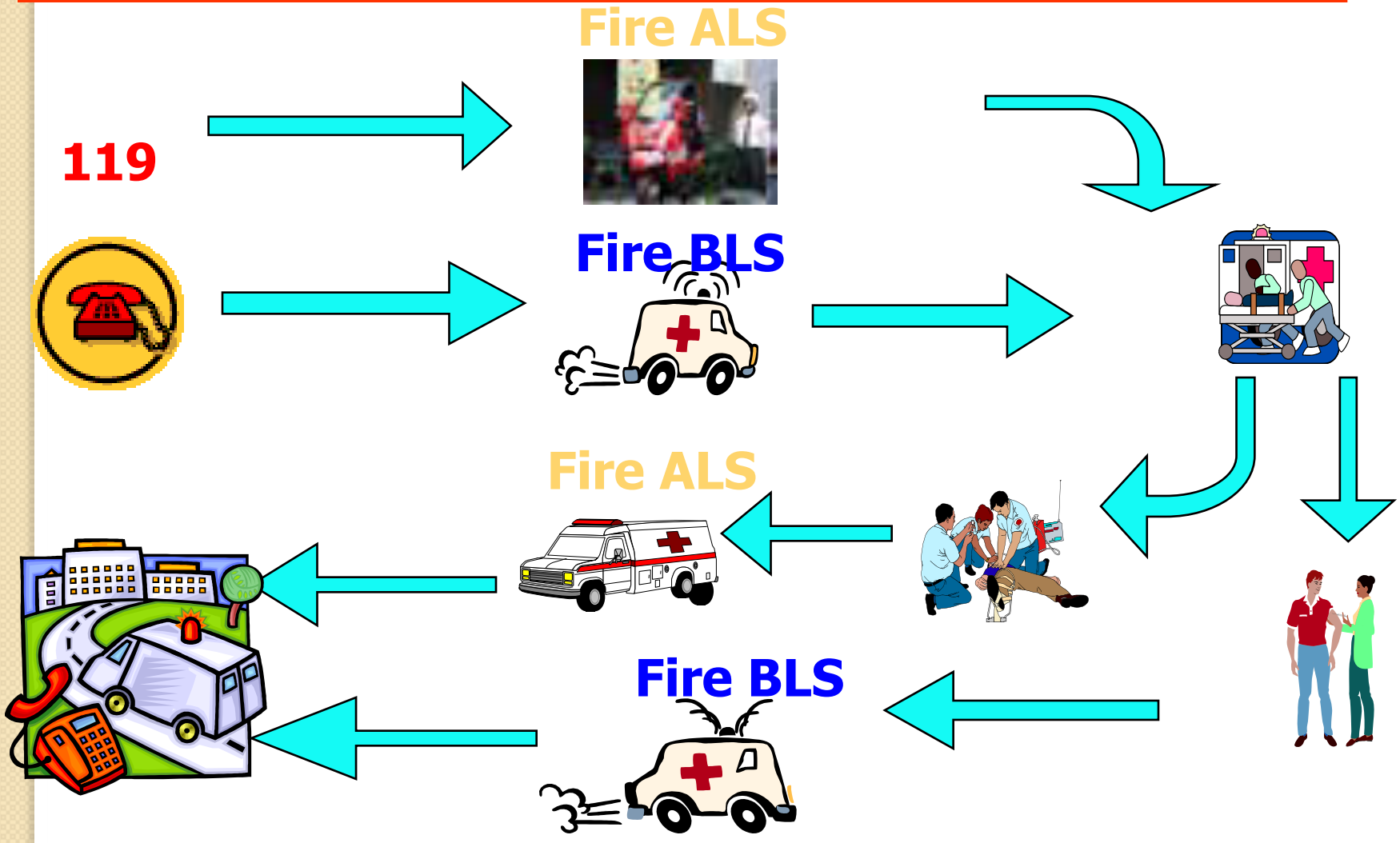
- All levels of EMTs authorized to use AEDs since 2000
- All squads in TPEC equipped with AED
- AED implementation varies with jurisdiction
- Public access defibrillation since 2008

Fire-based ALS

- EMT-paramedics training started since 2002
- ALS services in few metropolitan cities, firstly in Taipei City since 2003
- Versatile ambulance deployment
- Motorcycle ambulance squads

Two Tiered BLS-D / ALS – Taipei City

Fire-based since 2003

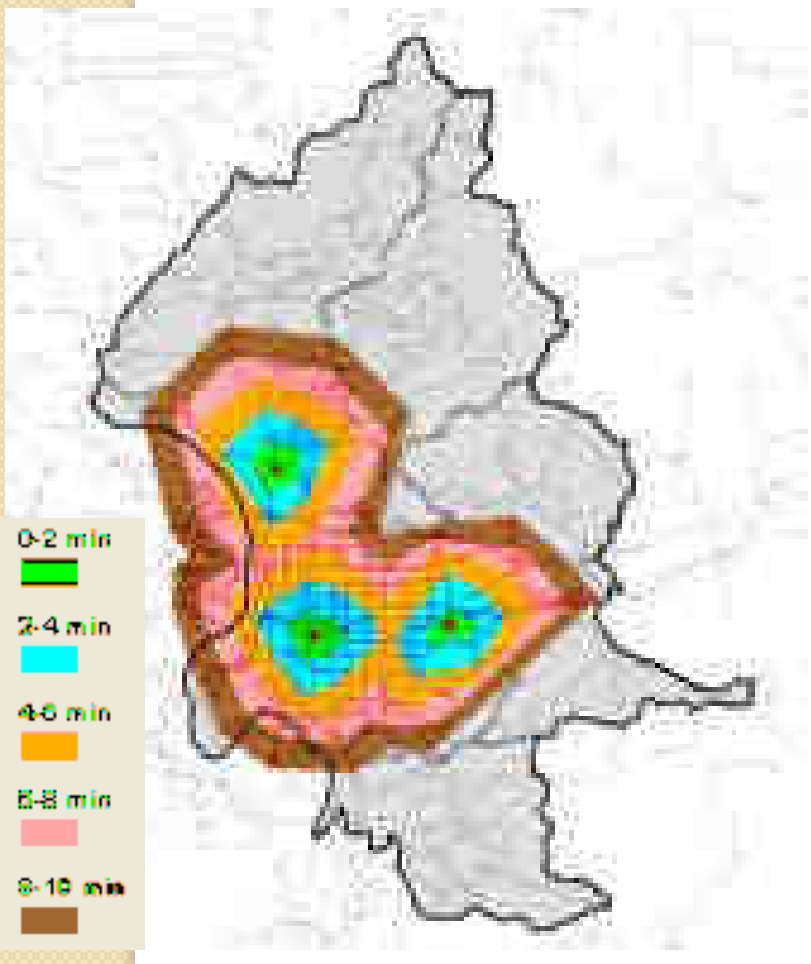


Three ALS squads

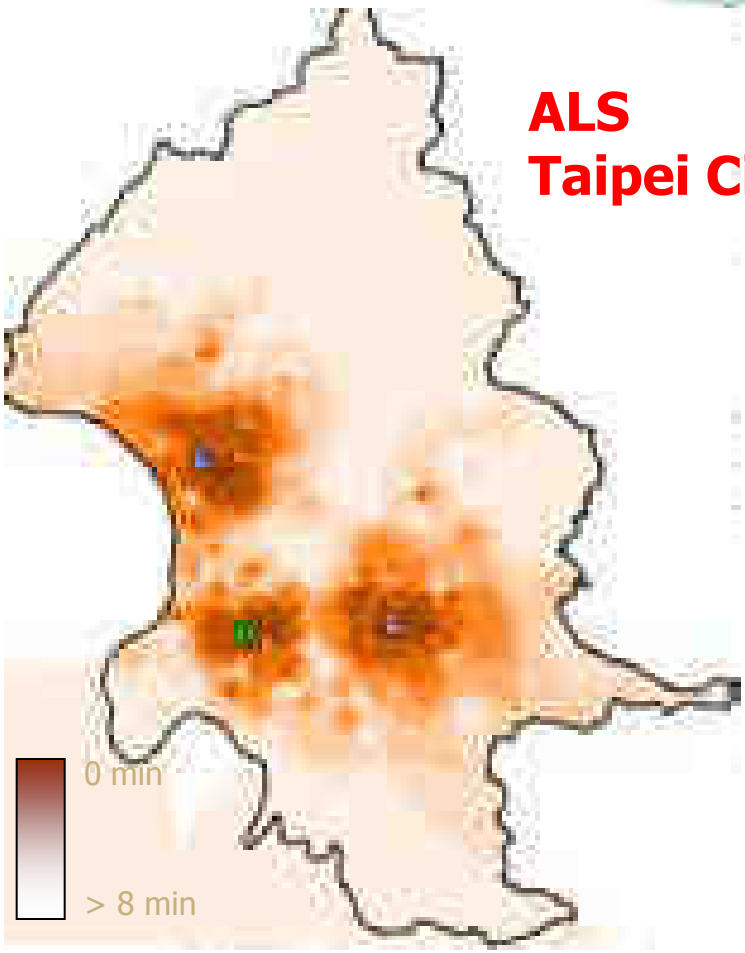
81 EMT-P

- 531/2003 OHCA patients
  (By 3 EMT-P squad), in 2008
- 0-2min 56 Cases (10.5%)
- 2-4min 143 Cases (26.9%)
- 4-6min 129 Cases (24.3%)
- 6-8min 90 Cases (16.9%)
- >8min 112 Cases (21.1%)

- 88.6% Matched
  - 0-2 (86.3%)
  - 2-4 (88.5%)
  - 4-6 (87.2%)
  - 6-8 (89.7%)
  - >8 (93.1%)



ALS
Taipei City



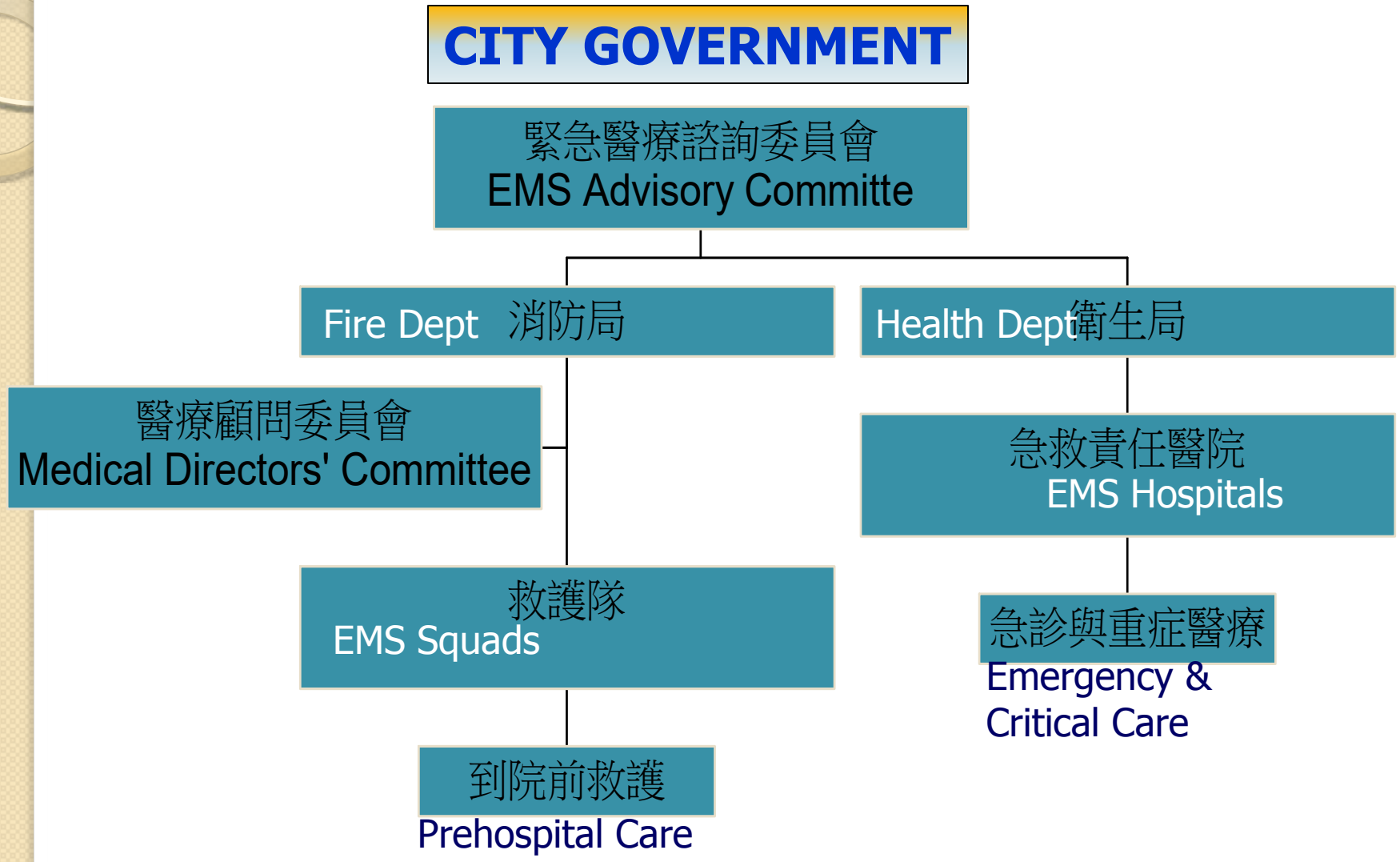
Trauma Care System Pilot in 2002 – Taipei City

- Trauma Center Categorization
- Trauma Triage Protocol
- Education / Inservice
- System Evaluation

Major Trauma Criteria – Taipei City Example

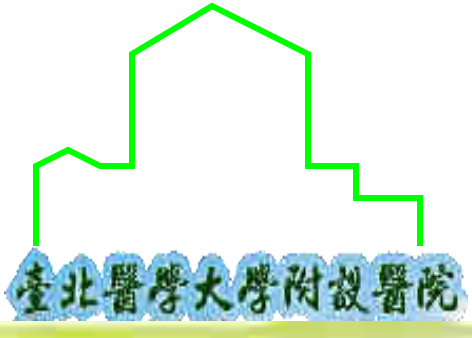
- Unconscious(GCS<14 or P / AVPU)
- Resp > 29 or < 10
- SBP < 90mmHg
- ≥ 2 proximal long bone fracture
- Paralysis
- Amputation above ankle or wrist
- Penetrating wound to head, neck and torso
- Second degree burn > 15%
- Fall > 6 m
- High energy impact
- Patient comorbidity

Medical Direction Committee 1999



Medical Direction Committee since 1999

Major responding hospitals in Taipei City



Main Tasks : Medical Direction Committee

- Set Standards / Protocols
- Education Programs
- Quality Control & Vigilance
- Implementation New Skills

臺北市政府消防局中級救護技術員緊急救護標準作業流程暨各項基本技術操作標準步驟手冊

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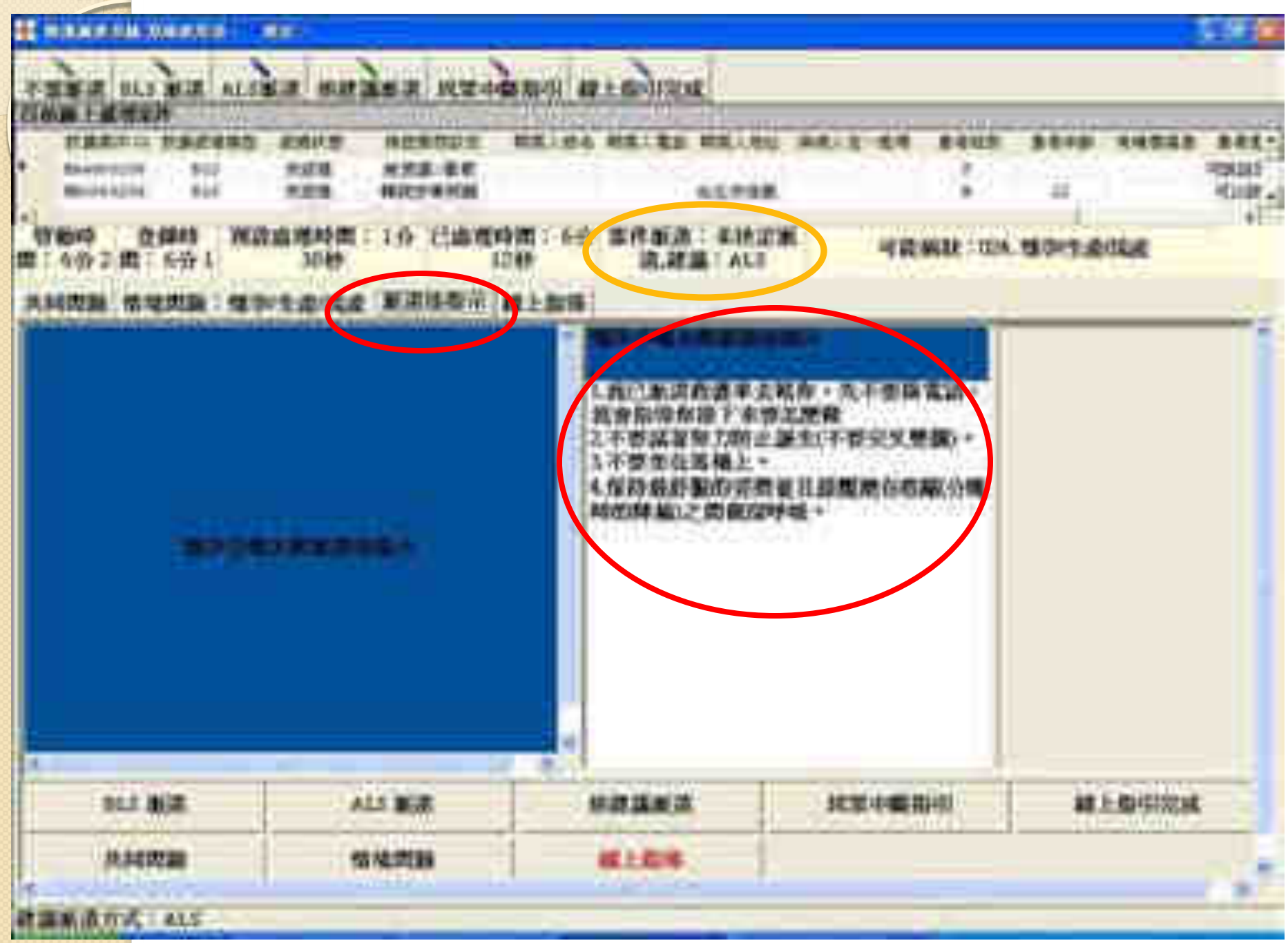

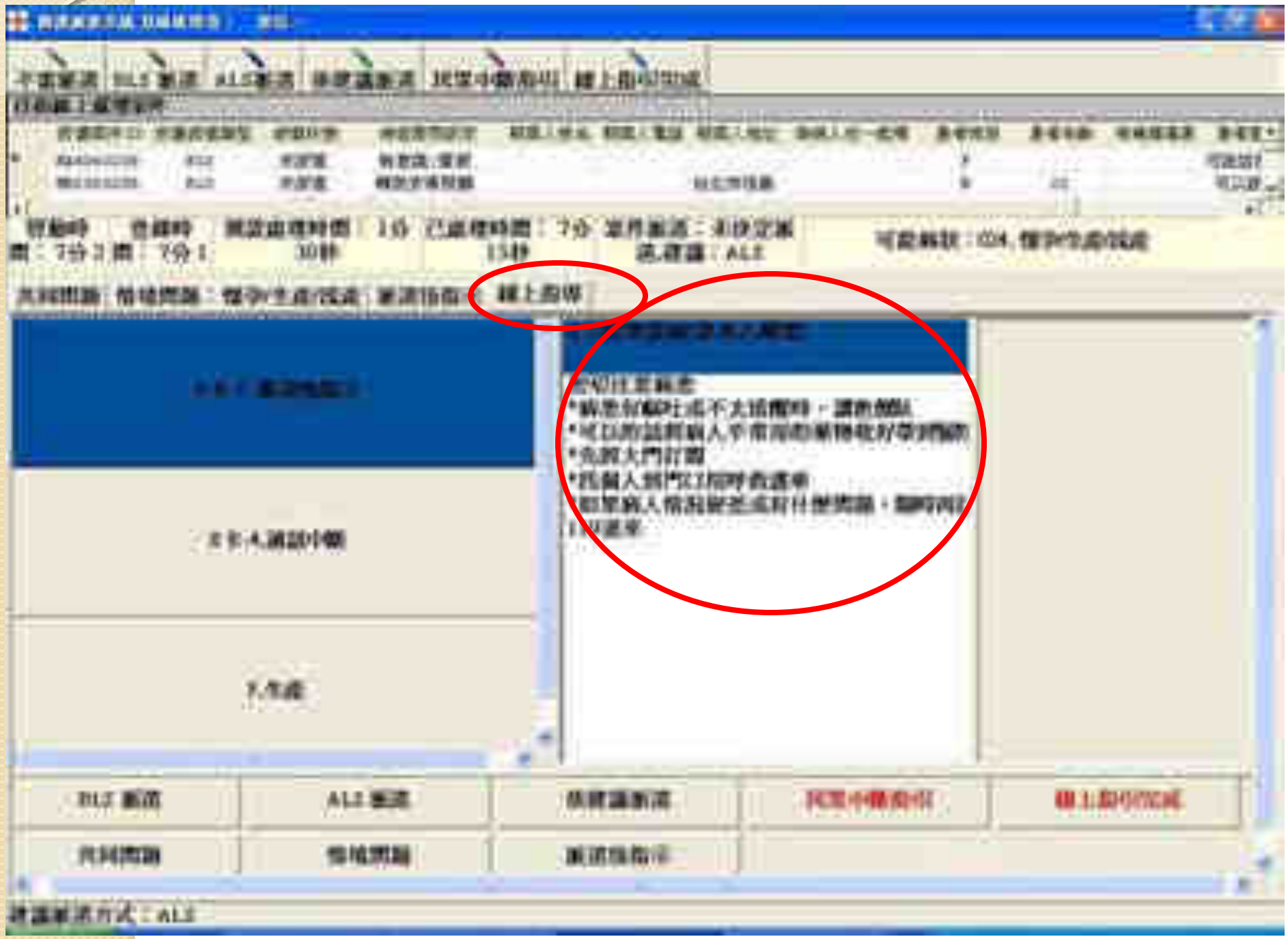
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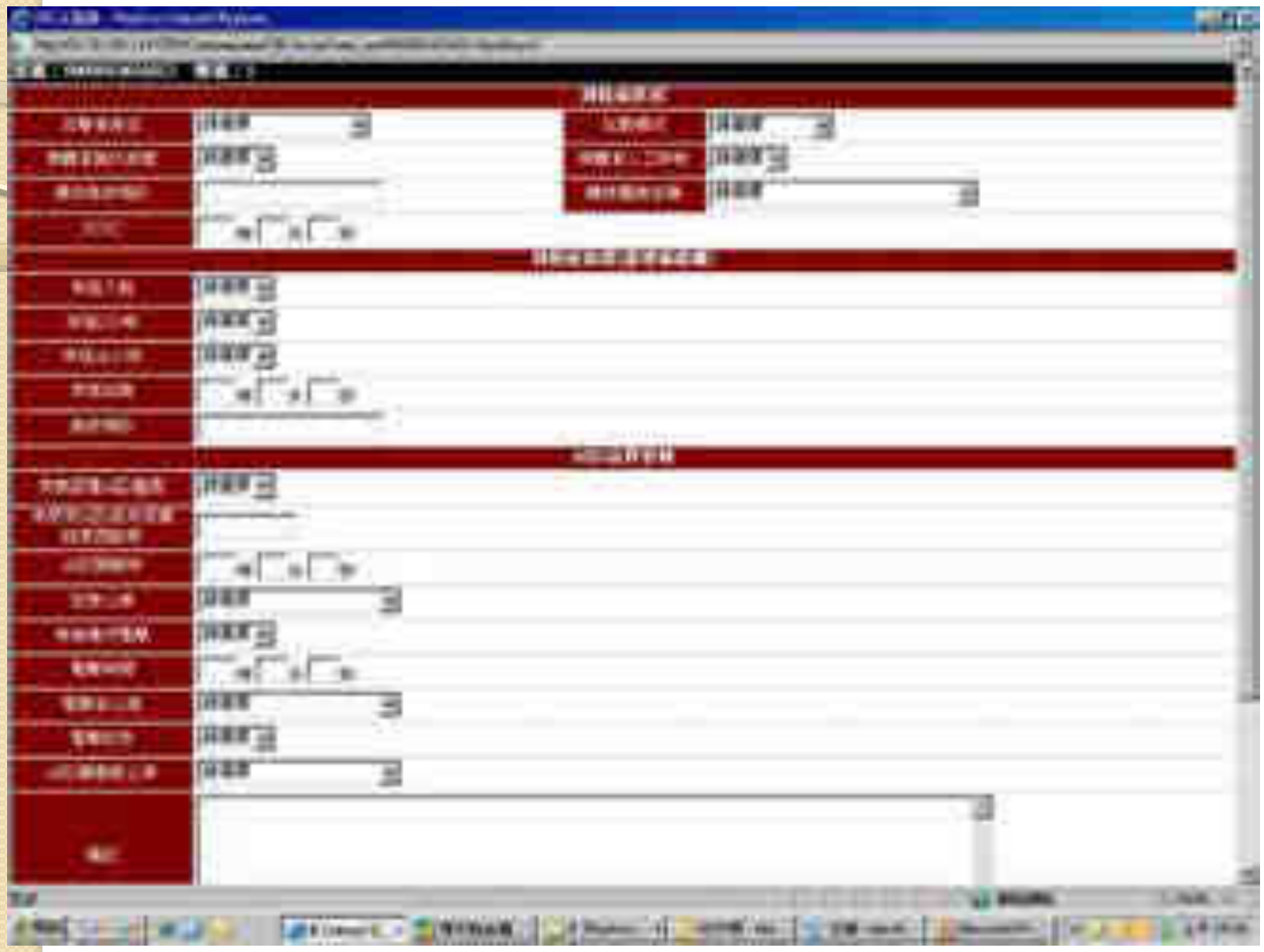


EMT Skill Competition

Medical Oversight / Director 2007

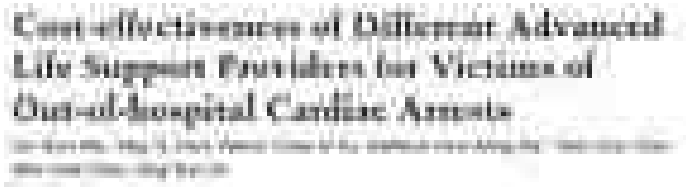
- System of medical oversight stipulated in EMS Act 2007
- Fire departments in jurisdictions required by law to identify medical director
- Medical Director Training by Taiwan Society of Emergency Medicine
- Pilot funding provided by Department of Health

- Currently, 15 / 23 jurisdictions have designated medical director
- Online consultation in Taipei City since 1999

Quality Assurance / Evaluation

Taipei City Government – NTUH ED

- *OHCA and trauma registry*
- *Dispatch*
- *AED implementation*
- *Quality of CPR*
- *ALS effectiveness on OHCA*
- *Cost-effectiveness analysis on OHCA*
- *Trauma system implementation*
- *Clinical trial*
- *Development of quality Indicators for EMSS*

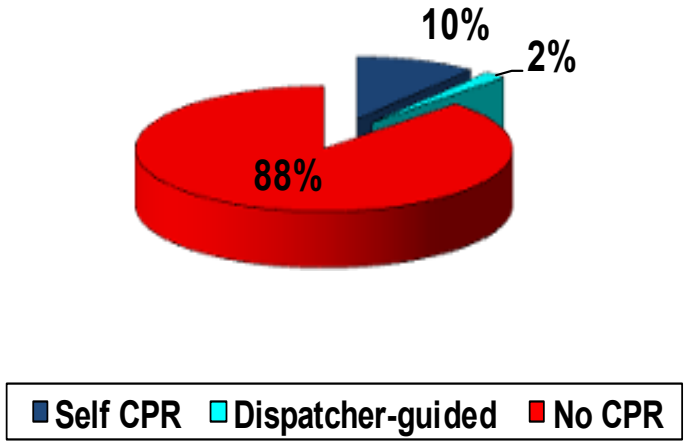

Cost-effectiveness of Different Advanced Life Support Providers for Victims of Out-of-hospital Cardiac Arrests

2008 Healthy City Survey

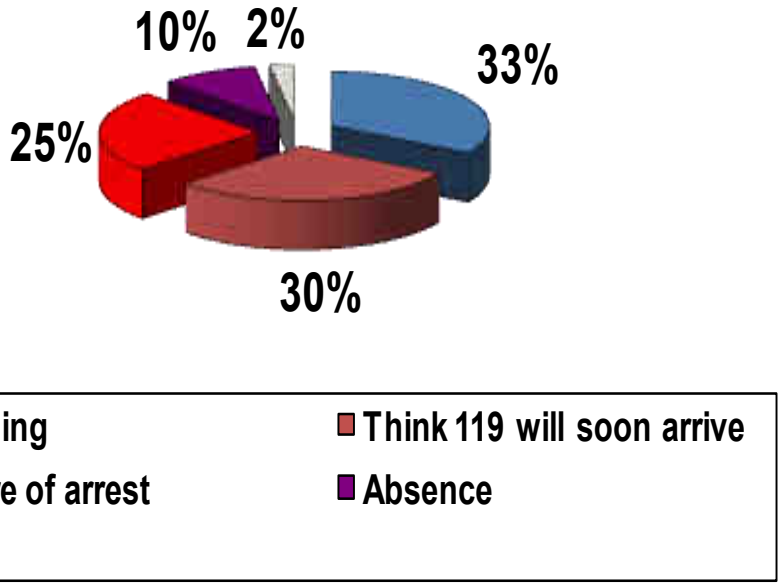
- Therapeutic hypothermia: two hospital
  - ECMO
- Clinical trial
- Web-based OHCA Registry

Problems~
Early CPR: needs improvement

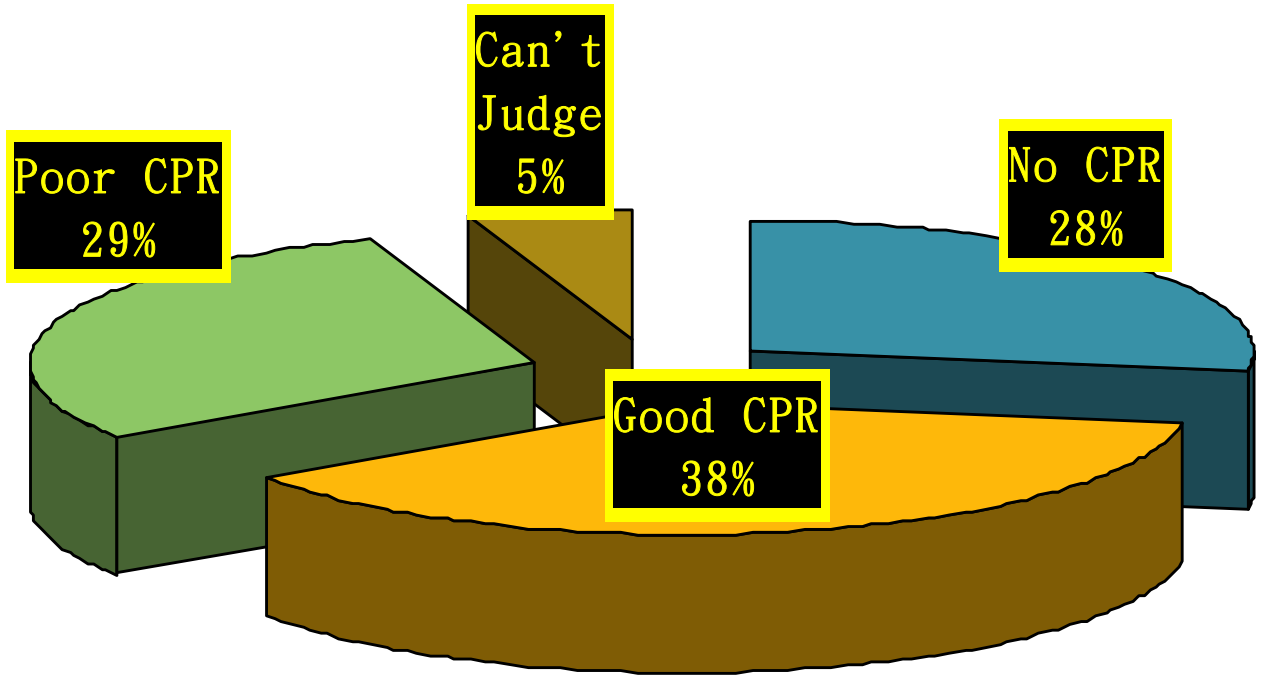
% bystander CPR



Reason of no-CPR



AED in Taipei City EMS
Quality of CPR



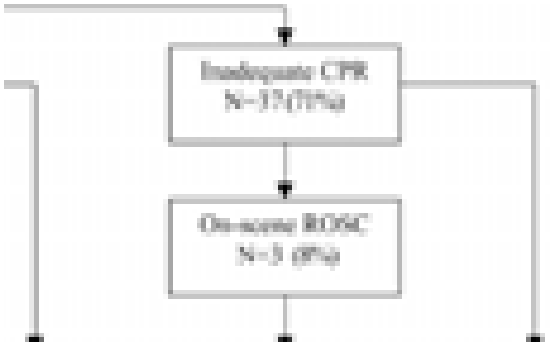
- 264 cases, 23 premature termination, based on 241 analyses

Ko et al. Resuscitation 2005

Improve CPR delivery

Q-CPR™ Measurement and Feedback Tool

monitoring CPR quality in real time



Inadequate CPR ($N = 37$)	Difference (95% CI)
3/37 (8%, 3–21%)	42% (19–68%)
5/37 (14%, 6–28%)	73% (45–83%)
3/37 (8%, 3–21%)	65% (37–82%)
3/37 (8%, 3–21%)	42% (19–68%)

CPR: cardiopulmonary resuscitation. ROSC: return of spontaneous

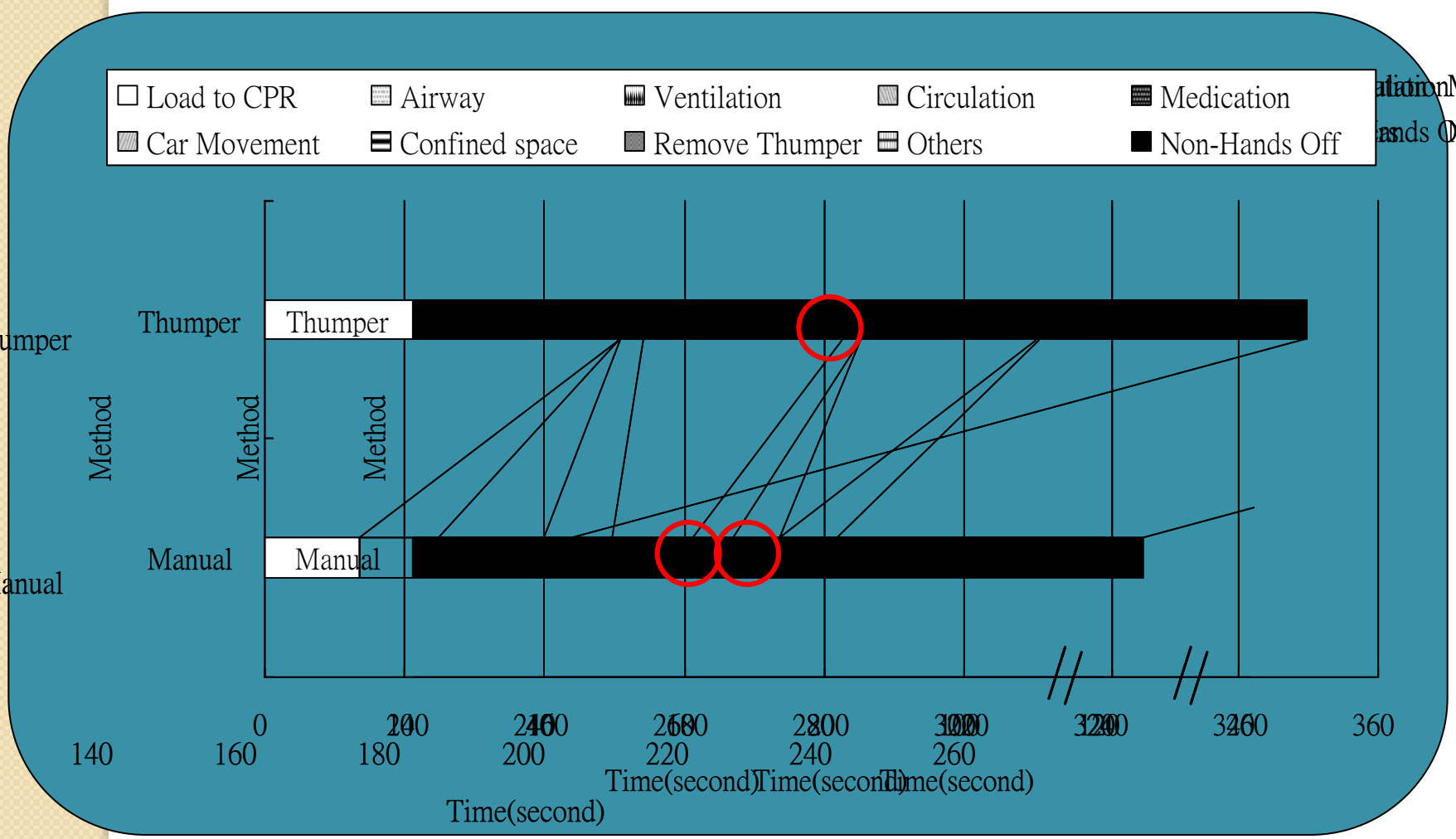
		P-value
		NS
		NS
		0.04
	58% (−23 – 75%)	0.001
)	9% (−23 – 29%)	NS
	0.3 (−0.6 – 1.2)	NS

s of variables, differences of means or proportions and 95% confidence
NS: not significant

PHILIPS

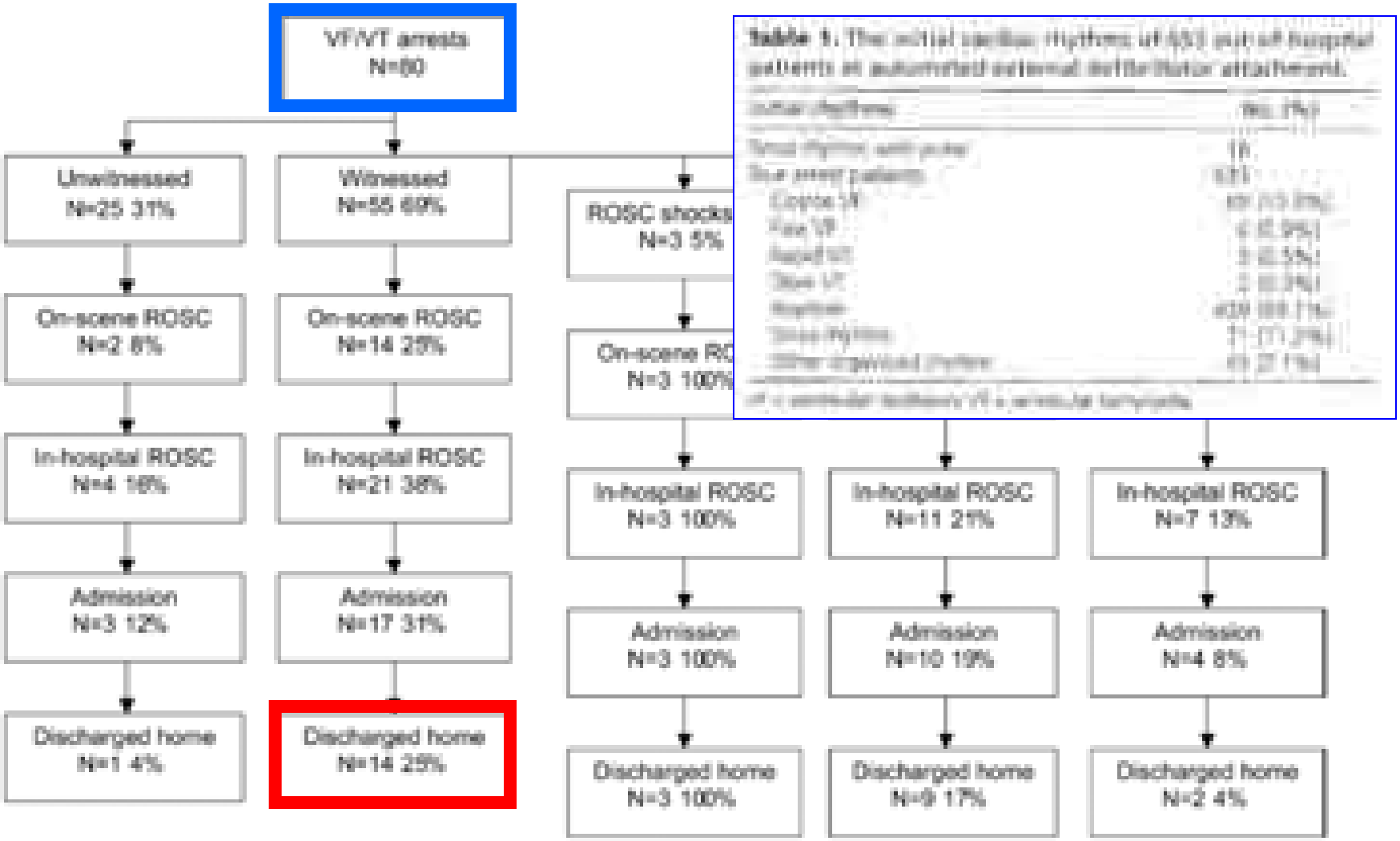
Ko et al. Resuscitation 2005

Cause of Suboptimal CPR



Wang et al. Resuscitation 2007

Well… survival for VF is good, but we have so few of them! (13%)

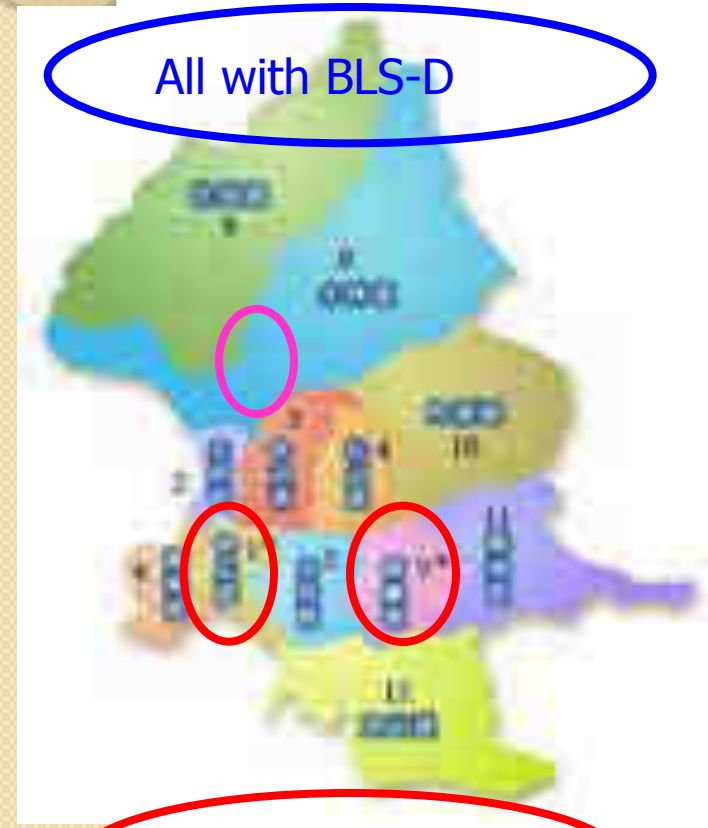


Ko et al. Resuscitation 2004

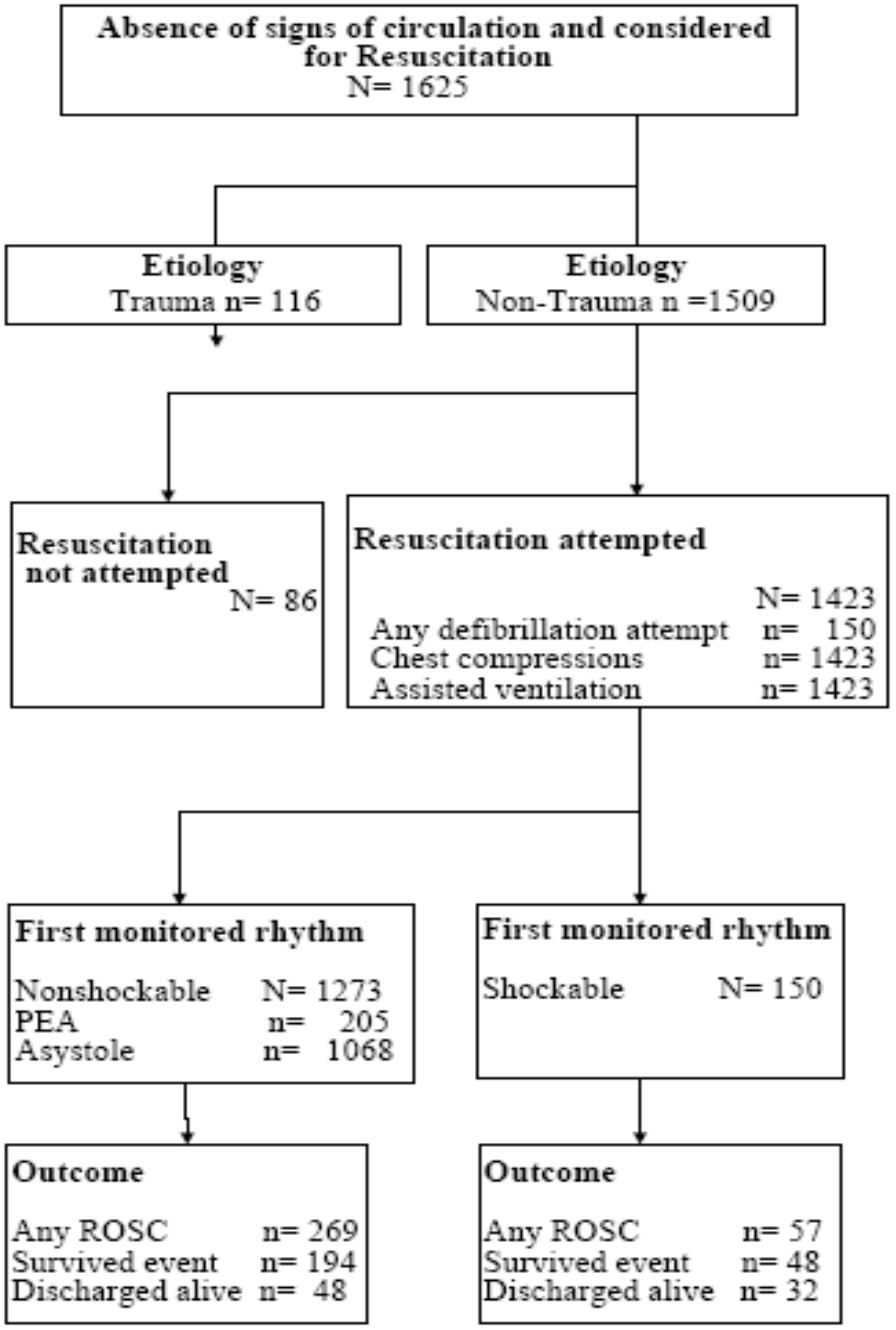
During the process of phasing in ALS capability...

Sep. 2003 ~ Aug. 2004

All with BLS-D



+ ALS teams



Adjusted Odds Ratios for Outcomes

1037 (73%) received BLS-D, and 386 (27%) received ALS.

	ROSC(%)			Survival to ED-ICU Admission(%)			Survival to Hospital Discharge(%)		
	OR	95%CI	p	OR	95%CI	p	OR	95%CI	p
Type of services (ALS vs. BLS-D)	1.57	1.18-2.08	0.002	1.66	1.21-2.25	0.002	0.41	0.85-2.32	0.18
Age group (66+ vs. 0-65)	1.25	0.94-1.67	0.12	1.10	0.80-1.51	0.57	1.32	0.78-2.23	0.30
Gender (Male vs. Female)	0.93	0.71-1.23	0.63	1.01	0.74-1.37	0.97	1.09	0.66-1.79	0.74
Witnessed by Bystander (Yes vs. No)	1.12	0.86-1.47	0.41	1.03	0.75-1.39	0.87	1.42	0.89-2.29	0.15
Bystander CPR (Yes vs. No)	1.72	0.87-3.04	0.06	1.83	1.01-3.44	0.04	2.26	1.03-3.44	0.04
Initial Monitored Rhythm (Shockable vs. Non-Shockable)	2.17	1.20-4.3	0.001	2.14	1.41-3.24	0.001	5.35	3.30-10.38	0.001

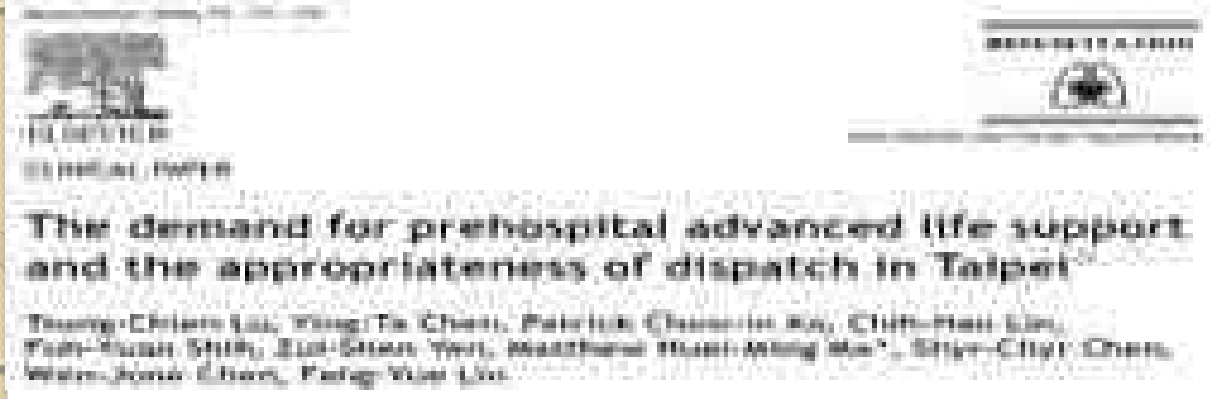
Ma et al. Resuscitation 2007

Adding video communication to dispatch instructions on the quality of rescue breathing in simulated cardiac arrests--a randomized controlled study.

- Yang CW, Wang HC, Chiang WC, Chang WT, Yen ZS, Chen SY, Ko PC, **Ma MH**, Chen SC, Chang SC, Lin FY.

- OBJECTIVE: Both ventilations and compressions are important for victims of prolonged cardiopulmonary resuscitation (CPR) and asphyxial arrest. Dispatch assistance increases bystander CPR, but the quality of dispatcher-assisted CPR (DA-CPR), especially rescue breathing, remains unsatisfactory. This study was conducted to assess the impact of adding interactive video communication to dispatch instructions on the quality of rescue breathing in simulated cardiac arrests.
- METHODS: In this simulation-based study, adults without CPR training within 5 years were recruited between April and July 2007 and randomized to receive dispatch assistance with either voice instruction alone (voice group, n=53) or interactive voice and video instruction (video group, n=43) via a video cell phone. The quality of rescue breathing was evaluated by reviewing the videos and mannequin reports.
- RESULTS: Subjects in the video group were more likely to open the airway correctly (95.3% vs. 58.5%, P<0.01) and to lift the chin properly (95.3% vs. 62.3%, P<0.01), but had similar rates of head-tilt (95.3% vs. 84.9%, P=0.10). Volunteers in the video group had larger volume of ventilation (median volume 540 ml vs. 0 ml, P<0.01), greater possibility to sustain an open airway (88.4% vs. 60.4%, P<0.01) and a tendency towards better nose-pinch (97.7% vs. 86.8%, P=0.06). The video group spent longer time to open the airway (59 s vs. 56 s, P<0.05) and to give the first rescue breathing (139 s vs. 102 s, P<0.01).
- CONCLUSION: Adding video communication to dispatch instructions improved the quality of bystander rescue breathing, including higher proportion of airway opened, and larger volume of ventilation delivered, in simulated cardiac arrests.

Yang CW, Ma MHM, Resuscitation 2008, Crit Care Med 2009



The demand for prehospital advanced life support and the appropriateness of dispatch in Taipei

Tsung-Chien Lu, Ying-Tai Chen, Patrick Chow-in Ko, Chih-Hao Lin, Fu-Yuan Shih, Zu-Shan Yen, Matthew Huei-Ming Ma*, Shyr-Chyr Chen, Wen-Jone Chen, Fang-Yue Liu

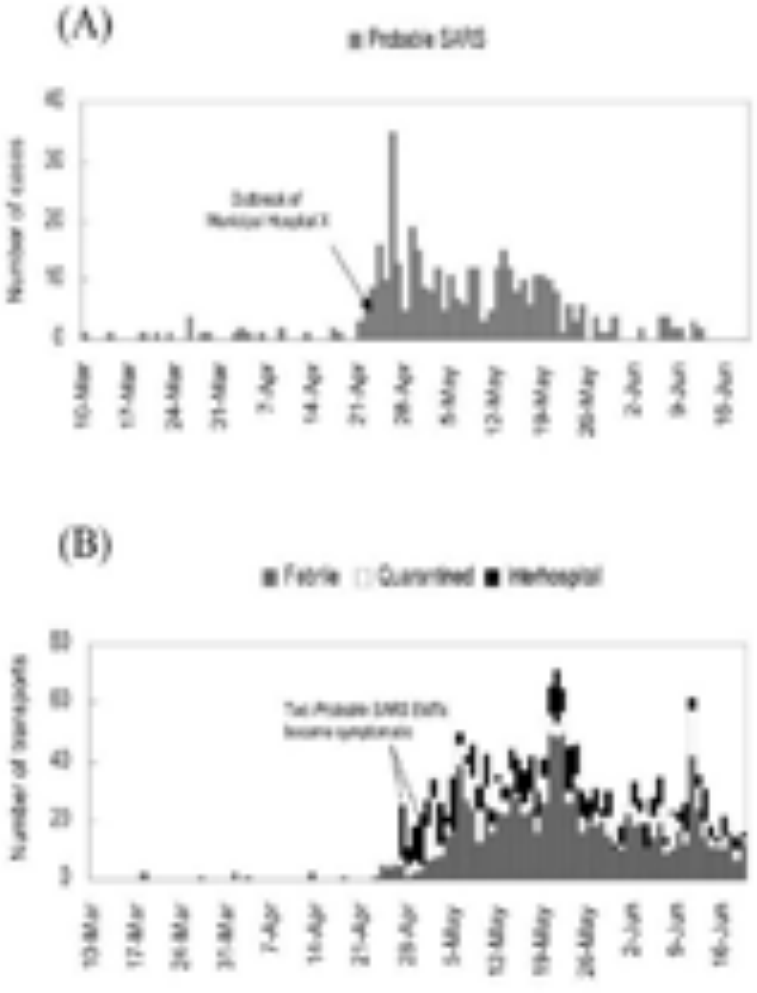
Table 5 Table demonstrating the result of ALS demand and calculation of the appropriateness of ALS dispatch among all retrieved EMS cases (N = 5423)

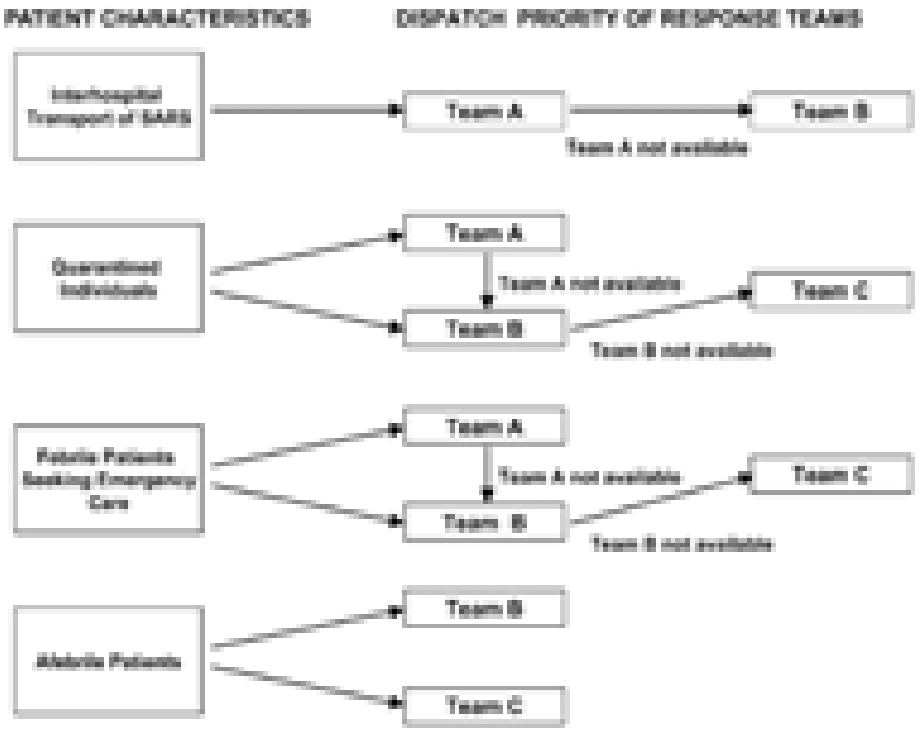
	ALS demand (n = 490)	BLS demand (n = 4943)
ALS dispatch (n = 175)	65	110
BLS dispatch (n = 5258)	425	4833
Rate of ALS demand	490/5423 = 9.03%	
Rate of ALS dispatch appropriateness	The number of people who should and actually received ALS out of the number of people who actually received ALS = (490 − 425)/(5423 − 5258) = 65/175 = 37.14%	
Rate of ALS overtriage	The number of people who should have received BLS out of the number of people who actually received ALS = (4943 − 4833)/(5423 − 5258) = 110/175 = 62.86%	
Rate of ALS undertriage	The number of people who should have received ALS out of the number of people who actually received BLS = (490 − 65)/(5423 − 175) = 425/5258 = 8.08%	

Lu TC, Ma MHM, Resuscitation 2005 → ***Computer Assisted……???***

CLINICAL INVESTIGATIONS

Emergency Medical Services Utilization during an Outbreak of Severe Acute Respiratory Syndrome (SARS) and the Incidence of SARS-associated Coronavirus Infection among Emergency Medical Technicians

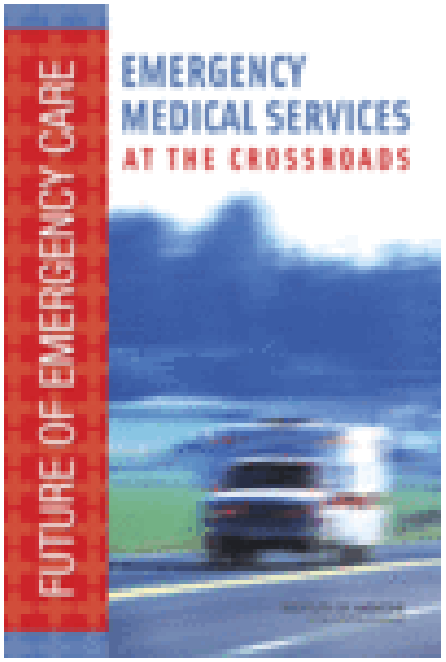




The infected rate was 1.3% (95% CI=0.4~3.6%), or 0.1% (95% CI=0.03~0.4%) per transport.

Ko et al. Acad Emerg Med 2004

Challenges
IOM: EMS at the Cross Road



- Insufficient coordination
- Disparities in response times
- Uncertain quality of care
- Lack of readiness for disaster
- Divided professional identify
- Limited evidence-base

Momentum of Progress

Ledership

Providers

Partnership

Community

Our Visions

- Providers
  - Competent, motivated, and empowered
- Service
  - Evidence-based, state-of-the art, and cost-effective
- Response
  - Immediate and Smart
- System
  - Coordinated, continuous, optimized and accountable

Thank U

EMSS in Taipei Related Publications- NTUH

1. Lin LY, Lo MT, Ko PC, Lin C, Chiang WC, Liu YB, Hu K, Lin JL, Chen WJ, Ma MH. Detrended fluctuation analysis predicts successful defibrillation for out-of-hospital ventricular fibrillation cardiac arrest. Resuscitation. 2010 Mar;81:297-301.
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當我成為高級救護技術員時，
我衷心地保證，
要奉獻自己為救護工作服務。

我將遵從倫理與法律的規範
為危急傷病患的福祉奮鬥。

維護病患的安全是我最高的原則，
保障病患的隱私是我當負的責任。

即使環境險惡，我仍要全力以赴。
讓所有的生老病苦，在我面前都能得到安撫。

我會持續精進自己的能力與判斷，
也會分享知識給任何需要的同僚，
為建立起高級救護技術員的光榮傳統，
我會盡最大的努力。

請上蒼賜予我智慧與勇氣，
讓每次的任務都能化險為夷。

我鄭重地，自主地以我的人格，作以上的宣誓。