Emergency medical dispatch services across Pan-Asian countries: a web-based survey

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Role of Dispatchers

Then

Telephone operators

Now

Resource allocators

Non-visual clinicians

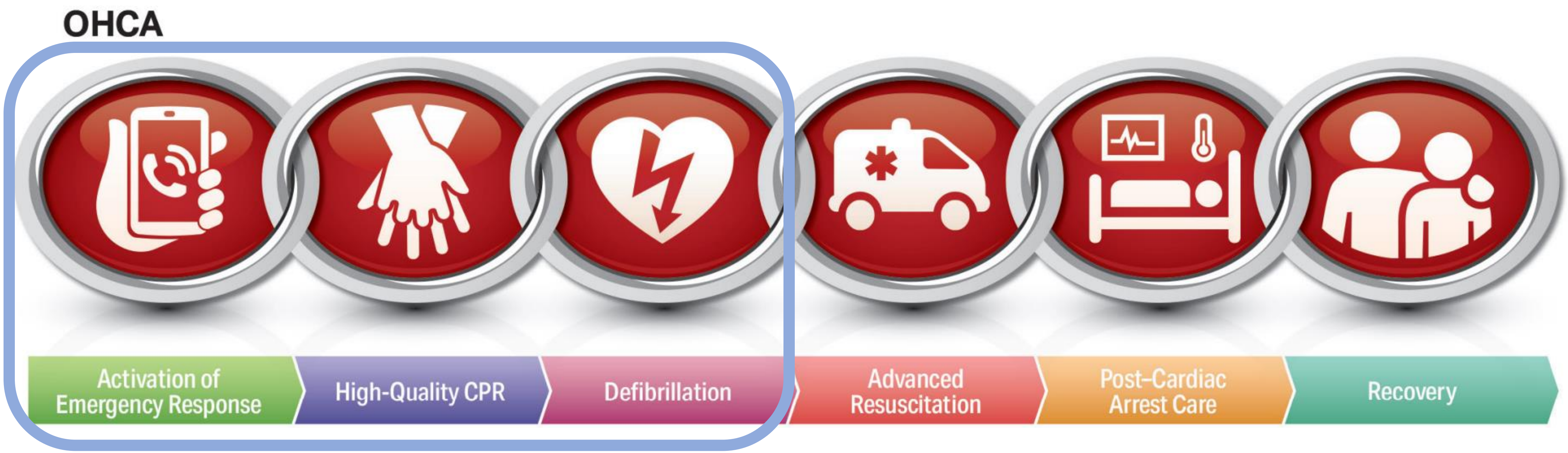
Gatekeepers

Gardett I, Clawson JJ, Scott G, Barron T, Patterson B, Olola C. *Past, present, and future of emergency dispatch research: a systematic literature review.* Ann Emerg Dispatch Response. 2013;1(2):29–42
Barron T, Patterson B. *Listen to the line*. Ann Emerg Dispatch Response. 2013;1(1)

Role of Dispatchers

Lavonas EJ, Magid DJ, Aziz K, et al. *Highlights of the 2020 American Heart Association (AHA) Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiovascular Care (ECC)*.; 2020.

Role of Dispatchers



Lavonas EJ, Magid DJ, Aziz K, et al. *Highlights of the 2020 American Heart Association (AHA) Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiovascular Care (ECC)*.; 2020.

What about Asia?

- Heterogenous emergency medical service (EMS) systems
- Different stages of maturity and development
- Relatively underdeveloped
- OHCA survival rates low

Rahman NH, Tanaka H, Do Shin S, Ng YY, Piyasuwankul T, Lin C-H, et al. *Emergency medical services key performance measurement in Asian cities*. Int J Emerg Med. 2015;8(1):12
Do Shin S, Hock Ong ME, Tanaka H, Ma MH-M, Nishiuchi T, Alsakaf O, et al. *Comparison of emergency medical services systems across Pan-Asian countries: a web-based survey*. Prehospital Emerg Care. 2012;16(4):477–96

We need to understand more about the various dispatch services within PAROS.

Methods

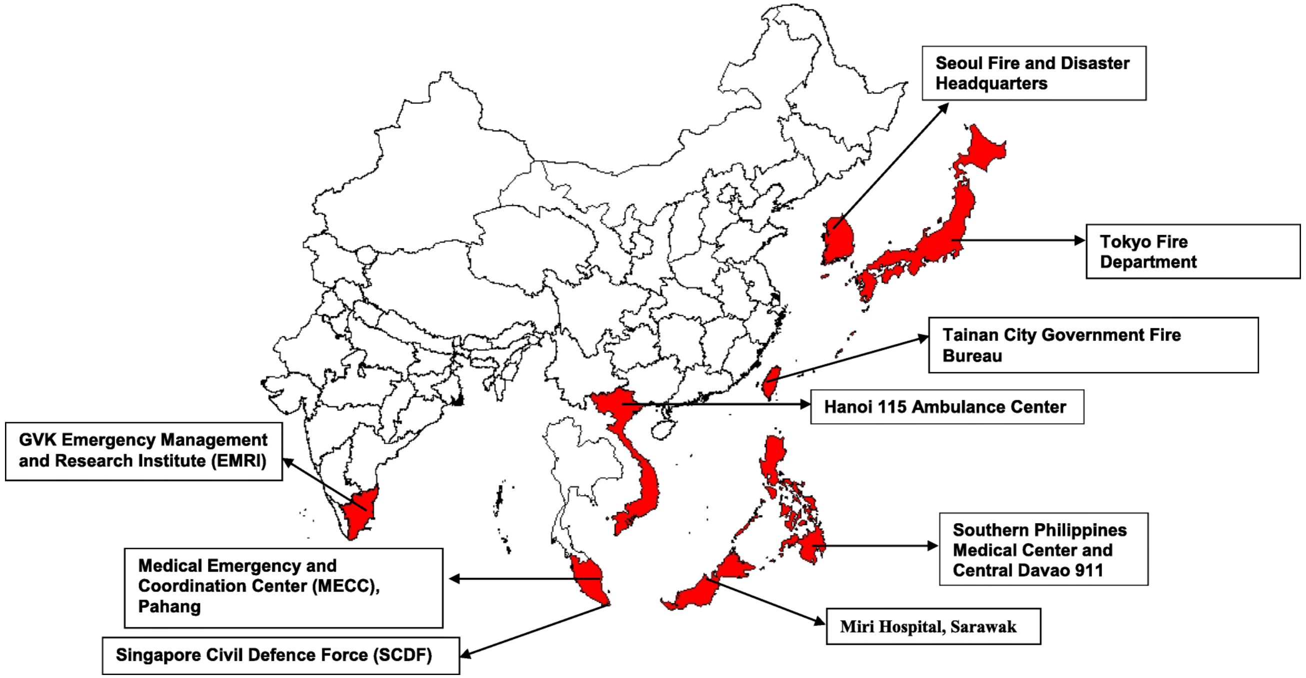
- Cross-sectional descriptive online survey
- Definitions
  - Utstein recommendations
  - PAROS definitions
- Dispatch Service (DS) defined as
  - Common reporting agency or ministry
  - Common operating framework and standard operating protocol
  - Common service region

Cummins RO, Chamberlain DA, Abramson NS, Allen M, Baskett PJ, Becker L, et al. *Recommended guidelines for uniform reporting of data from out-of-hospital cardiac arrest: the Utstein style. A statement for health professionals from a task force of the American Heart Association, the European Resuscitation Council, the Heart and Stroke.* Circulation. 1991;84(2):960–75

Singapore Clinical Research Institute. *Pan-Asian resuscitation outcomes study source documents*. 2019. Available from: http://www.scri.edu.sg/index.php/source-documents.

Results

- Sent to 19 sites
- Response rate 47.4% (n=9)
- 75% of PAROS countries (n=9) represented
- 23 dispatch centers
- Serve a total population > 80 million
- 66.7% (n=6) urban areas
- Call loads: 0.21 to 8.66
  - Call loads = Annual EMS transports : Annual DS man hours
  - (EMS transports activated/man hour)
- DACPR in 77.8% (n=7) of DS'
  - 85.7% (n=6) provided feedback for dispatchers
  - OHCA recognition sensitivity: 32.6% - 79.2%
  - Median time to first compression ~ 90s - 220s



Discussion

- Tiered response systems predominant
- Dispatchers predominantly healthcare providers
- Preference for algorithmic, protocol-driven dispatch
- DACPR
  - Internally developed scripts with local language(s)
  - Most provided *some* feedback, though not many on patient outcomes

Limitations

- Self-reported data
- Exclusion criteria for DACPR statistics were not finalized at time of data collection
- Call load metrics variable

What can we learn?

Take-Home Points

- Greater standardisation between DS/EMS
- Consider feedback for dispatchers
- Multilingual or simplified DACPR scripts

Lavonas EJ, Magid DJ, Aziz K, et al. *Highlights of the 2020 American Heart Association (AHA) Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiovascular Care (ECC)*.; 2020.

STRATEGIES TO IMPROVE SURVIVAL OUTCOMES OF OUT-OF-HOSPITAL CARDIAC ARREST (OHCA) GIVEN A FIXED BUDGET: A SIMULATION STUDY

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Si Oon Cheah, Michael Chia, Benjamin Leong, Han Nee Gan, Desmond Mao,
Lai Peng Tham, Stephanie Fook-Chong, Marcus Ong

Introduction

- Emergency medical conditions including OHCA are expected to rise in Singapore, which will place higher demands on PEC resources.
- Number of OHCA cases has increased from approximately 1000 to 2000 per year from 2010 to 2015.
- OHCA survival rate (Utstein) in Singapore is low (11%) compared to what had been reported in countries such as Japan (31%) and Korea (30%).
- Modifiable factors that improve OHCA survival outcomes include reducing ambulance response time, increasing bystander CPR and defibrillation.

Aim

- Identify a strategy that maximizes improvements in survival upon hospital discharge or 30-days post OHCA for a one-time investment of $1, $5, or $10 million Singapore dollars put toward one of the following strategies (compared to baseline of no investment):

  1) reducing response time via leasing of more ambulances;

  2) Increasing population trained in bystander CPR by offering more CPR training courses;

  3) increasing AED coverage by installing more AEDs

Methods

- No. of additional ambulances, individuals receiving bystander CPR training, and additional AEDs that could be purchased with a given budget using the below cost data were determined.

Resource	Annual cost	Coverage	Source of information
One ambulance	S$1M	Annual leasing service of one ambulance, training of additional paramedics and additional manpower needed, yearly capital investments, ambulance maintenance, and unexpected costs due to accidents and vehicle breakdown	Singapore Civil Defence Force
One person trained in CPR*	S$75**	Single session CPR training course which is valid for 2 years after which a refreshment course would be required.	National Resuscitation Council and Health Promotion Board
One AED†	S$500††	1 PAD Pak combined long-term battery and electrode cartridge, 1 soft carry case, user instruction and quick reference card, and 4-year shelf life	AED Singapore[32]

*CPR: cardiopulmonary resuscitation. **Unit cost of a single session CPR course is S$150. Annual cost is estimated as S$75 due to the 2-year validity of the CPR course.

†AED: automated external defibrillator. ††Unit cost of each AED is S$2000. Annual cost is estimated as S$500 due to the 4-year shelf life of each AED.

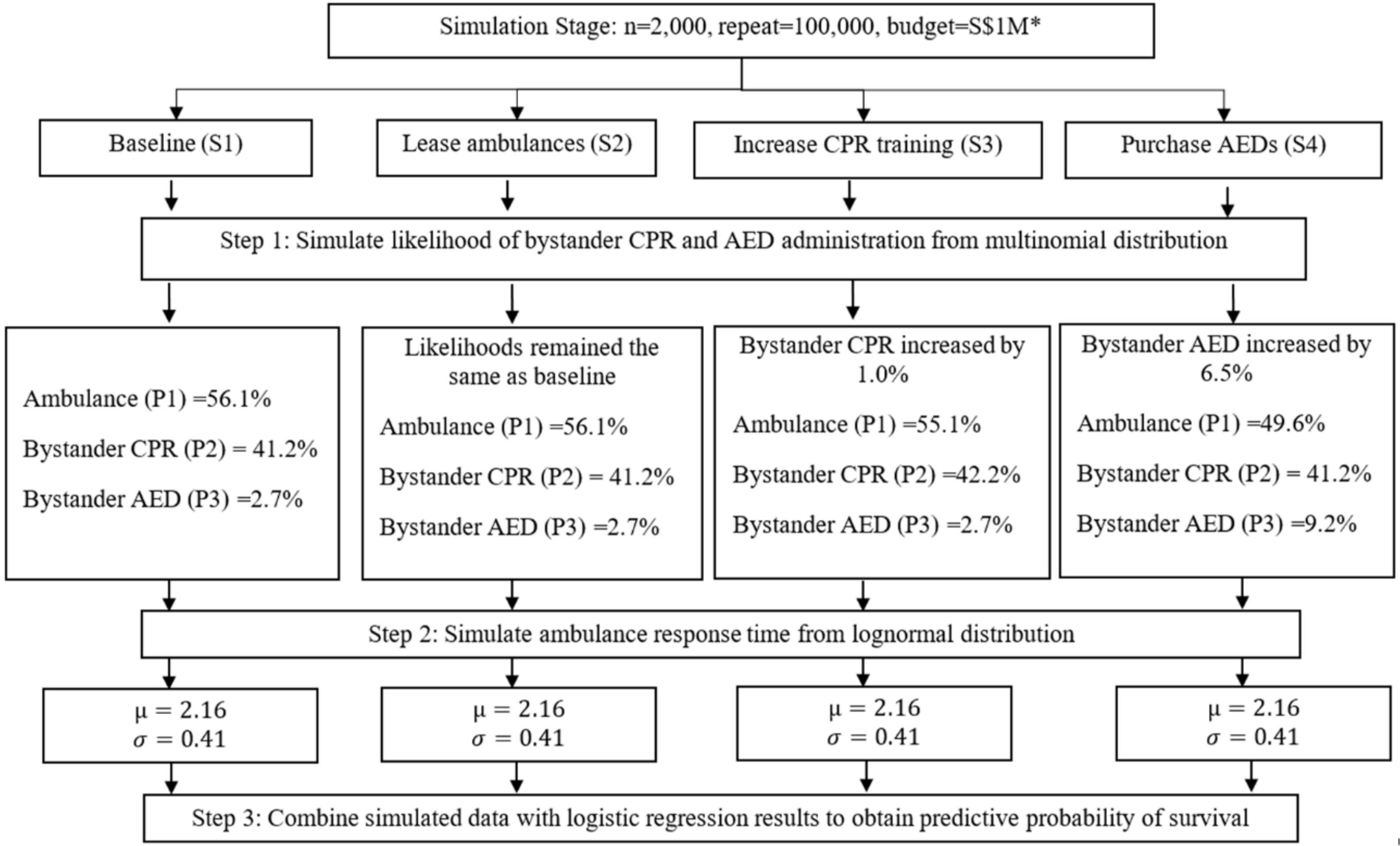
Methods

- Retrospective data collected from Singapore PAROS study between 2010 – 2015 was used to estimate the coefficient and the OR of the effects on survival of ambulance response time, bystander CPR and AED administration in a logistic regression.
- We simulated new ambulance response time, likelihood of bystander CPR and bystander AED administration as a function of their increased availability. Logistic regression model was used to predict new survival.
- Additional life years saved by each strategy was estimated based on improvement in survival and average life expectancy of OHCA survivors (15 years based on previous literature).

Method

- Exclusion criteria: patients who were pronounced dead, and for whom resuscitation was not attempted,
- Patients conveyed by private transport,
- Patients aged ≤18 years.
- Discounting of 3% was used for clinical outcomes

Simulation Steps



*when budget is S$5M, under S2, $P1=56.1\%$, $P2=41.2\%$, $P3=2.7\%$, $\mu=2.12$, $\sigma=0.48$; under S3, $P1=51.0\%$, $P2=46.3\%$, $P3=2.7\%$, $\mu=2.16$, $\sigma=0.41$;under S4, $P1=23.9\%$, $P2=41.2\%$, $P3=34.9\%$, $\mu=2.16$, $\sigma=0.41$. When budget is S$10M, under S2, $P1=56.1\%$, $P2=41.2\%$, $P3=2.7\%$, $\mu=2.08$,$\sigma=0.48$; under S3, $P1=45.8\%$, $P2=51.4\%$, $P3=2.7\%$, $\mu=2.16$, $\sigma=0.41$; under S4, $P1=0\%$, $P2=41.2\%$, $P3=58.8\%$, $\mu=2.16$, $\sigma=0.41$.

Results

Parameter	Coefficient ($\hat{\beta}$) (95% CI)	Odds Ratio (95% CI)	P-value
Intercept	-2.44 (-2.86, -2.06)	0.09 (0.06, 0.13)	<0.001
Ambulance response time	-0.14 (-0.20, -0.07)	0.87 (0.82, 0.94)	<0.001
Bystander CPR	0.33 (0.11, 0.54)	1.38 (1.11, 1.71)	0.003
Bystander AED	1.14 (0.72, 1.53)	3.13 (2.06, 4.63)	<0.001
Ambulance response time (quadratic term)	0.00 (0.00, 0.00)	1.00 (1.00, 1.00)	0.006

- Shorter ambulance response time, bystander CPR and bystander AED administration were significantly associated with increased survival.
- Bystander AED had the highest positive effect on survival.

Results

- Baseline survival: OR 4.03, 95%CI (3.96, 4.10)

Lease Ambulance				Increase CPR training				Purchase AED	
	Additional Ambulances (unit cost: S$1M)	Survival Rate (95% CI)	Additional life years saved	Additional CPR trainings (unit cost: S$75)	Survival Rate (95% CI)	Additional life years saved	Additional AEDs (unit cost: S$500)	Survival Rate (95% CI)	Additional life years saved
S$1M	1	4.03 (3.97, 4.10)	0	13,333	4.04 (3.98, 4.11)	2.46	2,000	4.44 (4.35, 4.54)	100.86
S$5M	5	4.16 (4.09, 4.24)	31.98	66,667	4.09 (4.03, 4.16)	14.76	10,000	6.10 (5.96, 6.24)	509.22
S$10M	10	4.25 (4.18, 4.33)	54.12	133,333	4.15 (4.09, 4.22)	29.52	20,000	7.63 (7.49, 7.76)	885.60

Discussion

- Investing in AEDs had the largest impact on survival, while investing in additional ambulances and CPR training resulted in relatively smaller improvements in OHCA survival.
- Saturation effect reached when the budget was increased to ≥S$5M, as survival had little further improvement except for investing in AEDs.

Discussion

- AHA recommends defibrillation to be delivered within 3-5 min from victim's collapse.
- To achieve this timing, there needs to be a widespread dissemination of AEDs, especially in areas where OHCA incidence is highest.
- However, increased AED coverage alone does not necessarily translate to optimal AEDs utilization, as usage is still dependent on other factors -ability of bystanders in locating AEDs quickly and willingness to render assistance to OHCA victims

Limitations

- We simulated scenarios where only one approach could be employed each time
- Unable to rule out the possibility that spending a portion of the investment on each approach could be a better use of resources, especially when CPR training is likely to have a positive impact on AED administration.

Conclusion

- Investing in AEDs had the most gain in survival, compared with leasing additional ambulances or increasing the number of people trained in CPR.
- Given a budget of S$1M, 100.86 additional life years could be saved, by investing in an additional 2000 AEDs.
- The strategies reached a saturation effect whereby improvement in survival was marginal when the budget was increased to ≥S$5M for investment in ambulances and CPR training.

Association of response time interval with neurological outcomes after out-of-hospital cardiac arrest according to bystander CPR

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Designation/Department: Kyungpook National University Hospital
Country: Korea

Outline of Study

- Introduction
- Aims/Hypotheses
- Methods
- Significance
- Results & Conclusion (for published study)

Introduction

- Response time interval (RTI): time of (arrest victim collapse – EMS response)
- Shorter response time interval (RTI) → higher survival
- More bystander CPR → higher survival

Aim/hypothesis

- Bystander CPR will give positive effect in relationship between RTI and clinical outcome
  - = Successful resuscitation by RTI will be different by b-CPR

- Will b-CPR affect RTI's effect on adult OHCA patients, in multinational setting?

Methods

- Retrospective, cross-sectional
- PAROS data from 2009. 1.–2016. 12.
  - Tokyo, Osaka, Aichi, Seoul, Taipei, Singapore
- EMS treated, nontraumatic, witnessed OHCA
  - Exclusion: nursing homes, EMT witnessed, insufficient data
- General demographics, prehospital arrest details
  - RTI: dispatcher call receive time – EMS amb arrive (at scene) time

Methods (2)

- Outcome: CPC 1/2 (1º), survival discharge (2º)

- Demographic: by b–CPR, by RTI
  - Sensitivity analysis for RTI cut–off point

- Multivariable logistic regression for RTI, b–CPR effect estimation
- Interaction analysis for where b–CPR affect RTI

Significance

- Clarify the association between RTI and favorable neurologic outcome, according to b-CPR in Asian countries.
- Helpful in establishing reasonable EMS resource (e.g. ambulance) allocation

Results

- 13245 cases included

- Median RTI: 6 min (±b-CPR)
- Sensitivity analysis: cut-off @ 6 min
- Shockable ECG, b-CPR, EMS epi, both outcome
  - Higher in ≤ 6 min group

- Longer RTI, b-CPR
  - → better outcome

Table 3
Odds ratios and confidence intervals of RTI and bystander CPR to primary and secondary outcomes.

Outcomes		Crude		Adjusted	
		OR[a]	95% CI[b]	OR	95% CI
RTI[c]					
	Total				
Good CPC[d]	≤ 6 min	1.00		1.00	
	> 6 min	0.62	0.54–0.72	0.65	0.56–0.76
	Total				
Survival	≤ 6 min	1.00		1.00	
	> 6 min	0.66	0.60–0.74	0.69	0.61–0.77
Bystander CPR					
	Total				
Good CPC	No	1.00		1.00	
	Yes	2.63	2.28–3.04	2.18	1.87–2.54
	Total				
Survival	No	1.00		1.00	
	Yes	1.97	1.77–2.19	1.68	1.49–1.89

[a] OR: odds ratio.
[b] CI: confidence interval.
[c] RTI: response time interval.
[d] CPC: cerebral performance category.

Results

- B-CPR (–)
  - RTI effect on outcome drops after 6 min
  - After 12 min: lower outcome (1°/2°)

- B-CPR (+)
  - RTI effect on outcome drops after 9 min
  - After 12 min: lower outcome (2° only)

Table 4
Interaction analysis of bystander CPR and RTI to primary and secondary outcomes.

Outcomes	RTI (by minutes)	Bystander CPR (−)		Bystander CPR (+)	
		AOR	95% CI	AOR	95% CI
Good CPC	3 < RTI ≤ 6 vs. RTI ≤3	1.42	1.17–1.73	2.02	1.62–2.52
	6 < RTI ≤ 9 vs. RTI ≤3	1.16	0.96–1.42	1.82	1.48–2.25
	9 < RTI ≤ 12 vs. RTI ≤3	0.88	0.68–1.14	1.20	0.89–1.62
	12 < RTI vs. RTI ≤3	0.46	0.27–0.77	0.86	0.53–1.40
Survival	3 < RTI ≤ 6 vs. RTI ≤3	1.31	1.15–1.51	1.66	1.41–1.96
	6 < RTI ≤ 9 vs. RTI ≤3	1.05	0.91–1.20	1.43	1.22–1.67
	9 < RTI ≤ 12 vs. RTI ≤3	0.89	0.75–1.07	1.06	0.84–1.34
	12 < RTI vs. RTI ≤3	0.45	0.32–0.62	0.63	0.43–0.93

CPR: cardiopulmonary resuscitation, RTI: response time interval, AOR: adjusted odds ratio, CI: confidence interval, CPC: cerebral performance category.

Conclusion

- Effect of RTI decreasing survival/neurological outcome
  - Weakens with b-CPR
- "Survival/neurological improving" RTI time range
  - Lengthened with b-CPR
- B-CPR allow longer RTI for prehospital care & EMS transport