

Comparison of two emergency medical services in Beijing and Hong Kong, China

Fei Shao¹, Kit-Ling Fan², Colin Robertson³, Marcus Ong⁴, Nan Liu⁵, Ling-Pong Leung⁶, Reynold Leung⁶, Chun-Sheng Li¹

¹Department of Emergency Medicine, Beijing Chao-Yang Hospital, Capital Medical University, Beijing 100020, China;

²Accident and Emergency Department, The Hong Kong University-Shenzhen Hospital, Shenzhen, Guangdong 518053, China;

³Accident and Emergency Medicine and Surgery, University of Edinburgh, Scotland, UK;

⁴Department of Emergency Medicine, Singapore General Hospital, Singapore;

⁵Health Services Research Centre, Singapore Health Services, Singapore;

⁶Emergency Medicine Unit, Li Ka Shing Faculty of Medicine, The University of Hong Kong, Hong Kong, China.

To the Editor: Out-of-hospital cardiac arrest (OHCA) is a major issue in emergency care worldwide. The incidence of OHCA is estimated to be 50 to 60 per 100,000 persons globally.^[1] Despite advances in treatment and technology, survival following OHCA remains low. There are multiple factors affecting the survival outcome. The type of emergency medical service (EMS) system is likely to be one of them. In Asia, the EMS structure and its service capability in terms of dispatch, airway management, and medications vary widely between communities.^[2] This study aimed to evaluate the survival outcomes of OHCA in Beijing and Hong Kong (HK), China and the effect of the type of EMS system on the survival outcomes for patients with OHCA.

This was a prospective study of OHCA in Beijing and HK, China. Patients aged 18 years or above with atraumatic OHCA who were treated by the EMS in both locations between June 1, 2015 and August 31, 2015 were included. Patients with OHCA caused by trauma or those without resuscitation initiated by the EMS in prehospital phase were excluded. The primary outcome measure was survival to hospital discharge or at 30 days; the secondary outcome was neurological performance measured by cerebral performance categories scale. All prehospital data were collected by the EMS personnel according Utstein template. Data on survival and neurological status were collected by the investigators in Beijing and HK based on in-hospital records. Ethical approval for the study was obtained at both study sites from the relevant bodies. Mann-Whitney test and chi-square test were used for analyzing the unadjusted continuous and categorical variables, respectively.

Beijing and HK are two metropolises in China. The EMS in Beijing is a one-tiered system supported by the Beijing Emergency Medical Center and Beijing Red Cross Emergency Rescue Center. It is a physician-based system and the ambulance crews include a paramedic driver, a physician, and a nurse. The EMS dispatchers do not give cardiopulmonary resuscitation (CPR) instructions to callers. In cases of cardiac arrest, besides CPR, EMS crews also provide advanced life support interventions including intravenous (IV) fluid, IV medications, and advanced airway techniques such as tracheal intubation. The crews also have the authority to withhold or withdraw CPR in the prehospital phase.

HK is a highly urbanized city and its EMS is provided by the HK Fire Services Department. It is also a one-tiered system. The level of training of the ambulance crew is intermediate level, which is similar to the Emergency Medical Technician. The EMS dispatchers do not give instructions on CPR when OHCA is reported. The EMS in HK is primarily a basic life support and a defibrillation system. A small number of EMS crews have been trained on setting an IV drip and inserting a laryngeal mask airway. However, these interventions are not commonly performed. The EMS crews are not allowed to withhold or withdraw CPR before emergency department (ED) arrival unless the patients are obviously unsalvageable.

During the study period, there were 789 and 1204 eligible OHCA cases in Beijing and HK, respectively. In comparison, patients in HK were older than those in Beijing. They were more likely to receive bystander CPR and had higher proportion of ventricular fibrillation or ventricular tachycardia. In both the cities, patient's home was the most

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Fei Shao and Kit-Ling Fan contributed equally to this work.

Correspondence to: Prof. Chun-Sheng Li, Department of Emergency Medicine, Beijing Chao-Yang Hospital, Capital Medical University, Beijing 100020, China
E-Mail: yining2000@sina.com

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Table 1: Patient demographics, arrest characteristics, and timeliness.

Variables	Unadjusted			Adjusted		
	HK (n = 1204)	Beijing (n = 789)	P	HK (n = 459)	Beijing (n = 459)	P
Age (years)	80 (66, 88)	67 (55, 78)	<0.001	71 (55, 83)	68 (56, 80)	0.064
Male	682 (56.6)	587 (74.4)	<0.001	327 (71.2)	321 (69.9)	0.664
Location of OHCA			<0.001			0.070
Home	649 (54.6)	563 (71.4)		334 (72.8)	317 (69.1)	
Public places	159 (13.4)	115 (14.6)		73 (15.9)	75 (16.3)	
Home for the aged	315 (26.5)	15 (1.9)		13 (2.8)	14 (3.1)	
En route	60 (5.0)	58 (7.4)		34 (7.4)	34 (7.4)	
Others	6 (0.5)	38 (4.8)		5 (1.1)	19 (4.1)	
Witnessed arrest	413 (34.7)	574 (72.8)	<0.001	254 (55.3)	278 (60.6)	0.109
CPR by bystander	319 (26.9)	141 (17.9)	<0.001	90 (19.6)	85 (18.5)	0.674
Defibrillation	159 (13.2)	272 (34.5)	<0.001	62 (13.5)	120 (26.1)	<0.001
Initial ECG rhythm			<0.001			0.090
VF/VT	99 (8.4)	23 (2.9)		30 (6.5)	22 (4.8)	
Asystole	956 (80.7)	361 (45.8)		315 (68.6)	282 (61.4)	
PEA	119 (10.1)	377 (47.8)		100 (21.8)	143 (31.2)	
Unknown	10 (0.8)	28 (3.5)		14 (3.1)	12 (2.6)	
Call to patient's side interval (min)	9 (8, 11)	15 (11, 20)	<0.001	10 (9, 13)	14 (10, 18)	<0.001
Recognition to EMS CPR interval (min)	10 (7, 14)	17 (12, 23)	<0.001	11 (7, 16)	16 (11, 22)	<0.001
Call to defibrillation interval (min)	11 (7, 19)	18 (12, 25)	<0.001	13 (8, 23)	16 (8, 24)	0.330

Data are expressed as median (interquartile range) or *n* (%). CPR: Cardiopulmonary resuscitation; EMS: Emergency medical service; HK: Hong Kong; OHCA: Out-of-hospital cardiac arrest; PEA: Pulseless electrical activity; VF/VT: Ventricular fibrillation/pulseless ventricular tachycardia.

common location of arrest. The time intervals of call to patient's side, recognition to CPR by EMS, and call to first defibrillation were all shorter in HK than Beijing. With respect to the outcomes of OHCA before adjustment, there was no significant difference between HK and Beijing in terms of the rate of ROSC before ED arrival, survival to hospital discharge or at 30 days, and good neurological outcome [Table 1].

After the propensity score adjustment, the rate of ROSC before ED arrival was higher in HK than Beijing (8.9% *vs.* 7.6%) and the rate of survival to hospital discharge or at 30 days was 3.3% in HK and 2.2% in Beijing. The percentage of survivors with a good neurological outcome was also higher in HK than Beijing (2.6% *vs.* 2.2%). However, all three survival outcome measures did not present statistical significance. On regression analysis, only the location of OHCA and shockable rhythm on presentation were predictors of survival to hospital discharge or at 30 days. Patients presenting with ventricular fibrillation or ventricular tachycardia had the highest probability of survival.

Although Beijing had more cases of witnessed cardiac arrest than in HK, its bystander CPR rate was lower. According to a survey in HK, nearly 96% of respondents would respond to a victim of OHCA.^[3] In Mainland China, public attitudes toward helping others may be different because of many malicious legal actions against bystander helpers. With the implementation of Good Samaritan laws in more Chinese cities, this situation may improve in future.

The defibrillation rate in HK was lower than that of Beijing. This is likely related to the high percentage of

asystole among victims of OHCA in HK. However, the call to defibrillation interval in Beijing was longer. This may be explained by the fact that in Beijing, almost all episodes of defibrillation were done by EMS because of the public lack of knowledge of using an automated external defibrillator. Similar to many studies worldwide, the location of arrest and the presence of a shockable ECG rhythm on EMS arrival are independent predictors.^[4]

No significant difference in the rates of ROSC before ED arrival and survival to hospital discharge or at 30 days between Beijing and HK was found in our study. Moreover, there was no significant difference in neurological outcome on discharge. Since the EMS in HK is not allowed to withhold or withdraw resuscitation at the scene, the calculated survival rate is likely to be negatively biased in comparison to that of Beijing. If patients who unlikely benefit from EMS resuscitation are excluded, we expect that the survival outcomes in HK should be better than that of Beijing.

In general, there are no significant differences in the effects of two EMS systems and survival from OHCA between Beijing and HK.

Conflicts of interest

None.

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