

Case Report

Distribution and epidemiological characteristics of disease spectrum in patients with pre-hospital care: a 5-year retrospective review

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Abstract: Pre-hospital first aid is the forefront of emergency medical service, which is increasingly valued by medical workers. Pre-hospital first aid is a developing, challenging, and rewarding area of clinical practice. With development of first-aid service, pre-hospital first aid has received more and more attention. In order to improve the public's first-aid awareness, it is necessary to analyze the disease spectrum and epidemiological changes of pre-hospital first aid. In the past five years, the number of pre-hospital emergencies has been increasing over year, with two small peaks at 20~29 years and 80~89 years respectively. The ratio of male to female was 1.33:1. In terms of disease spectrum, trauma has always been in first place. In the distribution of first aid call time, pre-hospital emergency patients' crying peak period was from 08:00 to 11:00 am, with 8:00 to 9:00 am being the peak. Through the analysis of disease spectrum and epidemiological changes of pre-hospital first aid, it is helpful to adjust and strengthen emergency resources, so as to improve the emergency response capability.

Keywords: Pre-hospital first aid, disease spectrum, epidemiology

Introduction

Pre-hospital first aid is the rescue on scene and en-route monitoring process from the scene of the victim to the hospital [1, 2]. Pre-hospital first aid is carried out on site and on the way. Pre-hospital first aid is a developing, challenging, and rewarding area of clinical practice. The gradual professionalization of pre-hospital medicine has brought both recognition and scrutiny to the subspecialty [3]. As advances in knowledge and technology enable more complex interventions to be carried out at the roadside responsible clinicians are able to rationalize and justify the risk/benefit of all procedures that might delay delivery of the patient to definitive care. There has been increasing evidence-based standardization of pre-hospital first aid [4, 5].

Although pre-hospital first aid is temporary, it is very important for some critically ill patients. If there is no effective and urgent treatment in the pre-hospital first aid, it is hard to rescue life

in the following emergency department in some of the sickest patients. Therefore, pre-hospital first aid is the forefront of the emergency medical service system, and its importance is increasingly valued by medical workers. Pre-hospital first aid reflects the level of medical emergency services provided in a country or region [6, 7]. Pre-hospital first aid is an important part of the emergency service system. With the development of China's first-aid service, pre-hospital first aid has received more and more attention [8]. Moreover, the success of pre-hospital first aid is not only dependent on the level of medical care, but also on self-protection awareness, self-help, and mutual rescue ability of citizens. In order to improve the public's first-aid awareness, it is necessary to vigorously promote the popularization of first-aid knowledge in the whole society. Taking the correct medical care in pre-hospital first aid can significantly reduce the mortality rate of emergency patients. The purpose of this study was to facilitate best practices and reduce the clinical decision-making burden, as well as stimu-

Table 1. Age distribution of 236732 pre-hospital emergency patients

Age (year)	2013	2014	2015	2016	2017	Total
0~9	1159	1139	1365	2265	2491	8419
10~19	708	800	701	757	1704	4670
20~29	5736	5634	6492	7121	7674	32657
30~39	4380	4029	5257	6257	6196	26119
40~49	3660	3743	4981	6098	6058	24540
50~59	3966	4361	5206	5818	5665	25016
60~69	4287	5005	5266	6103	6139	26800
70~79	4925	4265	5261	6236	6164	26851
80~89	7883	7936	8915	10945	11159	46838
90~99	2535	2586	2985	3022	3289	14417
≥100	64	71	80	82	99	396

late a more rigorous audit and governance, to appraise and improve current practice and demonstrate both value and vulnerability of this area of work. It is paramount that safety and innovation are concurrent in the provision of the right treatment, for the right patient at the right time.

This study retrospectively analyzed the data of 236,732 emergency patients in Minhang District of Shanghai from 2013 to 2017. The aim of this study was to estimate the pre-hospital emergency disease spectrum and epidemiological characteristics.

Materials and methods

Shanghai Minhang District Emergency Center is a public medical and health institution affiliated to the Minhang District Health and Family Planning Commission. It is responsible for the daily pre-hospital first-aid of 2.528 million residents. The 236,732 pre-hospital emergency patients were retrospectively analyzed for the dates between January 1, 2013 and December 31, 2017. Inclusion criteria were as follows: pre-hospital first aid was effectively delivered; complete information. Exclusion criteria were as follows: incomplete information; ambulances returning or arriving at the scene. This study met the criteria of medical ethics, and the informed consent of treatment was received from all patients.

The gender, age, first aid call time, and disease types of 236,732 patients were collected for statistical analysis. Calculations were done using SPSS Version 17.0 for Windows (SPSS, Inc., Chicago, IL, USA). The count data are

expressed as a percentage, and the measurement data are expressed as mean ± standard deviation. The results are presented in the form of tables and figures.

Results

Overall pre-hospital emergency cases

A total of 236723 pre-hospital emergency patients were included in the final analysis during the five-year period between 2013 and 2017. The number of pre-hospital emergency cases showed significantly increasing trend, with 39303 cases on 2013 and 56638 cases on 2017.

Gender distribution

The pre-hospital emergency patients were included of 135245 males (57.13%) and 101478 females (42.87%), with a male to female ratio of 1.33:1.

Age distribution (Table 1)

The age of pre-hospital emergency patients was between the youngest being 1 day and the oldest being 110 years. The number of cases was the highest among 20-29 years and 80-89 years old. The number of patients older than 80 years has been continuously increased in the past five years.

Disease distribution of pre-hospital emergency patients

The top nine diseases were wounds, cardiovascular disease, nervous system disease, digestive system disease, respiratory disease, gynecological disease, urinary system disease, malignant tumor, and poisoning. Among them, the number of trauma patients was the highest, accounting for 24.3% (57547/236723), followed by cardiovascular diseases (12.761%) and nervous system diseases (12.759%). Therefore, it is necessary to strengthen health education for high-risk people. It was very beneficial to popularize first-aid knowledge in ordinary people, and improve the first-aid skill of first witnesses.

The call time distribution of pre-hospital emergency patients

The peak period of pre-hospital emergency patients' call time was 08:00~11:00 (3 hours),

Disease spectrum and epidemiological changes.

accounting for 18.12% (42899/236723). The highest peak was 8:00~9:00, accounting for 6.49% (15355/236723).

The month distribution of pre-hospital emergency patients

The number of pre-hospital emergency patients was highest in December, accounting for 9.468% (22414/236723), followed by August and July, accounting for 8.869% (20996/236723) and 8.835% (20916/236723), respectively. Among them, the least was February, accounting for 7.107% (16816/236723).

The season distribution of pre-hospital emergency patients

The most common season distribution of pre-hospital emergency patients was winter (from October to December), accounting for 26.444% (62602/236723), mainly concentrated in December, followed by autumn (from July to September) and spring (from January to March), accounting for 26.12% (61826/236723) and 23.979% (56765/236723), respectively. Summer (April to June) was the least common season, accounting for 23.457% (55530/236723). The number of pre-hospital emergency patients in the second half of the year (from July to December) was higher than the first half (from January to June), accounting for 52.56% (124428/236723) and 47.44% (112295/236723), respectively.

Discussion

Pre-hospital first aid is the forefront of the emergency medical service system, and its importance is increasingly valued by medical workers. The principal aim of pre-hospital care is to transport the patient as rapidly as possible to a hospital that can provide definitive care, remaining on scene only long enough to identify and treat time-critical life- or limb-threatening diseases [9]. The terms 'golden hour' and 'platinum ten' (minutes) refer to target time frames for the commencement of definitive treatment post-injury and pre-hospital team scene time, respectively [10, 11].

In the past five years, the number of pre-hospital emergency patients in Minhang District of Shanghai has been increasing year by year. With the rapid development of Shanghai's urban economy and the people's awareness of

health quality, the demand and quality of pre-hospital emergency services have increased significantly. Due to the aging trend of the urban population, the number of pre-hospital emergency patients had two small peaks in the age of 20-29 years and older than 80 years, which was becoming the main group of emergency services. There was also a small climax in the relatively young population of 20-29 years old. This part of the population was mostly present as trauma patients, which suggested that we should change the inherent thinking and strengthen the health and safety education in this people. In terms of disease spectrum, trauma was always in the first place. The increase in trauma cases may also be an important cause of the pre-hospital climax of 20-29 years. There have been changes in disease patterns with the rapid reduction of communicable diseases and the significant increase in non-communicable diseases and trauma [12]. Trauma remains the leading cause of death in the first four decades of life. Annually the deaths from injury are about 145,000 in the United States, disability from injury dwarfs the mortality by three to one [13]. Injury is the leading cause of death in children under 18, and road traffic injuries are the fifth leading cause of death. The Asian Development Bank estimated the annual economic loss from road accidents alone to be \$US 885 million, which accounts for 2.45% of the nation's annual gross domestic product [14]. Pre-hospital care is a critical component of efforts to lower trauma mortality [15].

In the pre-hospital first aid call time distribution, pre-hospital emergency patients' crying peak period was from 08:00 to 11:00, of which 8:00 to 9:00 was the highest peak. In the process of ambulance operation, objective reasons such as traffic jam should be considered in this period.

Pre-hospital first aid is an important part of public health services and is an important part of the emergency medical system [16, 17]. Previous studies have found that locations of pre-hospital first aid are concentrated in the community [2, 16]. Community first aid is a further extension of pre-hospital first aid. Constructing a pre-hospital first aid community-based network can effectively shorten the emergency response time and enhance the timeliness of treatment. As a result, the complete hospitalization from acute onset to admis-

sion can be effectively established [18, 19]. With the improvement of public health services, many large and medium-sized cities in China have basically formed a relatively complete pre-hospital emergency service system. The level of pre-hospital emergency has been significantly improved. However, compared with the growing demand for emergency medical services, there are still many inadequacies, such as long response time, unfamiliar emergency patient's condition, and a large number of non-emergency callers which that occupy too many pre-hospital emergency resources [13, 20, 21]. The advantages of community health services are convenient and accessible. However, the lack of communication between the existing pre-hospital emergency network and community health agencies has caused pre-hospital emergency personnel to deal with the complex conditions on the site alone, and to some extent, the idle medical waste of community medical resources [22, 23]. If community health services are integrated into pre-hospital first aid system, the pre-hospital emergency services can be further extended to make up for the shortcomings in the current situation. Combining the advantages of community health services with pre-hospital first aid, the pre-hospital emergency medical services can be extended to the community residents. As a result, the operational efficiency of the pre-hospital emergency system will be effectively enhanced [24].

Through the analysis of the pre-hospital emergency disease spectrum, it is helpful to adjust and strengthen the emergency resources, in order to improve the emergency response capability. Additionally, analyses of the pre-hospital disease spectrum are helpful to formulate policies and rationally equip pre-hospital resources for the decision-making departments.

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Disclosure of conflict of interest

None.

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References

- [1] Goodwin NS, Spinks A, Wasiak J. The efficacy of hydrogel dressings as a first aid measure for burn wound management in the pre-hospital setting: a systematic review of the literature. *Int Wound J* 2016; 13: 519-525.
- [2] Bakke HK, Steinvik T, Eidissen SI, Gilbert M, Wisborg T. Bystander first aid in trauma - prevalence and quality: a prospective observational study. *Acta Anaesthesiol Scand* 2015; 59: 1187-1193.
- [3] Lewin MR, Hori S, Aikawa N. Emergency medical services in Japan: an opportunity for the rational development of pre-hospital care and research. *J Emerg Med* 2005; 28: 237-241.
- [4] Sun JH, Shing R, Twomey M, Wallis LA. A strategy to implement and support pre-hospital emergency medical systems in developing, resource-constrained areas of South Africa. *Injury* 2014; 45: 31-38.
- [5] Fattah S, Rehn M, Lockey D, Thompson J, Losius HM, Wisborg T, Major Incidence Reporting Collaborators. A consensus based template for reporting of pre-hospital major incident medical management. *Scand J Trauma Resusc Emerg Med* 2014; 22: 5.
- [6] Wuytack F, Meskell P, Conway A, McDaid F, Santesso N, Hickey FG, Gillespie P, Raymakers AJN, Smith V, Devane D. The effectiveness of physiologically based early warning or track and trigger systems after triage in adult patients presenting to emergency departments: a systematic review. *BMC Emerg Med* 2017; 17: 38.
- [7] Millin MG, Hawkins SC. Wilderness emergency medical services systems. *Emerg Med Clin North Am* 2017; 35: 377-389.

Disease spectrum and epidemiological changes.

- [8] Suryanto, Plummer V, Boyle M. EMS systems in lower-middle income countries: a literature review. *Prehosp Disaster Med* 2017; 32: 64-70.
- [9] Scholten AC, Berben SA, Westmaas AH, van Grunsven PM, de Vaal ET, Rood PP, Hoogerwerf N, Doggen CJ, Schoonhoven L; Emergency Pain Study Group. Pain management in trauma patients in (pre) hospital based emergency care: current practice versus new guideline. *Injury* 2015; 46: 798-806.
- [10] Fadeyibi IO, Ibrahim NA, Mustafa IA, Uguro AO, Adejumo AO, Buari A. Practice of first aid in burn related injuries in a developing country. *Burns* 2015; 41: 1322-1332.
- [11] Gellerfors M, Fevang E, Bäckman A, Krüger A, Mikkelsen S, Nurmi J, Rognås L, Sandström E, Skallsjö G, Svensén C, Gryth D, Lossius HM. Pre-hospital advanced airway management by anaesthetist and nurse anaesthetist critical care teams: a prospective observational study of 2028 pre-hospital tracheal intubations. *Br J Anaesth* 2018; 120: 1103-1109.
- [12] Nguyen TL, Nguyen TH, Morita S, Sakamoto J. Injury and pre-hospital trauma care in Hanoi, Vietnam. *Injury* 2008; 39: 1026-1033.
- [13] Croser JL. Trauma care systems in Australia. *Injury* 2003; 34: 649-651.
- [14] Gilbert L, Walker L. Treading the path of least resistance: HIV/AIDS and social inequalities a South African case study. *Soc Sci Med* 2002; 54: 1093-1110.
- [15] Meel BL. Pre-hospital and hospital traumatic deaths in the former homeland of Transkei, South Africa. *J Clin Forensic Med* 2004; 11: 6-11.
- [16] Zhang H, Song D, An L. Effect of a real-time tele-transmission system of 12-lead electrocardiogram on the first-aid for athletes with ST-elevation myocardial infarction. *Pak J Pharm Sci* 2016; 29: 1059-1062.
- [17] Sun JH, Shing R, Twomey M, Wallis LA. A strategy to implement and support pre-hospital emergency medical systems in developing, resource-constrained areas of South Africa. *Injury* 2014; 45: 31-38.
- [18] VanderBurgh D, Jamieson R, Beardy J, Ritchie SD, Orkin A. Community-base first aid: a program report on the intersection of community-based participatory research and first aid education in a remote Canadian Aboriginal community. *Rural Remote Health* 2014; 14: 2537.
- [19] Spilsbury K, Rosenwax L, Arendts G, Semmens JB. The impact of community-based palliative care on acute hospital use in the last year of life is modified by time to death, age and underlying cause of death. A population-based retrospective cohort study. *PLoS One* 2017; 12: e0185275.
- [20] Black JJ, Davies GD. International EMS systems: United Kingdom. *Resuscitation* 2005; 64: 21-29.
- [21] Aminzadeh F, Dalziel WB. Older adults in the emergency department: a systematic review of patterns of use, adverse outcomes, and effectiveness of interventions. *Ann Emerg Med* 2002; 39: 238-247.
- [22] Mason S, Wardrope J, Perrin J. Developing a community paramedic practitioner intermediate care support scheme for older people with minor conditions. *Emerg Med J* 2003; 20: 196-198.
- [23] Gur S, Weizman S, Stubbs B, Matalon A, Meyerovitch J, Hermesh H, Krivoy A. Mortality, morbidity and medical resources utilization of patients with schizophrenia: a case-control community-based study. *Psychiatry Res* 2017; 260: 177-181.
- [24] Vandiver T, Anderson T, Boston B, Bowers C, Hall N. Community-based home health programs and chronic disease: synthesis of the literature. *Prof Case Manag* 2018; 23: 25-31.