

Which is better? Comparing the efficiency and information accuracy of pre-hospital emergency medical services (PEMS) dispatch in two call modes in Sichuan Province, China: a retrospective study

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Abstract

Background

China's PEMS system was established in the 1980s. Due to economic and resource inequalities, China's PEMS system does not have a uniform mode, and regions developed their models based on their circumstances, incorporating North America's and Europe's experiences. In the Sichuan PEMS model, when someone calls "120" for a pre-hospital emergency, he/she will first access the Medical Emergency Center, a dispatcher will record the incident information and makes a preliminary judgment, then that information and the judgment will be forwarded to a nearby general hospital, which will send an ambulance staffed by medical workers to provide PEMS. Instead, some people prefer to call hospitals directly for pre-hospital emergencies and communicate directly with medical staff. Which call mode is better has long been a point of contention.

Methods

This retrospective study included a total of 496 PEMS within 8 km of the participating hospital between 2020 and 2021. Cases that called the Emergency Medical Center dispatcher were classified as "referral group" (n = 318) and cases that called the hospital and communicated directly with medical personnel were classified as "direct group" (n = 178), and appropriate metrics were selected to measure efficiency and information accuracy

Results

There was no significant difference in the efficiency of PEMS between the two groups, but there was a notable difference in the information accuracy between the two groups on all indicators

Conclusion

Compared with calling '120', direct PEMS calls to general hospitals have obvious advantages in terms of information accuracy. Perhaps the Emergency Medical Center in Sichuan could try to reform as a supervisory agency for PEMS instead of a dispatch agency or adopt the Shenzhen EMS model where the Emergency Medical Center, after receiving a call for help, transfers the call to the appropriate hospital based on the caller's location and situation, allowing the caller to communicate directly with medical personnel.

Background

Pre-hospital emergency medical services (PEMS), as an essential component of emergency medical care, play an important role in first-aid and reducing patient transport time (Mackenzie, 2018). China's PEMS

system was established in the 1980s. Due to economic and resource inequalities, China's PEMS system does not have a uniform mode, and regions developed their models based on their circumstances, incorporating North America's and Europe's experiences. (Ali, 2001; Hung et al., 2009; Shi et al., 2020; Yan et al., 2017).

In the Sichuan model, pre-hospital emergency medical services (PEMS) are deeply dependent on general hospitals (Hung et al., 2009), but callers can not directly speak with hospital medical staff. When someone calls "120" for a pre-hospital emergency, he/she will first access the Medical Emergency Center, a dispatcher will record the incident information and makes a preliminary judgment according to the Medical Priority Dispatch System, then that information and the judgment will be forwarded to a nearby general hospital (Yan et al., 2017), which will send an ambulance staffed by medical workers to provide PEMS (Hung et al., 2009; Tang et al., 2020). Instead, some people prefer to call hospitals directly for pre-hospital emergencies, a process similar to the Shenzhen PEMS mode, which collects the incident information, transfers the call to the appropriate hospital and lets the caller communicate directly with medical staff (Hung et al., 2009). Which call mode is better has long been a point of contention. A deadly delay in a PEMS has brought this controversy to the forefront across China this year. A girl with a brain hemorrhage was misjudged by the Medical Emergency Center dispatcher after she called 120 eventually leading to her passing away ("120 " , ! _ -The Paper2022). Many people believe that this tragedy would not have occurred if the girl had been able to communicate directly with the medical staff. However, no relevant studies were found in the retrieve. Therefore, it is necessary to compare the efficiency and information accuracy of the two call modes of PEMS to provide a reference for the reform of the pre-hospital emergency care model in China.

Methods

Setting:

The study was approved by the Ethics Review Committee of Guangyuan Central Hospital and waived the informed consent requirement, carried out by the Sex and Gender Equity in Research (SAGER) guidelines, using retrospective data.

The study was conducted in the biggest tertiary hospital in Guangyuan, Sichuan province, China, with more than 10 PEMS per day and more than 3700 PEMS annually. As all pre-hospital emergencies forwarded by the Medical Emergency Center are recorded in detail on the mobile platform (Fig. 1), while pre-hospital emergencies contacted directly by patients with medical staff are recorded manually on the computer (Fig. 2) which provides the data needed for this study. To avoid bias caused by the Covid-19 pandemic, PEMS data from 2020 to 2021 were extracted for this study. Further, to exclude the effect of traffic situation and distance, only PEMS cases within 8 km of that hospital were included (n = 496). Cases called to the Medical Emergency Center dispatchers were divided into the 'referral group'(n = 318) and cases called hospitals and directly communicated with medical staff were divided into the 'direct group'(n = 178).

Measurements

The flow of PEMS in Sichuan Province is as follows (Fig. 3). Four indicators including 'preparation time', 'transit time', 'on-site time', and 'return time' were selected to measure the efficiency of PEMS. And the occurrences of 'ambiguous address,' 'invalid phone number,' 'No answer, need to call several times,' 'inaccurate preliminary judgment' and 'need further manpower/equipment support' were selected to measure the information accuracy.

Data analysis

SPSS was used to perform data normality testing and subsequent t-tests (version 24.0, IBM Corporation). The significance level was set at P 0.05.

Results

There was no significant difference in the efficiency of pre-hospital emergency care between the two groups, but there was a notable difference in the information accuracy between the two groups on all indicators (Table 1).

Table 1
Results of comparing the efficiency and information accuracy of two pre-hospital emergency call modes

| | referral group | direct group | P-value |
|---------------------------------------|----------------|--------------|---------|
| Baseline characteristics | | | |
| Cases | 318 | 178 | |
| Gender | 318 | 178 | 0.727 |
| Male | 168(52.7%) | 90(50.5%) | |
| Female | 150(47.1) | 88(49.5%) | |
| Age | 51.51 | 47.2 | 0.035* |
| Efficiency indicator | | | |
| Preparation time | 1.73 | 1.70 | 0.692 |
| Transit time | 5.12 | 5.30 | 0.311 |
| On-site time | 11.03 | 10.88 | 0.842 |
| Return time | 5.41 | 5.20 | 0.211 |
| Information accuracy indicator | | | |
| Ambiguous address | 56 | 18 | 0.017* |
| Invalid phone number | 102 | 16 | 0.001* |
| Wrong number | 4 | 2 | |
| Third-party phone number | 49 | 11 | |
| No answer, need to call several times | 49 | 3 | |
| Inaccurate preliminary judgment | 179 | 37 | 0.000** |
| Worse | 143 | 28 | |
| Milder | 36 | 9 | |
| Need further support | 38 | 3 | 0.000** |
| Note: *p < 0.05; **p < 0.001 | | | |

Discussion

Although there is no basic standard or unified model for pre-hospital emergency care in China so far, provinces have taken a series of measures around "building a 15-minute emergency circle" to improve the efficiency and quality of pre-hospital emergency care. For example, electronic information systems have

been introduced to fortify PMES efficiency; ambulance personnel is equipped with electronic mobile platforms for better communication (Ali, 2001; Hung et al. 2009; Tang et al. 2020; Yan et al. 2017). In addition, each province has set strict time limits for pre-hospital emergency response procedures; for example, a general hospital must dispatch an ambulance within three minutes after receiving an emergency order. And both ambulance personnel and dispatchers were required to record detailed data for each prehospital emergency separately (Zhan et al., 2020), and government departments monitored the response time for each emergency. (Huang et al., 2020). This may be the reason why there was no significant difference in PEMS efficiency between the two groups.

However, the difference in information accuracy between the two groups is notable. Dispatcher overload due to uneven allocation of PEMS resources was identified as one of the main factors contributing to inaccurate PEMS information transmitted through dispatchers. (Tang et al., 2020; Yan et al., 2017). Although both in the previous rounds of healthcare reform and the recently released Health China 2030 Plan, the Chinese government has been committed to providing the people with access to equitable, high-quality PEMS (Tan et al., 2017). But, there are still significant inequalities in PEMS between regions, cities, rural and urban areas. Studies indicate that PEMS resources are deeply affected by GDP growth and urbanization (Tan et al., 2017; Tang et al., 2020; Yan et al., 2017; Zhu et al., 2021). Historically, the western part of Sichuan Province has been at an economic disadvantage compared to the eastern part, especially in terms of road construction and population density. Most emergency facilities are concentrated in the eastern region, while the distribution of emergency resources in the western region is much less (Tang et al., 2020). Using the same PEMS model with different resources may worsen this situation. For example, Guangyuan City, which maintains a population of 2'667'000 in 16307.73 km² (Tang et al., 2020), has only one emergency center and 10 dispatchers to handle all emergency calls. And these 10 dispatchers are divided into different shifts, with less than 5 actual dispatchers per shift. The dispatchers have to speed up the efficiency of collecting information and shorten the duration of calls, which results in insufficient time for them to verify the information and make appropriate judgments about the situation and give necessary and reasonable advice to the callers, which undoubtedly makes the information accuracy drops dramatically.

The Sichuan PEMS model is believed to be another cause of this result. In this model, the Emergency Medical Center owns no medical equipment or personnel. The Emergency Medical Center and its dispatcher are not directly involved in any PEMS, the dispatcher only needs to screen incoming calls, determine which are genuine alarms, and transfer the relevant information to the general hospital in a timely and accurate manner (Hung et al., 2009). Even if the information itself is not clear enough (e.g., vague addresses, third-party phone numbers) or even interferes with subsequent PEMS, it is neither the dispatcher's job nor does it create any recourse for them. In contrast, the medical staff will be directly involved in the PEMS, and unclear information can directly increase the workload of the medical staff and affect patient outcomes, and as the medical staff takes responsibility when inaccurate information delays the PEMS (Ning et al., 2021), giving the medical staff an incentive to clarify and confirm the information to ensure the efficiency of each PEMS.

Compared with medical staff, lack of relevant medical knowledge and clinical experience among dispatchers is another major contributing reason. A Chinese study pointed out that dispatchers generally come from nurses or doctors with clinical work experience, however, compared with active medical staff, dispatchers lack subsequent training in relevant dispatching skills and medical knowledge, and medical knowledge is not updated promptly (Gao., 2019). Worse still, in the wake of the above tragedy, media investigations found that as economic growth declined and local revenues decreased, emergency medical centers in many areas hired a large number of temporary workers to serve as assistant dispatchers, who did not meet the nationally mandated dispatcher admission standards and lacked relevant medical background (120 : 11 , , 2022). However, these people play the role of dispatchers directly in the workplace without proper supervision and guidance. In this context, dispatchers are unaware of the importance of information accuracy for subsequent PEMS and cannot summarize information to make accurate judgments.

Conclusion

Compared with calling '120', direct PEMS calls to general hospitals have obvious advantages in terms of information accuracy. Perhaps the Emergency Medical Center in Sichuan could try to reform as a supervisory agency for PEMS instead of a dispatch agency or adopt the Shenzhen EMS model where the Emergency Medical Center, after receiving a call for help, transfers the call to the appropriate hospital based on the caller's location and situation, allowing the caller to communicate directly with medical personnel. Future research could compare different PEMS models in China to find the best solution.

Abbreviations

PEMS: pre-hospital emergency medical services

Declarations

Availability of data and materials

The datasets generated and analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request

Ethics approval and consent to participate

All methods were performed in accordance with relevant guidelines and regulations. The study was approved for using retrospective data by the Ethical Review Committee of Guangyuan Central Hospital, and the committee also waived the requirement for informed consent because there were no effects or risks to patients throughout the study.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

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None

Authors' contributions

ZYL: conception, acquisition of data, design, the analytical plan, drafting of the manuscript. SHL: Critical revision of the manuscript for important intellectual content. YYL, LHY and SYZ: Critical revision of the manuscript, approval of the final version to be published.

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Figures



Figure 1

EMS details automatically recorded by the mobile platform

| 日期 | 接听电话时间 | 呼救电话 | 出诊原因 | 出诊地点 | 出发时间 | 到达现场时间 | 离开现场时间 | 患者姓名 | 性别 | 年龄 | 病情 | 返回医院时间 | 收入科室 | 反馈120时间 | 反馈人姓名 | 医生 | 护士 | 司机 |
|-----------|--------|-----------------|------|---------|-------|--------|--------|---------|----|----|----|----------|--------|---------|-------|-----|-----|----|
| 2022-6-27 | 11:32 | 18181024700 | 胸痛 | 二医院 | 11:35 | 11:40 | 11:50 | 刘宏伟 | 男 | 74 | 轻 | 11:56 | 门诊 | / | / | 田小东 | 李佳 | 田斌 |
| 2022-6-27 | 13:10 | 13718570769 | 肋骨骨折 | 泰华医院 | 13:12 | 13:18 | 13:27 | 魏松伍 | 女 | 13 | 轻 | 13:34 | 耳鼻喉 | / | / | 张丙 | 金明 | 田斌 |
| 2022-6-27 | 13:58 | 3391 | 气管插管 | 神经内科 | 14:00 | | | 电话取消 | | | | 神经内科 | / | / | 田小东 | / | / | |
| 2022-6-27 | 19:15 | 120/13618125405 | 外伤 | 南街财神楼 | 19:20 | 19:22 | 19:23 | 魏晓军 | 男 | 48 | 轻 | 19:25:00 | | 18:36 | 徐成平 | 何治亮 | 徐成平 | 田斌 |
| 2022-6-28 | 2:13 | 120/18095774132 | 会阴外伤 | 圆融如家酒店 | 2:15 | 2:19 | 2:29 | 王姗姗 | 女 | 29 | 轻 | 2:38 | 妇儿并院急诊 | / | / | 何治亮 | 刘智宁 | 田斌 |
| 2022-6-28 | 13:21 | 18284080265 | 冠心病 | 沙河镇无西村 | 13:23 | 13:40 | 13:43 | 苏云强 | 男 | 56 | 重 | 13:57 | 心内 | / | / | 罗江玲 | 陆奇秀 | 王兵 |
| 2022-6-28 | 14:54 | 120/15984069671 | 吐血 | 天星公寓 | 14:56 | 15:00 | 15:04 | 李小平 | 女 | 57 | 中 | 15:08 | 消化内科 | / | / | 罗江玲 | 金明 | 王兵 |
| 2022-6-28 | 15:30 | 120/13194730088 | 抽搐 | 下河街咖啡斯 | 15:32 | 15:39 | 15:46 | 卢景仲 | 男 | 48 | 中 | 15:50 | 脑血管 | 16:02 | 陆奇秀 | 罗江玲 | 陆奇秀 | 王兵 |
| 2022-6-28 | 15:32 | 15196139351 | copd | 煤研社区 | 15:59 | 16:15 | 16:19 | 夏俊洲 | 男 | 95 | 中 | 16:33 | 呼吸 | / | / | 罗江玲 | 李佳 | 王兵 |
| 2022-6-28 | 20:05 | 13618120800 | 头昏 | 民政局与瑞对面 | 20:08 | 20:12 | 20:13 | 刘军 | 男 | 67 | 中 | 20:17 | 消化 | / | / | 陈琳 | 李佳 | 王兵 |
| 2022-6-29 | 1:36 | 120/1772697711 | 腹痛 | 上河街创意十足 | 1:38 | 1:40 | 1:53 | 马加昆 塔斯尔 | 男 | 28 | 轻 | 1:56 | 急诊科急诊 | 1:58 | 张江 | 张江 | 张江 | 王兵 |

Figure 2

EMS details manually recorded by medical staff

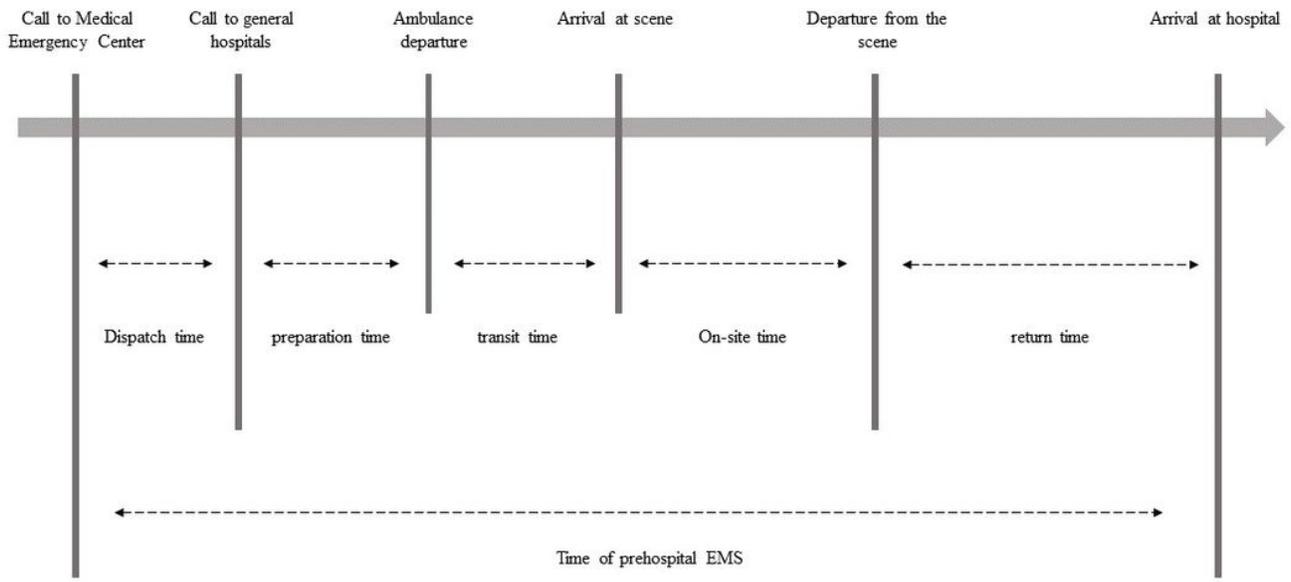


Figure 3

the EMS process in Sichuan province, China