



# Exploring the impact of the COVID-19 epidemic on the medical emergency calls and calls for cardiovascular diseases in Hangzhou, China

Juan Chen<sup>1</sup> · Yong-ran Cheng<sup>2</sup> · Xin-yan Fu<sup>1</sup> · Chun-yi Wang<sup>1</sup> · Wen Wen<sup>1</sup> · Jie Ni<sup>1</sup> · Jing-jie Jiang<sup>1</sup> · Zhao Xu<sup>1</sup> · Meng-Yun Zhou<sup>3</sup> · Lan Ye<sup>4</sup> · Zhan-hui Feng<sup>5</sup> · Gang Liu<sup>6</sup> · Ming-Wei Wang<sup>1</sup> · Xing-wei Zhang<sup>2</sup> · Zhong-jun Ge<sup>7</sup> · Guo-fan Chen<sup>1</sup>

Received: 26 December 2020 / Accepted: 6 May 2021 / Published online: 21 May 2021  
© Royal Academy of Medicine in Ireland 2021

## Abstract

**Aims** We aimed to evaluate the impact of the COVID-19 epidemic on emergency and cardiovascular disease-related calls in Hangzhou, China.

**Methods** We conducted a single-center retrospective study, collecting data on emergency calls to the Hangzhou Emergency Center (HEC) during the COVID-19 epidemic (January 20, 2020, to March 15, 2020). Data were compared with the same period in 2019.

**Results** Compared to 2019, the number of emergency calls has dropped by 21.63%, ambulance calls by 29.02%, rescue calls by 22.57%, and cardiovascular disease-related emergency calls by 32.86%. The numbers of emergency, ambulance, and rescue calls in 2020 were significantly lower than in 2019.

**Conclusions** During the COVID-19 epidemic in Hangzhou, the numbers of emergency and cardiovascular disease-related calls have decreased significantly. These results point to a severe social problem that requires the attention of the medical community and the government.

**Keywords** Cardiovascular diseases · COVID-19 · Emergency call · SARS-CoV-2

---

Juan Chen, Yong-ran Cheng, and Xin-yan Fu contributed equally to this work

✉ Ming-Wei Wang  
wmw990556@163.com

✉ Xing-wei Zhang  
hsdzw@126.com

✉ Guo-fan Chen  
w18758871517@163.com

<sup>1</sup> Hangzhou Institute of Cardiovascular Diseases, Affiliated Hospital of Hangzhou Normal University, 126 Wenzhou Road, Gongshu District, 310015 Hangzhou, China

<sup>2</sup> School of Public Health, Hangzhou Medical College, No. 8 Yikang Street, Lin'an District, 311300 Hangzhou, China

<sup>3</sup> Department of Molecular & Cellular Physiology, Shinshu University School of Medicine, 3900803 Asahi, Matsumoto, Japan

## Introduction

The COVID-19 epidemic has affected the medical systems of many countries [1, 2]. An increasing body of evidence suggests that patients with emergencies intentionally avoid the

<sup>4</sup> Basic Medical College, Guizhou Medical University, University Town, Gui'an New District, Guiyang 550004, China

<sup>5</sup> Department of Neurology, Affiliated Hospital of Guizhou Medical University, No. 28, Guiyi Street, 550025 Guiyang, China

<sup>6</sup> Hangzhou Emergency Medical Center, 568 Mingshi Road, Jianggan District, 310021 Hangzhou, China

<sup>7</sup> Hangzhou Lin'an Fourth People's Hospital, No. 88, Binjiang South Road, Changhua Town, Lin'an District, Hangzhou 311321, China

emergency department due to concerns about the risk of contracting SARS-CoV-2 infection [3]. It is widely known that timely diagnosis and treatment of cardiovascular diseases is crucial, and treatment delay is a predictor of adverse outcomes. It has recently been reported that the number of emergency room patients in the USA has decreased by nearly 50%, and ST-segment elevation myocardial infarction (STEMI) activation in the cardiac catheterization room has decreased by 38% [4]. The admission rates for heart failure (HF), pulmonary embolism (PE), implantable device failure (DF), and atrial fibrillation (AF) in Italy have also decreased, and about half of the acute myocardial infarction (AMI) patients did not arrive at the hospital [5]. The Spanish STEMI catheterization room activation has declined by 40%. In Hong Kong, the accident and emergency department (AED) attendance rate has also decreased significantly [6]. China was the first to report about the COVID-19 epidemic. On January 23, 2020, it announced the closure of Wuhan City, Hubei Province [7]. As of May 20, 2020, Hangzhou City reported a total of 181 cases of SARS-CoV-2 pneumonia and no deaths. The ten public hospitals in Hangzhou had fever clinics to isolate suspected SARS-CoV-2 patients from the general patient population and avoid cross-infection. The Hangzhou Emergency Center (HEC) includes 25 first-aid outlets (Appendix Fig. 3a). Two hospitals and one intensive care center treated suspected and confirmed cases in Hangzhou. A special transfer process was enacted during the epidemic. Patients with suspected SARS-CoV-2 infection were separated from the general patient population, including in the emergency admission procedures (Appendix Fig. 3b).

Against this background, the number of emergency calls to the HEC has significantly declined compared to a year before. This study analyzed changes in emergency calls and assessed the correlation between shifts in these calls and trends in the COVID-19 epidemic in China. We searched for the reasons for the decline in the number of emergency calls,

aiming to find solutions to the fact that people avoid making emergency calls in life-threatening situations.

## Methods

### Research subjects

We conducted a single-center, retrospective study to evaluate the effect of the COVID-19 epidemic in Hangzhou on the use of emergency medical services in the HEC. Data collected included the number of daily emergency calls, ambulance calls, and rescue calls, and cardiovascular disease-related emergency calls. Data collected covered the 55 days between January 20 and March 15, 2020. The same data were collected for the same period in 2019.

### Time node selection

On January 23, 2020, Wuhan City, Hubei Province, China, announced the city's closure. This news quickly spread to all parts of the country. As the HEC has formulated a new COVID-19 transfer plan shortly before January 20, this date was selected as the starting point for the analysis. The residential area in Hangzhou was closed during the epidemic and has gradually reopened until about March 15. It was still necessary to wear masks, measure body temperature, and show the Health Code when entering or leaving public places after that date. The "First Aid" key function in the Health Code application dials 120 to connect the caller to the rescue center at the HEC. This will be discussed in detail in the "Discussion" section. We selected March 15, the end of the lockdown, as the analysis endpoint.

### Cardiovascular diseases

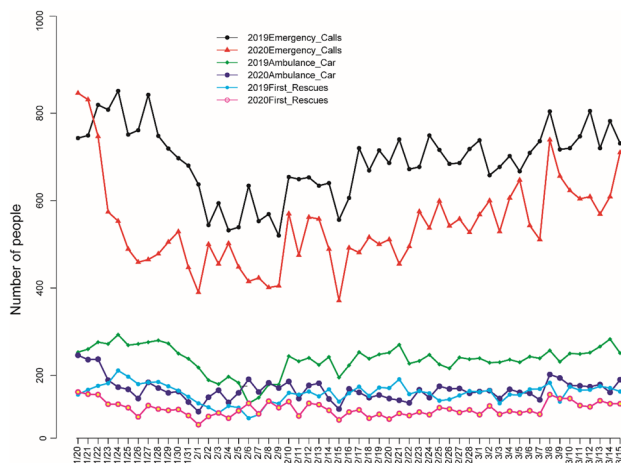
Cardiovascular diseases are a group of disorders of the heart and blood vessels. They include coronary heart disease, cerebrovascular disease, rheumatic heart disease, and other conditions [8].

### Analysis objectives

1. Compare the number of emergency calls, ambulance calls, and rescue calls between the two periods;
2. Compare the number of cardiovascular disease-related emergency calls between the two periods.

### Statistical analysis

Categorical variables are presented as absolute numbers or percentages. Continuous variables are presented as



**Fig. 1** The significance of the numbers of daily emergency, ambulance, and rescue calls during epidemic

mean  $\pm$  standard deviation (SD) and were compared by *t*-test. Time series analysis compared the trend of change.

The R software (Version 3.60) was used for all analyses. Differences were considered statistically significant at  $P < 0.05$ .

## Results

### Comparison between 2019 and 2020 for the total number of emergency, ambulance, and rescue calls

The number of emergency calls during the period in 2020 was 38,027. This number was 21.63% lower than the number during the same period in 2019. The number of ambulance calls had decreased by 29.02%, and the number of rescue calls declined by 22.57% (Table 1).

### Comparison of trends in the number of emergency, ambulance, and rescue calls between 2019 and 2020

Comparing 2019 with 2020, we found that the numbers of daily emergency, ambulance, and rescue calls during the epidemic were significantly lower than the respective numbers during the same period in 2019 (Fig. 1).

### Comparison of the number of cardiovascular disease-related emergency calls between 2019 and 2020

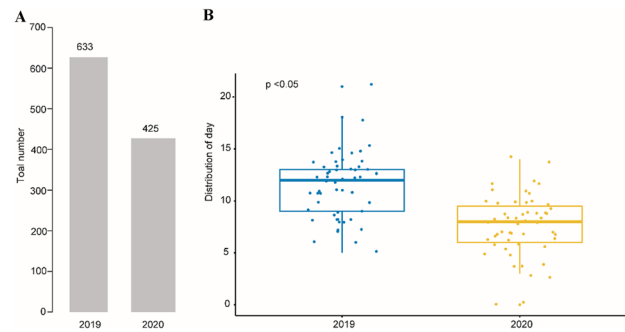
There were 425 cardiovascular disease-related emergency calls during the COVID-19 epidemic, compared to 633 during the same period in 2019, a decrease of 32.86% (Fig. 2A). Figure 2B compares the daily cardiovascular disease-related emergency calls between 2019 and 2020. We found that the number of daily calls in 2019 was significantly higher than in 2020 ( $P < 0.05$ ).

## Discussion

This study showed that the numbers of calls to the HEC for emergency, ambulance, and rescue during the COVID-19 epidemic had decreased significantly compared to the same period

**Table 1** Comparison of the number of emergency, ambulance, and rescue calls

Type	2019 (N)	2020 (N)	Change (N, %)	P
Emergency calls	38,027	29,798	8229 (21.63)	0.04
Ambulances	12,994	9222	3773 (29.02)	0.03
Rescues	8745	6771	1974 (22.57)	0.07



**Fig. 2** **A** Comparison of 425 cardiovascular disease-related emergency calls during the COVID-19 epidemic to 633 during the same period in 2019. **B** Comparison of the daily cardiovascular disease-related emergency calls between 2019 and 2020

in 2019. The decreasing trend in emergency calls for cardiovascular diseases was particularly apparent since January 23, 2020, possibly due to the sharp rise in SARS-CoV-2 infections during the epidemic in China; the gradual recovery of the emergency call numbers for cardiovascular diseases after March 5, 2020, might be related to the progressive stabilization of the epidemic.

Various reasons may have caused the above phenomenon. First, patients delayed calling for emergency treatment because they feared getting infected by SARS-CoV-2. This fear was intensified after the media released news stories such as the one on a non-COVID-19-designated hospital, in which the infection had spread among the inpatients and medical staff because of protective equipment shortage. The general recommendation at the time was to avoid hospitalization for general patients with non-emergency cardiovascular diseases. These patients were encouraged to wait until the epidemic was contained before admitting to the hospital for non-emergency treatments. Patients were terrified of SARS-CoV-2 spread, so they delayed seeking medical help. Many attempted to relieve their symptoms by taking medications and sought help only when they could not bear it any longer. Meanwhile, the community response to out-of-hospital cardiac arrest (OHCA) was altered from March to May 2020, delays in emergency medical services (EMS) response time, less bystander cardiopulmonary resuscitation (CPR), and reduced survival from OHCA in the USA [9]. Second, the HEC joined forces with ten fever clinics in Hangzhou to set up an emergency response procedure under the epidemic situation. Patients suspected of COVID-19 based on fever or other related symptoms and relevant epidemiological history were transferred to a COVID-19-designated treatment hospital by a special ambulance. The first symptoms of these patients may have been of diseases other than those of the respiratory system. This may have prevented them from obtaining professional emergency medical services. On January 25, 2020, Hong Kong reported that the implementation of emergency measures to control the epidemic might prevent people from seeking medical services in a timely manner [5]. It

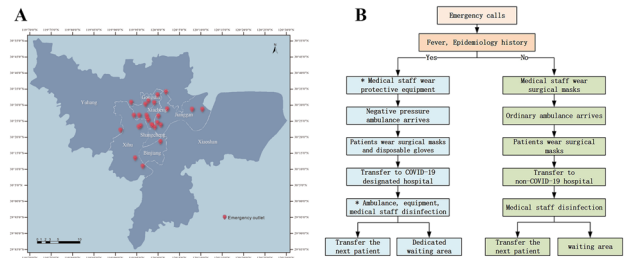
was also reported that the AED attendance rate in Hong Kong had dropped significantly compared to the period before the epidemic [5]. There were also fewer calls to the emergency medical services (EMS) for cardiovascular diseases in Israel [10]. Besides, we showed that the times from symptom onset to the first medical contact (SO-to-FMC), from hospital door entry to first balloon expansion (D-to-B), and catheter room activation in the 2020 group were significantly longer than in the 2019 group for STEMI patients [11].

In response to the above phenomenon, we propose several countermeasures. First, while working to control the epidemic, it is necessary to increase the number of medical staff in community hospitals and carry out multimedia education to the general public. WeChat public accounts and news headlines can be used to draw the public attention by relaying reports of specific ambulance call cases, encouraging people to call an ambulance in emergencies. Second, with the popularization of nucleic acid testing, comprehensive testing of personnel in four professions—education, medical services, public services, and transportation, would gradually reduce people’s anxiety about the travel environment. Medical and health units can quickly determine whether a patient has SARS-CoV-2 infection by checking recent nucleic acid test reports and increase the efficiency of transferring patients to specialized hospitals when needed. Third, Hangzhou was the first city to use the Health Code in China, starting on February 11, 2020. With this application, citizens can dial 120 to the HEC by pressing the “First Aid” key. The emergency center dispatcher can access the identity and location information of the caller in real-time. An emergency ambulance can be dispatched to the scene based on this information. Emergency doctors can view the caller’s health files while on the way to familiarize themselves with the patient’s medical history and health status. This way, they can make better preparations for precise on-site treatment. For critically ill patients, such as those with myocardial infarction, the emergency call center can also direct the information to nearby emergency volunteers through “the city brain emergency volunteer system.” These volunteers can receive accurate information and rush to the scene for preliminary rescue till the ambulance with the professional emergency doctor arrives. These measures increase the probability of critically ill patients getting medical assistance within the “golden five minutes.”

## Conclusion

The number of emergency, ambulance, and rescue calls and cardiovascular disease–related emergency calls to the HEC during the COVID-19 epidemic decreased compared with the same period in 2019. These results show a serious social problem that should attract the attention of the medical community and the government.

## Appendix



**Fig. 3** **A** The Hangzhou Emergency Center includes 25 first-aid outlets. **B** A special transfer process was enacted by the Hangzhou Emergency Center during the COVID-19 epidemic

**Acknowledgements** We are grateful to all the medical staff fighting the COVID-19 epidemic at the front line. We are grateful to the staff members of the Affiliated Hospital of Guizhou Medical University, Zhejiang Academy of Medical Sciences, Hangzhou Medical College, Affiliated Hospital of Hangzhou Normal University, and Basic Medical College of Guizhou Medical University for assisting with field investigation, administration, and data collection.

**Funding** This study was supported by Hangzhou Science and Technology Bureau Fund (No. 20150733Q24; No. 20191203B96; No. 20191203B105; No. 20171334M01), Youth Fund of Zhejiang Academy of Medical Sciences (No. 2019Y009), Medical and Technology Project of Zhejiang Province (No. 2020362651, No. 2021KY890), Clinical Research Fund of Zhejiang Medical Association (No. 2020ZYC-A13), and Hangzhou Health and Family Planning Technology Plan key projects (2017ZD02).

## Declarations

**Ethical approval** None required. All data were supplied and analyzed in an anonymous format, without access to personal identifying information.

**Conflict of interest** The authors declare no competing interests.

## References

1. Maudet L, Sarasin F, Dami F et al (2020) Emergency medical services: COVID-19 crisis. *Rev Med Suisse* 16(691–2):810–814. <https://pubmed.ncbi.nlm.nih.gov/32348041/>
2. Katayama Y, Kiyohara K, Kitamura T et al (2020) Influence of the COVID-19 pandemic on an emergency medical service system: a population-based, descriptive study in Osaka, Japan. *Acute Med Surg* 7(1):e534. <https://doi.org/10.1002/ams2.534>
3. Wong LE, Hawkins JE, Langness S et al (2020) Where are all the patients? Addressing Covid-19 fear to encourage sick patients to seek emergency care. *NEJM Cataly*. <https://catalyst.nejm.org/doi/full/10.1056/CAT.20.0193>
4. Garcia S, Albaghdadi MS, Meraj PM et al (2020) Reduction in ST-segment elevation cardiac catheterization laboratory activations in the United States During COVID-19 Pandemic. *J Am Coll Cardiol* 75(22):2871–2872. <https://doi.org/10.1016/j.jacc.2020.04.011>

5. De Rosa S, Spaccarotella C, Basso C et al (2020) Società Italiana di Cardiologia and the CCU Academy investigators group. Reduction of hospitalizations for myocardial infarction in Italy in the COVID-19 era. *Eur Heart J* 41(22):2083–2088. <https://doi.org/10.1093/eurheartj/ehaa409>
6. Tam CF, Cheung KS, Lam S et al (2020) Impact of Coronavirus Disease 2019 (COVID-19) outbreak on ST-segment-elevation myocardial infarction care in Hong Kong, China. *Circ Cardiovasc Qual Outcomes* 13(4):e006631. <https://doi.org/10.1161/circoutcomes.120.006631>
7. Biscayart C, Angeleri P, Lloveras S et al (2020) The next big threat to global health? 2019 novel coronavirus (2019-nCoV): What advice can we give to travellers?—interim recommendations January 2020, from the Latin-American society for Travel Medicine (SLAMVI). *Travel Med Infect Dis* 33:101567. <https://doi.org/10.1016/j.tmaid.2020.101567>
8. Mensah GA, Roth GA, Fuster V (2019) The global burden of cardiovascular diseases and risk factors: 2020 and beyond. *J Am Coll Cardiol* 74(20):2529–2532. <https://doi.org/10.1016/j.jacc.2019.10.009>
9. Uy-Evanado A, Chugh HS, Sargsyan A et al (2021) Out-of-hospital cardiac arrest response and outcomes during the COVID-19 pandemic. *JACC Clin Electrophysiol* 7(1):6–11. <https://doi.org/10.1016/j.jacep.2020.08.010>
10. Jaffe E, Sonkin R, Strugo R, Zerath E (2020) Evolution of emergency medical calls during a pandemic - An emergency medical service during the COVID-19 outbreak. *Am J Emerg Med* S0735–6757(20):30527–30531. <https://doi.org/10.1016/j.ajem.2020.06.039>
11. Fu XY, Shen XF, Cheng YR et al (2020) Effect of COVID-19 outbreak on the treatment time of patients with acute ST-segment elevation myocardial infarction. *Am J Emerg Med* S0735–6757(20):30833. <https://doi.org/10.1016/j.ajem.2020.09.038>