



Brief Communication

G20 Summit and emergency medical services in Osaka, Japan

Kenta Tanaka,¹ Kosuke Morikawa,² Yusuke Katayama,³  Tetsuhisa Kitamura,¹ 
Tomotaka Sobue,¹ Shota Nakao,⁴ Masahiko Nitta,⁵ Taku Iwami,⁶ Satoshi Fujimi,⁷ Toshifumi Uejima,⁸ Yuji Miyamoto,⁹ Takehiko Baba,¹⁰ Yasumitsu Mizobata,¹¹ Yasuyuki Kuwagata,¹²
Tetsuya Matsuoka,⁴ and Takeshi Shimazu³

¹Department of Social and Environmental Medicine, Graduate School of Medicine, Osaka University, Suita, Japan, ²Graduate School of Engineering Science, Osaka University, Toyonaka, Japan, ³Department of Traumatology and Acute Critical Care, Osaka University Graduate School of Medicine, Suita, Japan, ⁴Rinku General Medical Center, Senshu Trauma and Critical Care Center, Izumisano, Japan, ⁵Department of Emergency Medicine, Osaka Medical and Pharmaceutical University, Takatsuki, Japan, ⁶Kyoto University Health Service, Kyoto, Japan, ⁷Division of Trauma and Surgical Critical Care, Osaka General Medical Center, Osaka, Japan, ⁸Emergency Care Center, Kindai University Hospital, Osaka-Sayama, Japan, ⁹Otemae Hospital, Osaka, Japan, ¹⁰Baba Memorial Hospital, Sakai, Japan, ¹¹Department of Traumatology and Critical Care Medicine, Osaka City University Graduate School of Medicine, Osaka, Japan, and ¹²Department of Emergency and Critical Care Medicine, Kansai Medical University, Hirakata, Japan

Aim: To assess the impact of the Summit on Financial Markets and the World Economy held in Osaka City, Japan (G20 Osaka Summit) on the emergency medical services (EMS) system.

Methods: This study used the ORION database with its population-based registry of emergency patients comprising both ambulance and in-hospital records in Osaka Prefecture, Japan. The G20 Osaka Summit was held in Osaka City from 28 to 29 June, 2019. Changes in the EMS system and traffic regulations in Osaka were made during the period from 27 to 30 June, but we focused on the two summit days as the G20 period. The control periods comprised the same calendar days 1 week before and 1 week after the G20 period. We evaluated differences in the number of emergency transports, difficulties in obtaining hospital acceptance of patients, deaths among hospitalized emergency patients, and ambulance transport times between the two periods.

Results: In total, 2,590 cases in the G20 period and 5,152 cases in the control periods were registered. The relative risk of cases during the G20 versus control periods was 1.01 (0.96–1.05). Significant decreases were observed in the number of traffic accidents as ambulance calls (relative risk = 0.77; 95% confidence interval, 0.64–0.91). There were no significant differences in difficulties in obtaining hospital acceptance or deaths among hospitalized emergency patients between the G20 and control periods. In addition, ambulance transport times during the G20 period were not significantly longer than those in the control periods.

Conclusion: The G20 Osaka Summit did not adversely impact the provision of emergency medical care in the Osaka area.

Key words: Emergency medical care, emergency medical service, G20 summit, mass gathering, traffic regulation

INTRODUCTION

MASS GATHERINGS OFTEN require changes to the emergency medical service (EMS) system and traffic regulations and may adversely affect the provision of

emergency medical care (EMC) in the affected area.¹ For example, a previous study in the United States reported that major marathon dates delayed ambulance scene-to-hospital transport times, and the mortality of patients hospitalized for acute myocardial infarction (AMI) or cardiac arrest increased.²

International conferences at which leaders from different countries gather in the same place also require changes to the EMS system and strict traffic regulations as a part of the security measures. However, no studies, to our knowledge, have focused on the impact of these actions on the provision

Corresponding: Yusuke Katayama MD, PhD, Department of Traumatology and Acute Critical Care, Osaka University Graduate School of Medicine, 2-15 Yamada-Oka, Suita, Osaka 585-0871, Japan. E-mail: orion13@hp-emerg.med.osaka-u.ac.jp. Received 22 Mar, 2021; accepted 15 Apr, 2021

of EMC. In June 2019, the Summit on Financial Markets and the World Economy was held in Osaka City, Japan (G20 Osaka Summit). In this study, we evaluated the influence of the G20 Osaka Summit on ambulance transport times, difficulties in obtaining hospital acceptance of patients, and deaths among hospitalized emergency patients.

METHODS

THIS STUDY USED the database of the population-based registry of emergency patients that comprises both ambulance and in-hospital records managed by the Osaka emergency information Research Intelligent Operation Network (ORION) system, which is operated by Osaka Prefecture and covers all patients transported to critical care centers and emergency hospitals in Osaka Prefecture, Japan. Details of the ORION database and Osaka EMS system were described previously.³ This study enrolled emergency patients transported to medical institutions by ambulance, except for those transported between hospitals. In 2019, the G20 Osaka Summit was held in Osaka City from 28 to 29 June.⁴ Changes in the EMS system and traffic regulations in Osaka Prefecture were applied during the period from 27 to 30 June,⁵ but we focused on the two summit days as the G20 period.

The outcome measures were the number of emergency transports, difficulties in obtaining hospital acceptance (defined as ambulance crews having to make five or more phone calls to hospitals before obtaining hospital acceptance of the patient),⁶ deaths among hospitalized emergency patients at 21 days after hospitalization, and ambulance time courses, such as the time intervals from ambulance call to arrival on scene, from arrival on scene to hospital arrival, and from ambulance call to hospital arrival.

On the basis of previous studies, we used the double-control method,⁷ which allows for near-perfect temporal symmetry between cases and controls and does not create a time imbalance inside each pair, to assess the differences in emergency transport, difficulties in obtaining hospital acceptance, and deaths among hospitalized emergency patients during the G20 and control periods. In accordance with this method, the following two periods were identified: the exposure period occurring on the event dates and the control periods occurring during the same calendar days 1 week before and 1 week after the event dates. We defined the G20 period to be from 28 to 29 June and the control periods to be 21–22 June and 5–6 July. In addition, we focused on the overall area (Osaka City and other cities). In the subgroup analysis, we divided the subjects according to the reason for the ambulance call (traffic accidents, acute diseases, and others). To assess the influence of the G20 Osaka Summit on urgent

conditions, we also analyzed those patients whose diagnosis at hospital arrival was AMI (I21–I23) or stroke (I60–I64) (International Classification of Diseases, 10th Revision codes). Considering the period of changes in the EMS system and traffic regulations in Osaka Prefecture, we also assessed outcomes over 4 days as a sensitivity analysis (the G20 period, 27–30 June; control periods, 20–23 June and 4–7 July).

To assess the differences in the numbers of transports, difficulties in obtaining hospital acceptance, and deaths among hospitalized emergency patients between the G20 and control periods, we calculated relative risks (RRs) and their 95% confidence intervals (CIs) under the assumption that they followed common Poisson distribution. Details of the calculation method were described previously.⁷ Differences in the time intervals between the G20 and control periods were assessed using an unpaired *t*-test. All of the tests were two-tailed, and $P < 0.05$ was considered statistically significant. Statistical analyses were implemented using Stata version 14.0MP (StataCorp, College Station, TX, USA).

RESULTS

IN TOTAL, 2,590 cases in the G20 period and 5,152 cases in the control periods were registered. The RR of all cases during the G20 period versus the control periods was 1.01 (0.96–1.05) (Table 1). Significant decreases were observed in traffic accidents as ambulance calls (RR = 0.77; 95% CI, 0.64–0.91). There were no significant differences in difficulties in obtaining hospital acceptance or deaths among hospitalized emergency patients between the G20 and control periods. Especially in other areas except Osaka City, significant decreases were observed in the number of traffic accidents as ambulance calls (RR = 0.74; 95% CI, 0.60–0.91).

Table 2 shows ambulance time courses during the G20 and control periods. Overall, the time interval from ambulance call to arrival on scene was approximately 7.7 min, and the time interval from ambulance call to hospital arrival was approximately 34.8 min. Although the time interval from ambulance call to hospital arrival shortened in other cities, the time courses were not significantly longer during the G20 period than those during the control periods.

Table 3 shows the number of cases and time intervals for patients whose diagnoses at hospital arrival were AMI or stroke between the G20 and control periods. Compared with the control period, the RRs of the G20 period were 1.19 (95% CI, 0.64–2.21) for AMI and 0.96 (95% CI, 0.72–1.28) for stroke. There were no significant differences in time courses between the groups irrespective of cities.

Table 1. Ambulance calls during the Summit on Financial Markets and the World Economy (G20 Summit: 2 days) in Osaka, Japan, 2019

	G20 period	Control periods	RR	95% CI	P-value
Reason for ambulance call					
Total	2,590	5,152	1.01	(0.96–1.05)	0.819
Osaka City	1,019	1,970	1.03	(0.96–1.12)	0.378
Other cities	1,571	3,182	0.99	(0.93–1.05)	0.683
Traffic accidents	176	460	0.77	(0.64–0.91)	0.003
Osaka City	61	148	0.83	(0.61–1.12)	0.215
Other cities	115	312	0.74	(0.60–0.91)	0.005
Acute diseases	1,908	3,692	1.03	(0.98–1.09)	0.241
Osaka City	765	1,471	1.04	(0.95–1.14)	0.378
Other cities	1,143	2,221	1.03	(0.96–1.11)	0.426
Others	506	1,000	1.01	(0.91–1.13)	0.826
Osaka City	193	351	1.10	(0.92–1.31)	0.280
Other cities	313	649	0.96	(0.84–1.10)	0.602
Number of difficulties in obtaining hospital acceptance	61	96	1.28	(0.93–1.76)	0.134
Osaka City	39	62	1.26	(0.85–1.89)	0.252
Other cities	22	34	1.30	(0.76–2.23)	0.333
Number of deaths among hospitalized emergency patients transported by ambulance	60	103	1.19	(0.86–1.63)	0.295
Osaka City	23	47	1.00	(0.61–1.64)	0.991
Other cities	37	56	1.34	(0.89–2.03)	0.164

G20 period, 28–29 June, 2019; control periods, 21–22 June and 5–6 July, 2019. CI, confidence interval; RR, relative risk.

In addition, as shown in Tables S1–S3, results of outcomes measured over 4 days were almost the same as those measured over 2 days.

DISCUSSION

THE PRESENT STUDY showed no significant deteriorations in ambulance time courses, difficulties in obtaining hospital acceptance, and deaths among hospitalized emergency patients during the G20 period compared with the control periods, and the G20 Osaka Summit had no apparent adverse impacts on the provision of EMC. The impact of mass gatherings on health services has been insufficiently evaluated,⁸ and the ORION database, which covers approximately 8.8 million people, enabled us to evaluate the influence of a large-scale international conference on the EMS system. This is the first such evaluation, and our findings could provide helpful clues for improving health services at mass gatherings.

This study did not find that the changes made to the EMS system and traffic regulations adversely affected the provision of EMC. In addition, we did not observe delays in ambulance time courses or increases in the number of deaths among

hospitalized emergency patients whose diagnoses at hospital arrival were AMI or stroke that especially required emergency procedures. A study in 2017 in the United States focusing on large marathons showed that those hospitalized for AMI or cardiac arrest on the marathon dates had longer ambulance transport times (4.4 min longer) and higher 30-day mortality than those hospitalized on non-marathon dates,² a finding that was inconsistent with ours. Although the definitive reason for this difference is unclear, it might be explained by the thorough proactive measures taken before the G20 Osaka Summit. With the aim of reducing the traffic volume by 50% during the G20 Osaka Summit, the Osaka prefectural government office and police agency thoroughly notified the public of the alterations in the traffic regulations in advance and asked for their cooperation to reduce traffic volumes. As a result, the traffic volume was reduced by 51.2%⁹ and the number of traffic accidents as ambulance calls dropped by 23%, as indicated in this study. Decreases in the number of traffic accidents and shorter hospital arrival times were observed in other areas except Osaka City. Many workers might have hesitated to commute by car to Osaka City, and the decreased traffic volume might have led to the shortening of hospital arrival times. Importantly, various proactive

Table 2. Ambulance time courses during the Summit on Financial Markets and the World Economy (G20 Summit: 2 days) in Osaka, Japan, 2019

	G20 period Mean ± SD	Control periods Mean ± SD	P-value
Reason for ambulance call: Total			
Time interval from ambulance call to arrival on scene (min)	7.69 ± 2.54	7.75 ± 2.66	0.294
Osaka City	7.73 ± 2.57	7.74 ± 2.59	0.928
Other cities	7.66 ± 2.51	7.76 ± 2.70	0.206
Time interval from arrival on scene to hospital arrival (min)	26.93 ± 11.41	27.18 ± 11.52	0.352
Osaka City	26.97 ± 12.83	26.63 ± 12.59	0.492
Other cities	26.90 ± 10.39	27.53 ± 10.79	0.057
Time interval from ambulance call to hospital arrival (min)	34.61 ± 11.91	34.94 ± 12.07	0.263
Osaka City	34.70 ± 13.27	34.37 ± 13.05	0.519
Other cities	34.56 ± 10.94	35.29 ± 11.41	0.036
Reason for ambulance call: Traffic accidents			
Time interval from ambulance call to arrival on scene (min)	7.97 ± 3.12	7.88 ± 3.05	0.748
Osaka City	8.13 ± 3.23	8.01 ± 3.67	0.818
Other cities	7.88 ± 3.07	7.82 ± 2.71	0.843
Time interval from arrival on scene to hospital arrival (min)	26.66 ± 11.22	27.29 ± 11.36	0.534
Osaka City	27.77 ± 13.37	26.18 ± 13.27	0.432
Other cities	26.08 ± 9.91	27.82 ± 10.32	0.119
Time interval from ambulance call to hospital arrival (min)	34.63 ± 11.62	35.17 ± 11.91	0.609
Osaka City	35.90 ± 13.08	34.18 ± 13.60	0.402
Other cities	33.96 ± 10.77	35.63 ± 11.01	0.161
Reason for ambulance call: Acute diseases			
Time interval from ambulance call to arrival on scene (min)	7.66 ± 2.42	7.69 ± 2.58	0.639
Osaka City	7.69 ± 2.43	7.68 ± 2.44	0.953
Other cities	7.64 ± 2.41	7.70 ± 2.67	0.524
Time interval from arrival on scene to hospital arrival (min)	26.32 ± 10.86	26.55 ± 10.94	0.446
Osaka City	25.82 ± 11.77	25.63 ± 11.24	0.718
Other cities	26.66 ± 10.21	27.17 ± 10.70	0.185
Time interval from ambulance call to hospital arrival (min)	33.98 ± 11.36	34.25 ± 11.53	0.407
Osaka City	33.50 ± 12.24	33.31 ± 11.80	0.721
Other cities	34.30 ± 10.71	34.86 ± 11.30	0.160
Reason for ambulance call: Others			
Time interval from ambulance call to arrival on scene (min)	7.70 ± 2.73	7.93 ± 2.73	0.132
Osaka City	7.78 ± 2.86	7.87 ± 2.67	0.691
Other cities	7.66 ± 2.66	7.96 ± 2.76	0.112
Time interval from arrival on scene to hospital arrival (min)	29.30 ± 13.06	29.45 ± 13.25	0.830
Osaka City	31.27 ± 15.53	31.01 ± 16.21	0.854
Other cities	28.08 ± 11.12	28.61 ± 11.26	0.492
Time interval from ambulance call to hospital arrival (min)	37.00 ± 13.64	37.38 ± 13.69	0.612
Osaka City	39.05 ± 16.07	38.88 ± 16.46	0.910
Other cities	35.74 ± 11.74	36.57 ± 11.87	0.309

G20 period, 28–29 June, 2019; control periods, 21–22 June and 5–6 July, 2019.
SD, standard deviation.

measures, including changes in the EMS system, were taken by governments, fire departments, and hospitals in Osaka.¹⁰ However, the changes to the EMS system and strict traffic

regulations did not adversely affect ambulance time courses, difficulties in obtaining hospital acceptance, or deaths among hospitalized emergency patients.

Table 3. Acute myocardial infarction (AMI) and stroke and related ambulance time courses during the Summit on Financial Markets and the World Economy (G20 Summit: 2 days) in Osaka, Japan, 2019

	G20 period	Control periods	RR	95% CI	P-value
Reason for ambulance call					
Acute diseases (AMI)	16	27	1.19	(0.64–2.21)	0.577
Osaka City	11	12	1.83	(0.81–4.15)	0.146
Other cities	5	15	0.68	(0.25–1.87)	0.456
Acute diseases (stroke)	70	146	0.96	(0.72–1.28)	0.773
Osaka City	28	70	0.80	(0.52–1.24)	0.319
Other cities	42	76	1.11	(0.76–1.61)	0.603
Reason for ambulance call: Acute diseases (AMI)					
Time interval from ambulance call to arrival on scene (min)	8.06 ± 2.35	8.37 ± 2.24			0.671
Osaka City	8.09 ± 2.12	8.67 ± 2.42			0.552
Other cities	8.00 ± 3.08	8.13 ± 2.13			0.915
Time interval from arrival on scene to hospital arrival (min)	25.50 ± 11.47	24.22 ± 6.56			0.643
Osaka City	26.91 ± 13.39	22.00 ± 4.57			0.244
Other cities	22.40 ± 5.22	26.00 ± 7.47			0.335
Time interval from ambulance call to hospital arrival (min)	33.56 ± 10.22	32.59 ± 7.41			0.721
Osaka City	35.00 ± 11.92	30.67 ± 5.60			0.270
Other cities	30.40 ± 4.34	34.13 ± 8.46			0.362
Reason for ambulance call: Acute diseases (stroke)					
Time interval from ambulance call to arrival on scene (min)	7.47 ± 3.08	7.73 ± 2.59			0.526
Osaka City	8.18 ± 3.54	7.49 ± 2.68			0.296
Other cities	7.00 ± 2.68	7.95 ± 2.50			0.057
Time interval from arrival on scene to hospital arrival (min)	25.47 ± 9.85	27.48 ± 12.65			0.244
Osaka City	25.68 ± 12.24	27.77 ± 16.05			0.536
Other cities	25.33 ± 8.04	27.21 ± 8.50			0.244
Time interval from ambulance call to hospital arrival (min)	32.94 ± 10.45	35.21 ± 13.69			0.223
Osaka City	33.86 ± 12.44	35.26 ± 17.03			0.694
Other cities	32.33 ± 8.99	35.16 ± 9.78			0.125

Data are shown as number of cases or mean ± standard deviation. G20 period, 28–29 June, 2019; control periods, 21–22 June and 5–6 July, 2019. CI, confidence interval; RR, relative risk; SD, standard deviation.

If a mass gathering such as the G20 summit had caused negative impacts on the provision of EMC, it would be necessary for us to reconsider the allocation of emergency medical resources, such as by increasing the number of ambulances and medical staff. However, our results showed that by carefully enacting proactive measures for mass gatherings, the provision of EMC can remain effective. As of April 2021, the preparation of EMS and disaster medical response system for the 2020 Tokyo Olympic and Paralympic Games (due to start 23 July, 2021) has been steadily underway,¹¹ and our results suggested that careful measures, like those implemented for the G20 Osaka Summit, would help maintain the EMS system during mass gatherings such as the Olympics.

The present study has some limitations. First, details of the changes made to the EMS system during the G20 period in Osaka Prefecture were not available because they have not been disclosed due to national security interests. Second, our

results might not be generalized to other countries because this study focused solely on the G20 Summit in Osaka, Japan.

CONCLUSION

THE G20 SUMMIT held in Osaka did not adversely affect the provision of EMC. Our results could be helpful as fundamental material for improving health services during mass gatherings.

ACKNOWLEDGMENTS

THE OSAKA PREFECTURE Government greatly appreciates all of the EMS personnel and concerned physicians in Osaka Prefecture and the Osaka Medical Association for their indispensable cooperation and support. This study was supported by the Ministry of Education, Culture,

Sports, Science and Technology (grant no. 18H02902) and the Ministry of Health, Labour, and Welfare (grant no. 19LA2002). This article was supported by the Clinical Investigator's Research Project of the Osaka University Graduate School of Medicine.

DISCLOSURES

Approval of the research protocol: The protocol was approved by the Ethics Committee of Osaka University as the corresponding institution (No. 15003).

Informed consent: The requirement for informed consent of patients was waived.

Registry and the registration no. of the study/trial: N/A.

Animal studies: N/A.

Conflict of interest: None.

REFERENCES

- Chalfin DB, Trzeciak S, Likourezos A, Baumann BM, Dellinger RP. DELAY-ED study group. Impact of delayed transfer of critically ill patients from the emergency department to the intensive care unit. *Crit. Care Med.* 2007; 35: 1477–83.
- Jena AB, Mann NC, Wedlund LN, Olenski A. Delays in emergency care and mortality during major U.S. marathons. *N. Engl. J. Med.* 2017; 376: 1441–50.
- Okamoto J, Katayama Y, Kitamura T *et al.* Profile of the ORION (Osaka emergency information Research Intelligent Operation Network system) between 2015 and 2016 in Osaka, Japan: a population-based registry of emergency patients with both ambulance and in-hospital records. *Acute Med. Surg.* 2018; 6: 12–24.
- G20 2019 JAPAN. SUMMIT SCHEDULE. [cited 9 Feb 2021]. Available from: https://www.mofa.go.jp/policy/economy/g20_summit/osaka19/en/summit/schedule/ (in Japanese).
- Osaka Prefectural Police. Request for cooperation in the G20 Osaka Summit. [cited 9 Feb 2021]. Available from: <https://www.police.pref.osaka.lg.jp/result.html?q=G20> (in Japanese).
- Katayama Y, Kitamura T, Kiyohara K *et al.* Factors associated with the difficulty in hospital acceptance at the scene by emergency medical service personnel: a population-based study in Osaka City, Japan. *BMJ Open.* 2016; 6: e013849.
- Sado J, Morikawa K, Hattori S *et al.* Full moon and out-of-hospital cardiac arrest in Japan—population-based, double-controlled case series analysis. *Circ. Rep.* 2019; 1: 212–8.
- Ranse J, Hutton A, Keene T *et al.* Health service impact from mass gatherings: a systematic literature review. *Prehosp. Disaster Med.* 2017; 32: 71–7.
- G20 Osaka Summit official records. The traffic regulation measures. [cited 9 Feb 2021]. Available from: https://www.city.osaka.lg.jp/contents/wdu010/digitalbook/keizai/2019-g20-osaka/#target/page_no=147 (in Japanese).
- A study about the construction of EMS system at international conferences (G20 Summit) held in urban cities. [cited 9 Feb 2021]. Available from: <https://mhlw-grants.niph.go.jp/niph/search/NIDD00.do?resrchNum=201806006A> (in Japanese).
- Morimura N, Mizobata Y, Sugita M *et al.* Medicine at mass gatherings: current progress of preparedness of emergency medical services and disaster medical response during 2020 Tokyo Olympic and Paralympic Games from the perspective of the Academic Consortium (AC2020). *Acute Med. Surg.* 2021; 8: e626.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Table S1. Ambulance calls during the Summit on Financial Markets and the World Economy (G20 Summit: 4 days) in Osaka, Japan.

Table S2. Ambulance time courses during the Summit on Financial Markets and the World Economy (G20 Summit: 4 days) in Osaka, Japan

Table S3. Acute myocardial infarction (AMI) and stroke and related ambulance time courses during the Summit on Financial Markets and the World Economy (G20 Summit: 4 days) in Osaka, Japan.