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Analysis of Transfer Distance of Emergency Stroke Cases in Kumamoto, Japan

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Abstract

In this article, we have investigated the actual situation of transfer distance of emergency cases by pathology base (neurological, cardiologic, pediatric and injury cases), based on the DPC data of Kumamoto prefecture. We have extracted 36,490 emergency cases of Kumamoto prefecture from the DPC database (1st July 1 2010 to 31st December 2010). Using the master table for the distance between each hospitals and each residential place represented by ZIP code in Japan, we have estimated the transfer distance of each emergency case and calculated the average distances for each of 5 categories (neurological, cardiologic, pediatric and injury cases) for each health care region (HCR). In the case of neurological cases, average, standard deviation (SD) and Coefficient of variance (CV) were 11.9Km, 10.3Km and 25.1% for Kumamoto total. There was a wide variation for average transfer distance from 5.9Km (Kumamoto HCR) to 30.0 km (Kamoto HCR). The situation is similar for cardiac cases, injury cases and pediatric cases. In order to solve this access problem of emergency care, the governance power of Regional Health Care Plan must be strengthened.

Key words: DPC, regional health care plan, emergency care

❖Introduction

Most of the citizens regard that an appropriate system for emergency care is one of the most important social infrastructures for their community. There have been reported many problems for the emergency care in Japan, i.e., denial of acceptance because of insufficient capacity. The Ministry of Health, Labour and Welfare (MHLW) has tried to ameliorate the situation by setting financial incentive for emergency care. However, as the Japanese health system allows a considerable freedom for choice of specialty and working place for medical doctors, it has been very difficult to realize an appropriate resource allocation for emergency care.

In other countries, such as France, they have a sophisticated information system for emergency care and use it for regional planning of emergency care[1]. In Japan, we need such an information system for better regional planning of emergency care. This kind of information will be important in order to have an

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objective discussion with medical association and ask them to ameliorate the current situation.

There have been several reports for actual situation of emergency care in Japan[2,3]. However, there have been few reports that investigated the situation by pathology base. In the DPC (Diagnosis Procedure Combination; the Japanese original casemix system) project, MHLW includes the ZIP code of patient in the discharge summary since 2010. This makes it possible to estimate the transfer distance of each emergency case.

Using the DPC data of Kumamoto prefecture, we have investigated the actual situation of transfer distance of emergency cases by pathology base (neurological, cardiologic, pediatric and injury cases).

❖Materials and Method

Data for this study were extracted from the Japanese inpatient administrative claims database, the DPC database[4]. The database was originally instituted as part of a national project to develop a Japanese casemix classification system, which has been ongoing since 2002. The number of collected cases in the database is approximately three million. The database contains: i) demographic characteristics of patient, such as birth date, sex, and ZIP code; iii) main diagnoses, preexisting comorbidities at admission and complications after admission which are coded with ICD-10 codes; iii) surgical procedures coded with Japanese original codes (K-codes), operation time and the performed date; vi) discharge status (dead or alive); and v) a list of drugs and blood products used and the dates of use.

For this study, we have extracted 36,490 emergency cases of Kumamoto prefecture from the DPC database (1st July 1 2010 to 31st December 2010). One of our research team (Ishikawa, KB) has developed a master table for the distance between each hospitals and each residential place represented by ZIP code in Japan.

Using these datasets, we have estimated the transfer distance of each emergency case and calculated the average distances for each of 5 categories (neurological, cardiologic, pediatric and injury cases). Statistical analyses were conducted using IBM SPSS version 19.0 (IBM SPSS, Armonk, NY, USA).

Study approval was obtained from the Institutional Review Boards and the Ethics Committee of The Tokyo Medical and Dental University. Given the anonymous nature of the data collection process, informed consent was not required.

❖Results

Figure 1 shows the map of Kumamoto prefecture with its 11 Health Care Regions (HCR). According to the Health care law, the emergency care must be provided within each HCR.

Table 1 shows the results of neurological cases. During the studied period, 1692 cases were transferred to the DPC hospitals in Kumamoto prefecture. Average, Standard deviation (SD) and Coefficient of variance (CV) were 11.9Km, 10.3 km and 25.1% for Kumamoto total. The average distance is below 10Km for Kumamoto (5.9 km), Yatsushiro (8.4 km) and Kuma.HCR (9.2 km). As shown in Figure 1, most of the acute care hospitals locate at Kumamoto HCR (prefecture capitol). There is a large scale core hospital for Yatsushiro (Kumamoto Rosai Hospital; 410 beds) and Kuma.(Hitoyoshi General Hospital; 274 beds). In other areas, there exist small and medium size acute care hospitals that cover wide areas with relatively small number of medical staffs. The longest transfer distance was observed for Kamoto (30.0 km), followed by Ariake (25.1 km), Amakusa (20.9 km), Uki (18.9 km), Kikuchi (16.7 km) and Ashikita (15.3 km). The difference among the HCRs was statistically significant (P<0.01; ANOVA).

Table 2 shows the results of cardiac cases. There were 1,220 cases in Kumamoto prefecture. Average, SD and CV were 11.7 km, 10.2 km and 29.1% for Kumamoto total. The average distance is below 10 km for Kumamoto (5.9 km), Yatsushiro (8.3 km) and Kuma.HCR (8.1 km). The longest transfer distance was observed for Kamoto (29.2 km), followed by Ariake (23.9 km), Amakusa (23.4 km), Uki (19.1 km), Kikuchi (18.6 km) and Ashikita (15.9 km). The difference among the HCRs was statistically significant (P<0.01; ANOVA).

Table 3 shows the results of injury, burn and intoxication cases. There were 2122 cases in Kumamoto prefecture. Average, SD and CV were 10.9 km, 9.8 km and 21.2% for Kumamoto total. The average distance is below 10 km for Kumamoto (5.9 km), Yatsushiro (7.7 km) and Kuma.HCR (8.2 km). The longest transfer distance was observed for Kamoto (28.6 km), followed by Ariake (21.3 km), Amakusa (17.1 km), Uki (16.7 km), Ashikita (14.1 km) and Kikuchi

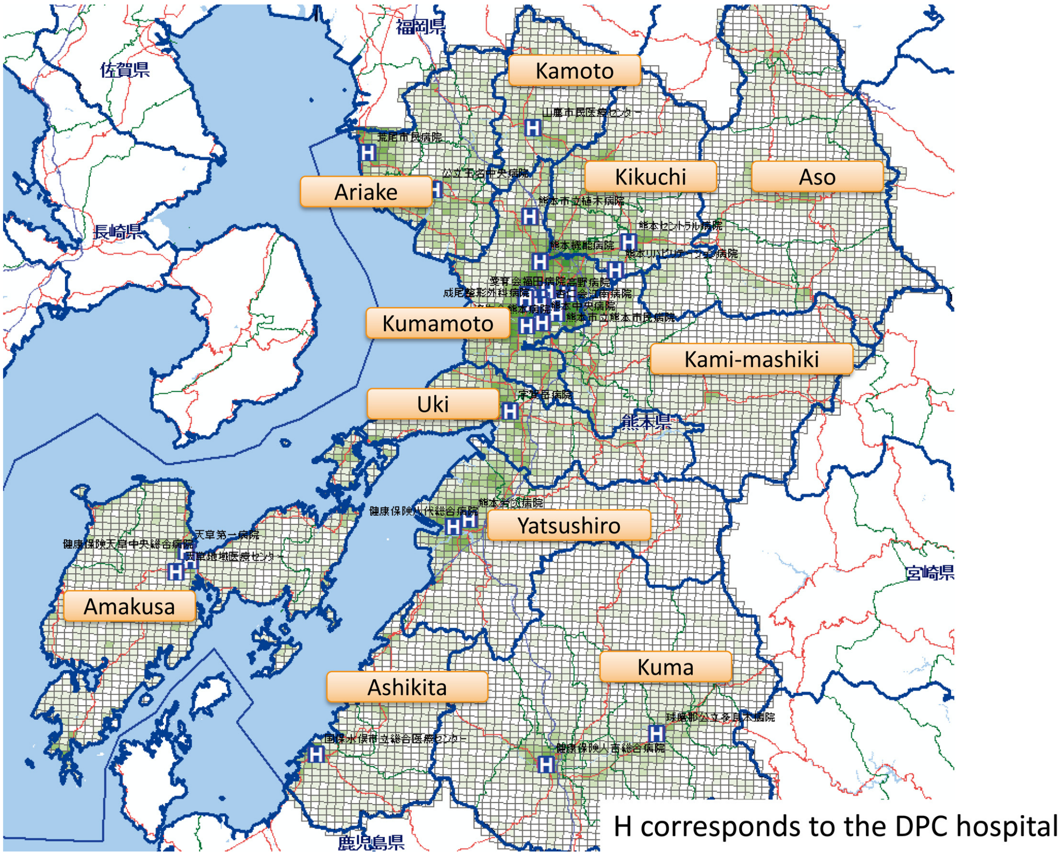

Figure 1 Health care regions of Kumamoto prefecture

Table 1 Transfer distance of emergency cases of Kumamoto prefecture by HCR (Neurological disorders including stroke)

HCR	N	Average	SD	CV	95% of CI	Min	Max
4301 Kumamoto	745	5.9	4.1	15.2%	5.6–6.2	.6	23.2
4302 Uki	155	18.9	7.7	62.0%	17.6–20.1	3.3	40.6
4303 Ariake	64	25.1	9.2	115.0%	22.8–27.4	4.1	41.9
4304 Kamoto	19	30.0	3.3	75.0%	28.4–31.5	23.6	35.5
4305 Kikuchi	133	16.7	7.1	61.4%	15.5–17.9	1.5	38.5
4308 Yatsushiro	186	8.4	7.3	53.4%	7.4–9.5	.6	38.1
4309 Ashikita	53	15.3	14.4	198.0%	11.3–19.2	.5	39.9
4310 Kuma	96	9.2	9.6	98.0%	7.3–11.2	.4	42.5
4311 Amakusa	119	20.9	13.6	124.5%	18.4–23.4	.8	47.2
Kumamoto prefecture	1692	11.9	10.3	25.1%	11.4–12.3	.4	49.6

HCR: Health care region, SD: Standard deviation, CV: Coefficient of variance, CI: Confident interval.

(13.6 km). The difference among the HCRs was statistically significant ($P<0.01$; ANOVA).

Table 4 shows the results of pediatric cases. There were 332 cases in Kumamoto prefecture. Average, SD and CV were 12.2 km, 10.6 km and 57.9% for Kumamoto total. The average distance is below 10 km for Kumamoto (6.4 km) and Kuma.HCR (8.9 km). The longest transfer distance was observed for Kamoto (29.7 km), followed by Ariake (27.0 km), Uki (21.2 km), Ashikita (20.3 km), Kikuchi (15.2 km), Amakusa (15.1 km) and Yatsushiro (10.5 km). The difference among the HCRs was statistically significant ($P<0.01$; ANOVA).

Table 2 Transfer distance of emergency cases of Kumamoto prefecture by HCR (Cardiac disorders)

HCR	N	Average	SD	CV	95% of CI	Min	Max
4301 Kumamoto	568	5.9	3.9	16.4%	5.6–6.2	.6	24.0
4302 Uki	104	19.1	8.2	80.6%	17.5–20.7	3.0	41.0
4303 Ariake	47	23.9	10.2	148.1%	20.9–26.9	4.4	40.2
4304 Kamoto	16	29.2	2.1	51.7%	28.1–30.3	25.7	33.0
4305 Kikuchi	82	18.6	7.5	83.0%	16.9–20.2	3.3	38.5
4308 Yatsushiro	129	8.3	7.3	64.3%	7.0–9.6	.2	36.9
4309 Ashikita	28	15.9	14.4	271.6%	10.3–21.5	.7	40.3
4310 Kuma	64	8.1	5.2	65.4%	6.8–9.4	.5	20.5
4311 Amakusa	94	23.4	12.9	133.3%	20.8–26.1	3.5	47.2
Kumamoto prefecture	1220	11.7	10.2	29.1%	11.1–12.3	.2	47.2

HCR: Health care region, SD: Standard deviation, CV: Coefficient of variance, CI: Confident interval.

Table 3 Transfer distance of emergency cases of Kumamoto prefecture by HCR (Injury, burn and intoxication)

HCR	N	Average	SD	CV	95% of CI	Min	Max
4301 Kumamoto	935	5.9	4.2	13.7%	5.6–6.1	.6	32.2
4302 Uki	202	16.7	9.1	64.4%	15.4–17.9	.4	44.5
4303 Ariake	64	21.3	9.9	123.3%	18.9–23.8	4.4	42.7
4304 Kamoto	29	28.6	4.9	90.9%	26.7–30.5	16.7	35.7
4305 Kikuchi	149	13.6	7.7	62.9%	12.4–14.9	1.5	32.5
4308 Yatsushiro	252	7.7	6.7	41.9%	6.9–8.6	.6	38.7
4309 Ashikita	89	14.1	11.5	121.4%	11.7–16.5	.1	42.7
4310 Kuma	102	8.2	8.9	88.1%	6.5–10.0	.4	41.8
4311 Amakusa	126	17.1	12.8	113.6%	14.8–19.3	.7	47.2
Kumamoto prefecture	2122	10.9	9.8	21.2%	10.4–11.3	.1	51.3

HCR: Health care region, SD: Standard deviation, CV: Coefficient of variance, CI: Confident interval.

Table 4 Transfer distance of emergency cases of Kumamoto prefecture by HCR (Pediatrics)

HCR	N	Average	SD	CV	95% of CI	Min	Max
4301 Kumamoto	154	6.4	4.3	34.9%	5.7–7.1	.7	31.1
4302 Uki	29	21.2	7.4	138.1%	18.4–24.1	5.7	40.2
4303 Ariake	14	27.0	11.2	299.4%	20.5–33.4	8.2	41.5
4304 Kamoto	less than 10	29.7	3.6	161.3%	25.2–34.1	24.0	32.9
4305 Kikuchi	29	15.2	7.7	142.5%	12.3–18.1	2.8	27.2
4308 Yatsushiro	32	10.5	10.3	181.8%	6.8–14.2	.8	39.0
4309 Ashikita	less than 10	20.3	12.5	440.6%	9.9–30.7	1.7	40.0
4310 Kuma	14	8.9	6.4	171.5%	5.2–12.6	1.5	22.7
4311 Amakusa	24	15.1	13.9	283.2%	9.3–21.0	2.1	44.7
Kumamoto prefecture	332	12.2	10.6	57.9%	11.0–13.3	.7	47.6

HCR: Health care region, SD: Standard deviation, CV: Coefficient of variance, CI: Confident interval.

❖Discussion

Several limitations must be considered when interpreting our results. First, we lacked precise information about severity of emergency cases. If severe cases are selectively transferred to urban areas hospital from the remote areas, the transfer distance might be systematically large for the rural HCRs. Second, the current data does not include information of outpatient emergency services. Considering these limitations, we would like to discuss the implication of our research findings.

This study has clarified that there is a wide regional variation in accessibility for emergency care even in the same prefecture. The shortage of medical doctors in remote areas has been cited as a reason of this situation. In Kumamoto prefecture, there is a faculty of medicine at Kumamoto University. This faculty has one of the oldest medical schools in Japan with more than 10,000 graduates up to now. Before 2004, as the medical university was playing a strong governance role of physician's supply, the situation was better.

Japanese medical school education program is six years. After graduation and national board examination, the Japanese medical graduates start to work in hospitals as trainee. Before 2004, in most cases, they choose to work in specialized departments of University hospitals as well as their affiliated local hospitals. Therefore, University hospitals serve as provider of physicians to regional hospitals besides providing care. For example, in Fukuoka prefecture 44% of physicians working in local non-University hospitals were send from University hospital specialty departments[5]. Thus, departments of University hospitals kept large influence on physicians' supply.

From 2004, new postgraduate medical training program become mandatory for all medical school graduates through which they are requested to obtain primary health care skill. It was also aimed to increase fluidity of the postgraduate looking for training position and thus destruct the influence of University hospitals on local health supply. However, increasing fluidity of young physician may also worsen the physicians supply in rural areas where the positions are not attractive to young doctors and over supply of physician in the urban area.

Another reason of imbalance of physicians' supply between urban and remote areas is the principle of free practice in Japan. In order to regulate the physicians' supply, the French government set the admission number for each specialty and region (training hospital), even though France has a long tradition of free practice[6]. The number of admission for each training hospital is determined by the balance of needs and supply of each region annually. This kind of regulation must be adopted in Japan.

In order to solve this imbalance of physicians' supply, there must be a governance tool of physicians' supply. The Regional Health Care Plan (RHCP) that is mandatory established by prefectural government every 5 years is such a tool. However, the current Japanese RHCP only regulates the number of beds for each HCR. There is no regulation for the number of physicians by specialty, the number of high-tech medical devices and equipment, and emergency services. This caused the unbalanced situation between needs and supply in the Japanese health market. For example, there are 70 CT scanners per 1,000,000 inhabitants in Japan[7]. Compared with the number of USA (23), this figure strongly suggests the inappropriate resource allocation in Japan. In the case of the French Regional Health Care Plan (SROS), the emergency services are organized in the way that all citizens can access to the emergency services within 30 minutes. Furthermore, it sets the criteria for human resources and equipment in order to have an emergency service. For this reason, it is not the case in France that many small and medium size hospitals compete for accepting the emergency cases in the urban areas. The emergency medical service is a core part of reliable health system. It is not suitable for depending on competition among the hospitals. It must be more programed services. The governance of RHCP must be strengthened.

Hospitals in remote areas are also required to make effort to attract young doctors. In the case of Kumamoto, Kuma area is one of the very remote areas. However, they keep relatively enough number of young doctors. According to the personal interview with the director of Hitoyoshi General Hospital (Dr. Kimura), they continue to make efforts to ameliorate the training environment and working condition under the good communication with the Kumamoto University. They accept clinical clerkship students (undergraduate) from Kumamoto University and treat them with much hospitality. Because of these efforts, every year they can have the enough number of candidates for post-graduate training.

As Niki has suggested, the Japanese medical professionals must reconsider the social role that is required by the community[8]. The objective information about the current situation about emergency care is an important source for appropriate resource allocation. It is strongly recommended that MHLW systematizes the data analysis like the current study and open the results for the public.

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