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Original Article

Emergency transport for Japanese children with non-life-threatening conditions

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Abstract ***Background***: Emergency rooms in Japan are overused by children with non-life-threatening conditions, and utilization of emergency transport for children in Japan should also be analyzed.

Methods: Utilization rates of emergency transport per 1000 live births or 1000 children from 1985 to 2008 in Japan were calculated from national data of emergency transport, child population and annual live births.

Results: Emergency transport per 1000 preschool-age (28 days-6 years old) and school-age (7–17 years old) children rose, and that for newborn babies (0–27 days old) per 1000 live births grew from 1985 to 2008. The utilization rates, however, did not grow homogeneously among the different severity groups. The rates of transport for children who needed no hospitalization or those for children who needed inpatient care <3 weeks rose in each of the three age groups. The rates for patients who were dead on arrival or who needed hospitalization ≥3 weeks, however, declined in all the age groups.

Conclusions: Emergency transport per 1000 live births or 1000 children grew from 1985 to 2008. The utilization rates, however, did not grow homogeneously among different severity groups. The rates for children with non-life-threatening conditions rose, while those for children dead on arrival or with severe conditions declined in the past two decades.

Key words emergency transport, Japan, severity.

In the past 20 years, the number of children who visited emergency rooms (ERs) at night and during holidays increased in Japan.[1] Only 6% of them, however, needed inpatient care.[2] In contrast, the rapid growth of utilization of emergency transport, mostly requested by the elderly, resulted in an extended arrival time of ambulance teams to patients and medical facilities.[3,4]

The child population in Japan under 15 years old decreased from 26 042 000 in 1985 to 17 176 000 in 2008,[5,6] and the change in the number of emergency transports for patients below 18 years old, from 438 912 in 1985 to 445 548 in 2008, was not significant.[4] Therefore, it is clear that the utilization rate (utilization number/population) of emergency transport for Japanese children rose in the past two decades. Did the incidence of illness and injuries in Japanese children rise? Or did the severity of illness of transported children change in Japan? In order to answer these questions, we analyzed the utilization rates of emergency transport for newborn babies, preschool- and school-aged children with different severity conditions in the past two decades.

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Methods

This study is an observation of emergency transport per 1000 live births or 1000 children from 1985 to 2008. The number of emergency transports for children was drawn from the reports annually published by Fire and Disaster Management Agency (FDMA).[4] Child population data were obtained from Population Estimates[5] and Population Census[6] published by Ministry of Internal Affairs and Communications. Live birth data were from Vital Statistics published by Ministry of Health, Labour, and Welfare.[7]

Over the study period of 1985–2008, no fee was charged for an emergency transport in Japan. Ambulance teams have a duty to provide transport services on request even for patients with non-life-threatening conditions. Therefore, the need for emergency transport was not based on user's income, subsequent need for admission or duration of hospitalization, but depended only on the patient's chief complaint.

Information on all alarms was documented in incident reports by ambulance teams and entered into a computerized management information system and summarized by FDMA.[4] In the case of responses for which services were rendered, the reporting system required a comprehensive, standard account of the patient's personal characteristics, physical condition, treatment, time to scene and destination, and duration of hospitalization estimated by physicians on arrival at medical facilities.

Children transported by ambulance teams were divided into three age groups in the FDMA reports: newborn babies, 0–27 days old; preschool children, 28 days–6 years old; and school children, 7–17 years old.[4] In Population Estimates[5], data on only Japanese children aged 0–4 years, 5–9 years, 10–14 years, and 15–19 years are given. Therefore, the numbers of preschool- (28 days–6 years old) and school-aged children (7–17 years old) were approximated as follows:

$$\text{Preschool children (28 days}-\text{6 years old)} = (0-4\text{ years old}) + (5-9\text{ years old}) \times (2/5), \text{ and}$$

$$\text{School children (7}-\text{17 years old)} = (5-9\text{ years old}) \times (3/5) + (10-14\text{ years old}) + (15-19\text{ years old}) \times (3/5).$$

The severity of transported patients was divided into four categories according to duration of hospitalization estimated by physicians on arrival: "dead", dead on arrival (DOA); "severe", hospitalization for ≥3 weeks; "moderate", inpatient care <3 weeks; "mild", outpatient care only.[4]

Emergency transport for newborn babies per 1000 annual live births, and per 1000 preschool-aged (28 days–6 years old) and school-aged children (7–17 years old) was calculated separately for the four severity groups. Because the Japanese population for each age was confirmed only in Population Census[6] surveyed every 5 years, we calculated the odds ratios (OR) and the confidence intervals (CI; $P = 0.95$) of transportation rates in 2005 compared with the year of 1985.

Results

Transportation rates for patients with mild conditions are given in Figure 1(a). Compared with the year of 1985, the OR (95%CI) for 2005 were 2.46 (2.31–2.62) for newborn babies (0–27 days old), 2.10 (2.08–2.11) for preschool-aged children (28 days–6 years old), and 1.80 (1.79–1.82) for school-aged children (7–17 years old), respectively (Table 1).

Transportation rates for patients with moderate conditions are given in Figure 1(b). Compared with the year of 1985, the OR (95%CI) for 2005 were 1.66 (1.61–1.71) for newborn babies, 1.68 (1.66–1.70) for preschool-aged children, and 1.04 (1.03–1.05) for school-aged children, respectively (Table 2).

Transportation rates for patients with severe conditions are shown in Figure 1(c). Compared with the year of 1985, the OR (95%CI) for 2005 were 0.68 (0.65–0.72) for newborn babies,

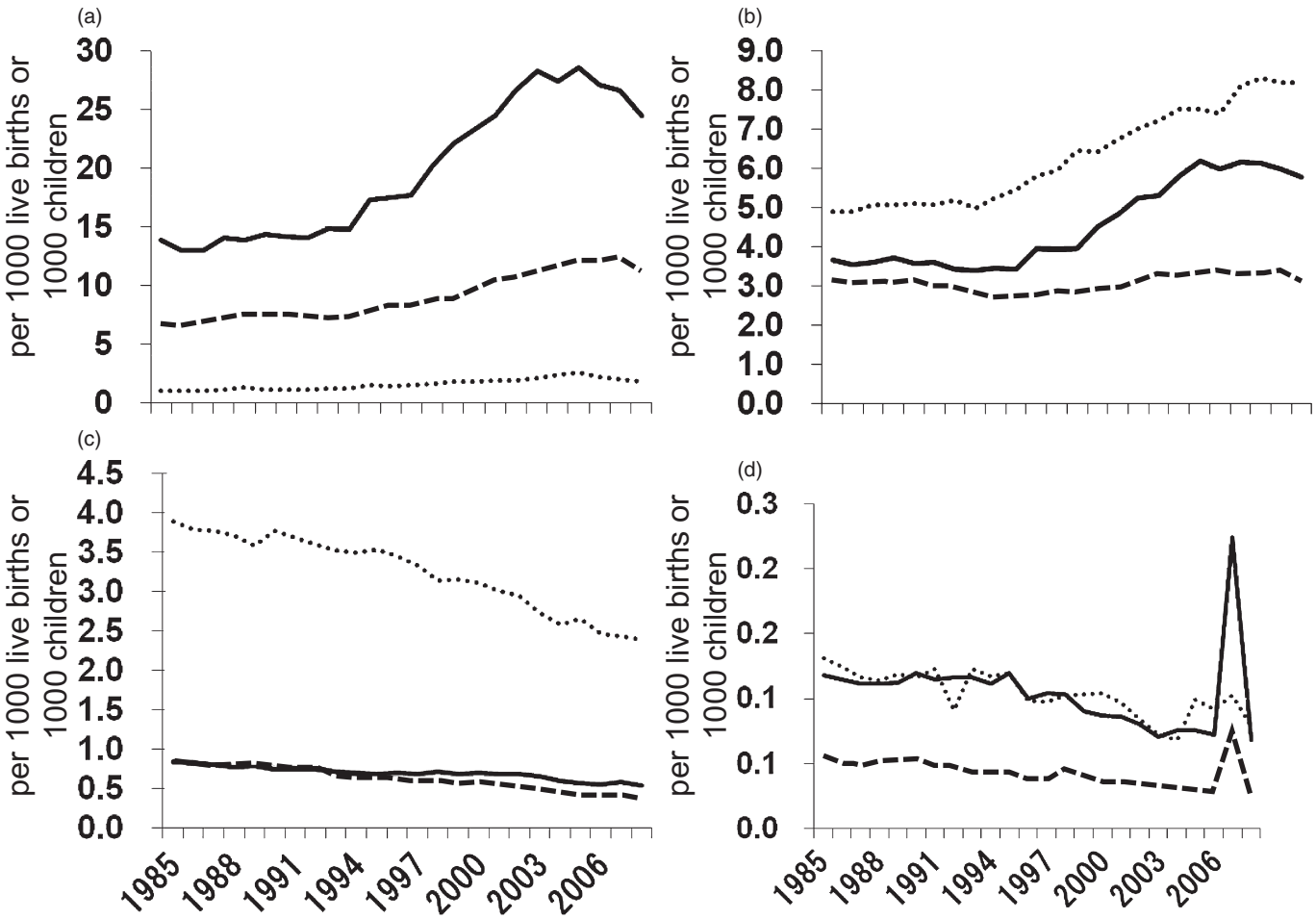

Fig. 1 Emergency transport per 1000 live births or 1000 children for (a) mild conditions, (b) moderate conditions, (c) severe conditions and (d) patients who were dead on arrival, vs age. (····) 0–27 days; (—) 28 days–6 years; (---) 7–17 years.

Table 1 Emergency transportation vs time for patients with mild conditions

Age	Transported	Non-transported	OR (95%CI)
0–27 days			
2005	2 762	1 059 768	2.46 (2.31–2.62)
1985	1 513	1 430 064	
28 days–6 years			
2005	227 779	7 751 221	2.10 (2.08–2.11)
1985	150 384	10 725 616	
7–17 years			
2005	164 624	13 397 176	1.80 (1.79–1.82)
1985	138 997	20 417 803	

CI, confidence interval; OR, odds ratio.

0.68 (0.66–0.71) for preschool-aged children, and 0.50 (0.49–0.52) for school-aged children, respectively (Table 3).

Transportation rates for patients DOA are shown in Figure 1(d). Compared with the year of 1985, the OR (95%CI) for 2005 were 0.75 (0.59–0.96) for newborn babies, 0.64 (0.58–0.71) for preschool-aged children, and 0.54 (0.49–0.61) for school-aged children, respectively (Table 4).

Discussion

Transportation rates for patients with mild or moderate conditions rose in all of the three age groups from 1985 to 2005, and then the rates for the two severity groups declined. Ohshige reported that a public awareness campaign for appropriate ambulance use reduced requests for ambulance transport.[8] The reason for reduced transport, however, was inconclusive.

Table 2 Emergency transportation vs time for patients with moderate conditions

Age	Transported	Non-transported	OR (95%CI)
0–27 days			
2005	8 616	1 053 914	1.66 (1.61–1.71)
1985	7 015	1 424 562	
28 days–6 years			
2005	49 106	7 929 894	1.68 (1.66–1.70)
1985	39 955	10 836 045	
7–17 years			
2005	45 055	13 516 745	1.04 (1.03–1.05)
1985	65 839	20 490 961	

CI, confidence interval; OR, odds ratio.

Table 3 Emergency transportation vs time for patients with severe conditions

Age	Transported	Non-transported	OR (95%CI)
0–27 days			
2005	2 826	1 059 704	0.68 (0.65–0.72)
1985	5 562	1 426 015	
28 days–6 years			
2005	4 545	7 974 455	0.68 (0.66–0.71)
1985	9 067	10 866 933	
7–17 years			
2005	5 785	13 556 015	0.50 (0.49–0.52)
1985	17 533	20 539 267	

CI, confidence interval; OR, odds ratio.

Table 4 Emergency transportation vs time for patients DOA

Age	Transported	Non-transported	OR (95%CI)
0–27 days			
2005	105	1 062 425	0.75 (0.59–0.96)
1985	188	1 431 389	
28 days–6 years			
2005	606	7 978 394	0.64 (0.58–0.71)
1985	1286	10 874 714	
7–17 years			
2005	411	13 561 389	0.54 (0.49–0.61)
1985	1147	20 555 653	

CI, confidence interval; DOA, dead on arrival; OR, odds ratio.

In contrast, the rates for patients with severe conditions or who were DOA fell from 1985 to 2008 with some exceptions. The reason is unknown. According to vital statistics in 2008, however, mortality rates (deaths/100 000) of Japanese children aged 0–4 years old, 5–9 years old, and 10–14 years old declined from 145.3, 21.1, and 16.5 in 1985 to 70.1, 9.7, and 8.7 in 2008, respectively.[7] Therefore, it is likely that incidence rates of severe illness and injuries in the three age groups declined in the past 20 years. Furthermore, transportation rates for newborn babies with severe conditions or who were DOA might be lowered by transfer of women with high-risk pregnancy before delivery to secondary and tertiary centers.

Certainly, the average length of stay of the children aged 1–14 years old in Japanese hospitals decreased from 1984 to 2008, as shown in Table 5.[9] Hospitalization for ≥3 weeks was classified as severe, and inpatient care <3 weeks was classified as moderate. Therefore, the same conditions classified as severe in the past might be classified as moderate now. Furthermore, emergency pediatrics is a new subspecialty. In the past, most ERs were run by residents and young junior staff, but the majority of ERs are now staffed by senior attending physicians. Young inexperienced physicians might over-triage patients, thus many mild cases could have been classified as moderate and severe. Senior experienced physicians, however, may be able to allocate patients more appropriately.

There were also other limitations in this study. National data annually published by FDMA describes only the number of emergency transports for each age group, according to four levels of severity.[4] Inter-rater reliability among physicians who determined severity of transported children was unknown, and economic background and residence of transported patients were not described. International comparison of utilization of emergency transport was difficult because similar studies in foreign countries

Table 5 Average length of hospital stay in Japan

Age (years)	1984 (days)	2008 (days)
0	8.4	9.9
1–4	11.3	6.9
5–9	13.2	8.5
10–14	15.9	12.4

were not available. Furthermore, hospitalization is not always a proper indicator of severity, because patients with conditions such as febrile convulsion and traffic accident usually may be transported to hospitals but do not always need inhospital care.

It is true, however, that transportation rates for patients with moderate or mild conditions rose faster than those for patients with severe conditions or who were DOA, which fell in the past 20 years. According to Japan Pediatric Society, only 6% of children who visited ERs at night and during holidays needed inpatient care.[2] *Kombini Jushin* (utilization of an ER like a convenience store at night and during holidays by patients with non-life-threatening conditions) is one of the reasons for the collapse of pediatric emergency systems. The reasons for overuse of emergency transport and ERs by children and their caregivers were inconclusive. The average number of family members, however, decreased from 3.14 in 1985 to 2.55 in 2005,[6] and the employment rates of women aged 30–34 years and 35–39 years rose from 47.8% and 56.7% in 1985 to 59.2% and 60.2% in 2005, respectively.[6] It is probable that many sick children could not visit pediatric clinics during the day because most of their caregivers were at work, and that they must use emergency transport and ERs at night and during the holidays.

Emergency transport and ERs are limited resources, and proper utilization is needed. Japanese physicians and administrators must also promote services other than emergency transport such as a telephone consultation for caregivers of sick children provided by local governments (#8000 Phone Consultation) because ambulance teams have a duty to provide transport on request even for patients with non-life-threatening conditions. Japanese citizens, physicians, and administrators must learn how to use the alternative services and to prevent the waste of precious resources.

Conclusion

Emergency transport per 1000 live births or 1000 children grew from 1985 to 2008. Utilization rates, however, did not grow homogeneously among the different severity groups.

The transportation rates for children with non-life-threatening conditions rose, while those for children DOA or who needed hospitalization ≥3 weeks have declined in the past two decades.

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