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Original article

## Clinical Features of Adult Patients Admitted to Pediatric Wards in Japan



Nobuaki Michihata, M.D., M.P.H.<sup>a,\*</sup>, Hiroki Matsui, M.P.H.<sup>a</sup>, Kiyohide Fushimi, M.D., Ph.D.<sup>b</sup>, and Hideo Yasunaga, M.D., Ph.D.<sup>a</sup>

<sup>a</sup> Department of Clinical Epidemiology and Health Economics, School of Public Health, The University of Tokyo, Tokyo, Japan

<sup>b</sup> Department of Health Policy and Informatics, Tokyo Medical and Dental University Graduate School of Medicine, Tokyo, Japan

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### ABSTRACT

**Purpose:** Pediatricians generally need to treat adult patients who require long-term care for pediatric diseases. However, little is known about the characteristics of adult patients in pediatric wards. Using a national inpatient database, the aim of this study was to determine the clinical details of adult patients admitted to pediatric wards in Japanese acute-care hospitals.

**Methods:** We extracted all inpatients aged  $\geq 19$  years who were admitted to pediatric departments in Japan from April 2012 to March 2013. We examined the patients' main diagnoses and the use of life-supporting home medical devices.

**Results:** Of 417,352 patients admitted to pediatric wards during the study period, we identified 4,729 (1.1%) adult patients. The major diagnoses of the adult patients were malignancy, congenital heart disease, epilepsy, and cerebral palsy. More than 35% of the patients with cerebral palsy had a tracheostomy tube, gastrostomy tube, home central venous alimentation, or home respirator. More than 20% of patients aged  $\geq 40$  years in pediatric wards had adult diseases, including ischemic heart diseases, cerebrovascular diseases, and adult malignancy.

**Conclusions:** Many adult patients in pediatric wards had adult diseases. It is essential to establish a disease-oriented support system for adults with chronic conditions that originated in their childhood.

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### IMPLICATIONS AND CONTRIBUTION

Our national inpatient database study showed that approximately 1% of patients in pediatric wards were adults. Their diagnoses included malignancy, congenital heart disease, epilepsy, and cerebral palsy. More than 20% of patients aged  $\geq 40$  years had adult diseases including ischemic heart diseases, cerebrovascular diseases, and adult malignancy.

Recent improvements in pediatric care have helped to save a considerable number of patients with previously fatal medical conditions; this has resulted in more children with special health care needs (CSHCN) [1,2]. CSHCN incorporates children with chromosomal anomalies, which include the following: Down syndrome; malignancy; inborn error of metabolism (IEM); congenital heart disease (CHD); immune deficiency; endocrine disorders, including diabetes; cerebral palsy; epilepsy; and other congenital anomalies requiring surgical treatment.

**Conflicts of Interest:** The authors have no conflicts of interest to report.

\* Address correspondence to: Nobuaki Michihata, M.D., M.P.H., Department of Clinical Epidemiology and Health Economics, School of Public Health, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 1130033, Japan.

E-mail address: michihata-ky@umin.org (N. Michihata).

When these patients become adults, the question of who should take care of them can become an important issue [3]. Physicians for adults lack experience in treating pediatric conditions. Pediatricians do not necessarily have experience in treating adult conditions, such as ischemic heart disease, cerebrovascular diseases, Type 2 diabetes, and adult malignant tumors. Adult patients with chronic conditions that originated in childhood may hesitate to seek treatment at pediatric departments [4]. Many challenges remain to be solved in the transition of patients from pediatrician to adult physician care.

Several studies have examined the effect of transition programs from pediatricians to physicians for adolescent or young adult patients [5–8]. However, there are scant data on the demographics of such patients. It is important for pediatricians to understand the current status of adult patients in pediatric

**Table 1**  
Sex and age distribution of patients with each major disease

	Total, n (%)	Male, n (%)	Age, n (%)			
			19–21 Years	22–29 Years	30–39 Years	≥40 Years
Chromosomal anomaly	112 (2.4)	56 (50.0)	38 (33.9)	45 (40.2)	23 (20.5)	6 (5.4)
Malignancy	787 (16.6)	359 (45.6)	110 (14.0)	82 (10.4)	50 (6.4)	545 (69.3)
Inborn error of metabolism	288 (6.1)	179 (62.2)	82 (28.5)	125 (43.4)	59 (20.5)	22 (7.6)
Cardiac anomaly	754 (15.9)	329 (43.6)	140 (18.6)	264 (35.0)	163 (21.6)	187 (24.8)
Immune deficiency	153 (3.2)	93 (60.8)	52 (34.0)	56 (36.6)	25 (16.3)	20 (13.1)
Endocrinology	265 (5.6)	116 (43.8)	99 (37.4)	84 (31.7)	32 (12.1)	50 (18.9)
Cerebral palsy	403 (8.5)	241 (59.8)	90 (22.3)	190 (47.1)	96 (23.8)	27 (6.7)
Other anomaly	271 (5.7)	138 (50.9)	89 (32.8)	126 (46.5)	46 (17.0)	10 (3.7)
Epilepsy	446 (9.4)	235 (52.7)	144 (32.3)	194 (43.5)	78 (17.5)	30 (6.7)
Other	1,250 (26.4)	637 (51.0)	313 (25.0)	389 (31.1)	217 (17.4)	331 (26.5)
Total	4,729 (100.0)	2,383 (50.4)	1,157 (24.5)	1,555 (100.0)	789 (100.0)	1,228 (100.0)

wards. Using a national inpatient database, the aim of the present study was to verify age and sex distribution, variation in comorbid conditions, and disease complications in adult patients admitted to pediatric wards in Japanese acute care hospitals.

## Methods

### Data source

For this study, we used the Japanese Diagnosis Procedure Combination (DPC) database. The DPC database includes administrative claims data and discharge abstracts. In 2012, data on about 6.85 million inpatients were collected for this database from more than 1,000 hospitals in Japan. This figure represents about 50% of all acute care inpatients in the country. The DPC database contains the following information: hospital identifiers; patient's age and sex; primary diagnoses, comorbidities, and complications coded with *International Classification of Diseases, Tenth Revision* codes; medical material codes; and discharge status [9]. All discharge abstract data for each patient are recorded on discharge by attending physicians. The database does not contain information about normal pregnancies.

Study approval was obtained from the Institutional Review Board at the University of Tokyo. The requirement for informed consent was waived for this study because of the anonymous nature of the data.

### Patient selection and data

From the DPC database, we extracted all inpatients admitted to pediatric departments from April 1, 2012, to March 31, 2013. In line with previous studies, we defined adult patients as those aged ≥19 years on admission [3,10]. We categorized age into the following groups: (1) 19–21; (2) 22–29; (3) 30–39; and (4) ≥40 years.

We classified the adult patients into the following categories according to their main diagnoses: chromosomal anomaly, malignancy, IEM, CHD, immune deficiency, endocrine diseases, cerebral palsy, other congenital anomalies, epilepsy, and other diseases. We determined gender differences with respect to the main diagnoses. We also verified the length of hospital stay and in-hospital mortality in each disease category.

We examined the patients' use of home medical devices, including tracheostomy tube, gastrostomy tube, home respirator, and home central venous alimentation. We also examined the following diseases: ischemic heart diseases, including angina

pectoris (*International Classification of Diseases, Tenth Revision* code, I20) and acute myocardial infarction (I21, I22, and I25.2), although excluding Kawasaki disease (M303); cerebrovascular diseases (I60, I61, I62, I63, and I64); several major cancers including lung, gastric, colon, hepatic, breast, uterus, and prostate cancer (C16, C18, C19, C20, C22, C50, C53, C54, C55, and C61); and Type 1 (E10) or Type 2 diabetes (E11).

### Statistical analysis

We used the Fisher exact test or the chi-square test for comparisons of the proportions related to main diagnoses and gender. We used the Cochran–Armitage test for trends of proportions of adult diseases in each age category. The analyses were performed with Stata version 13 software (StataCorp, College Station, TX). We used a two-tailed significance level of  $p < .05$  in all analyses.

## Results

Among the 417,352 patients admitted to pediatric wards during the study period, we identified a total of 4,729 (1.1%) adult patients. Table 1 provides the distribution of the main diagnoses in the patients aged 19–21, 22–29, 30–39, and ≥40 years. Overall, the most common diagnosis was malignancy (16.6%), followed by CHD (15.9%) and epilepsy (9.4%). Epilepsy was most frequently seen in patients aged 19–21 years, whereas CHD was most often seen in patients aged 22–29 and 30–39 years. Malignancy was the most common disease among patients aged ≥40 years, followed by CHD. IEM, immune deficiency, and cerebral palsy were significantly more common among males ( $p < .001$ ,  $p = .011$ , and  $p < .001$ , respectively); malignancy, cardiac anomaly, and endocrinology problems were significantly more common among females ( $p = .003$ ,  $p < .001$ , and  $p = .027$ , respectively).

Table 2 reports the following: the number of admissions per year; length of hospital stay; in-hospital mortality; and the number of patients with a tracheostomy tube, gastrostomy tube, home central venous alimentation, or home respirator. Overall in-hospital mortality rate was 2.6%. Patients with immune deficiency had the highest in-hospital mortality, followed by those with malignancy and cerebral palsy. The median (interquartile range) length of hospital stay was 7 days (3–14 days). The disease with the longest hospital stay was malignancy, followed by cerebral palsy and immune deficiency. More than 26% of patients with IEM needed ≥3 admissions per year. More than 35% of patients with

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