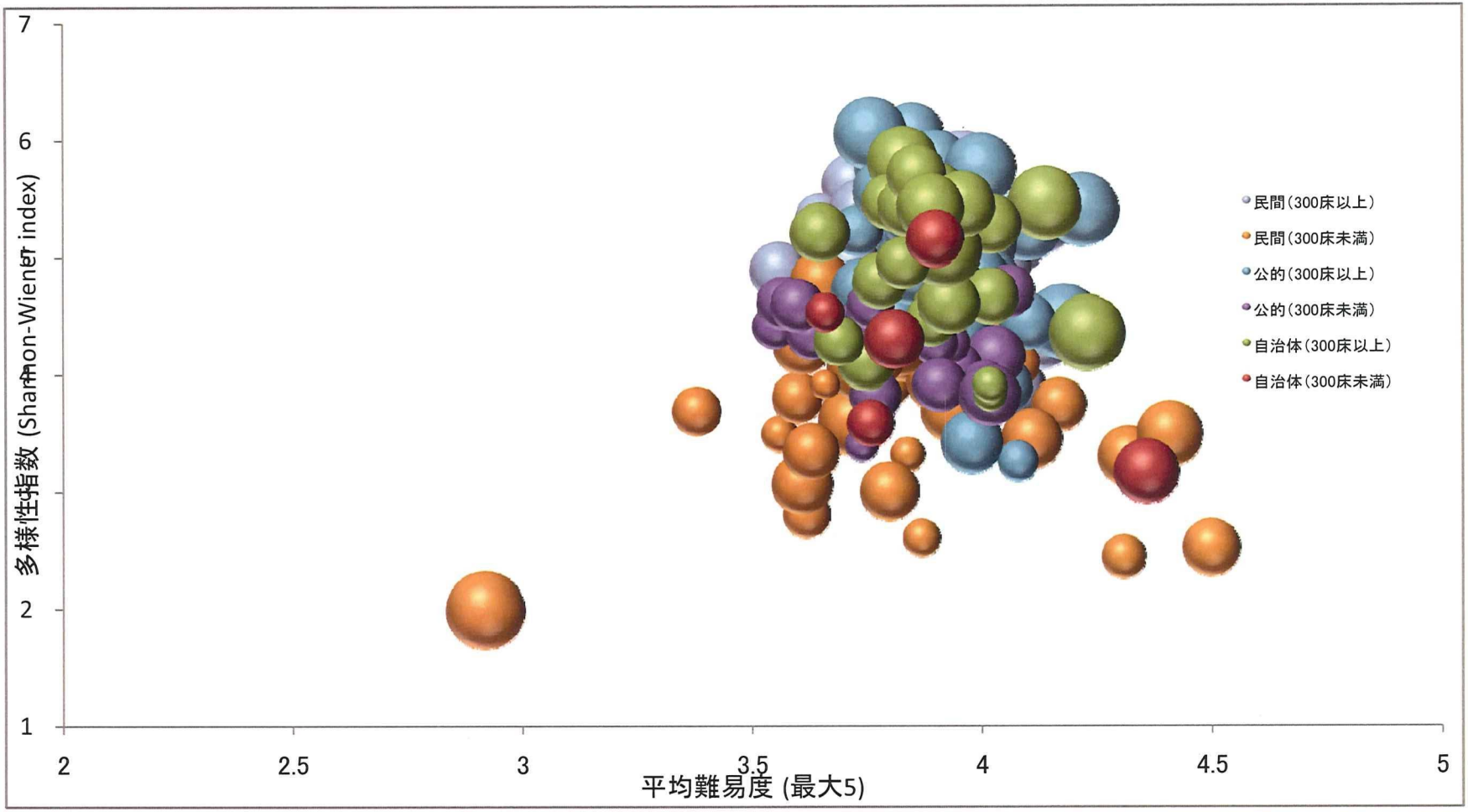
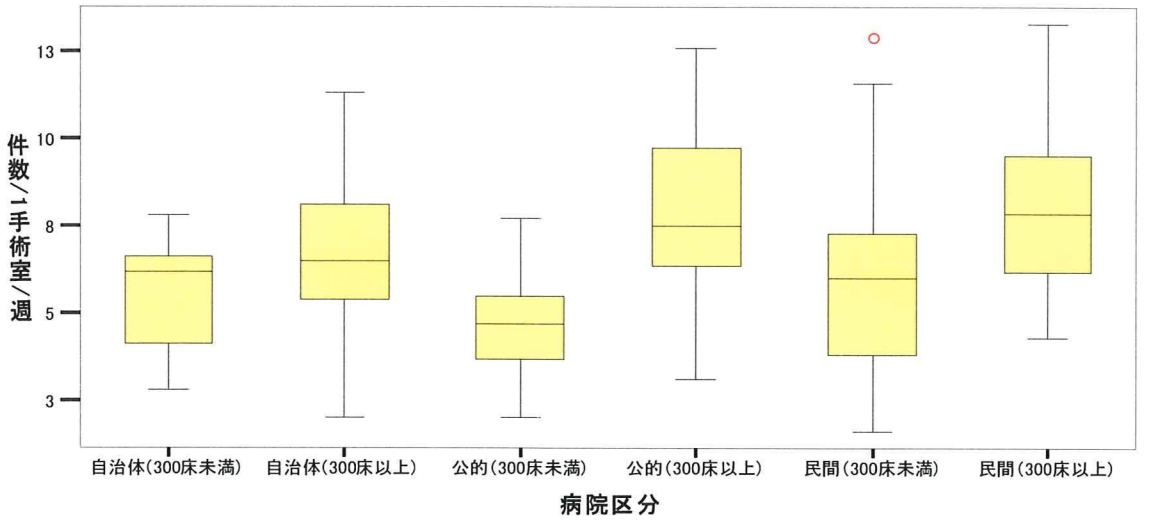
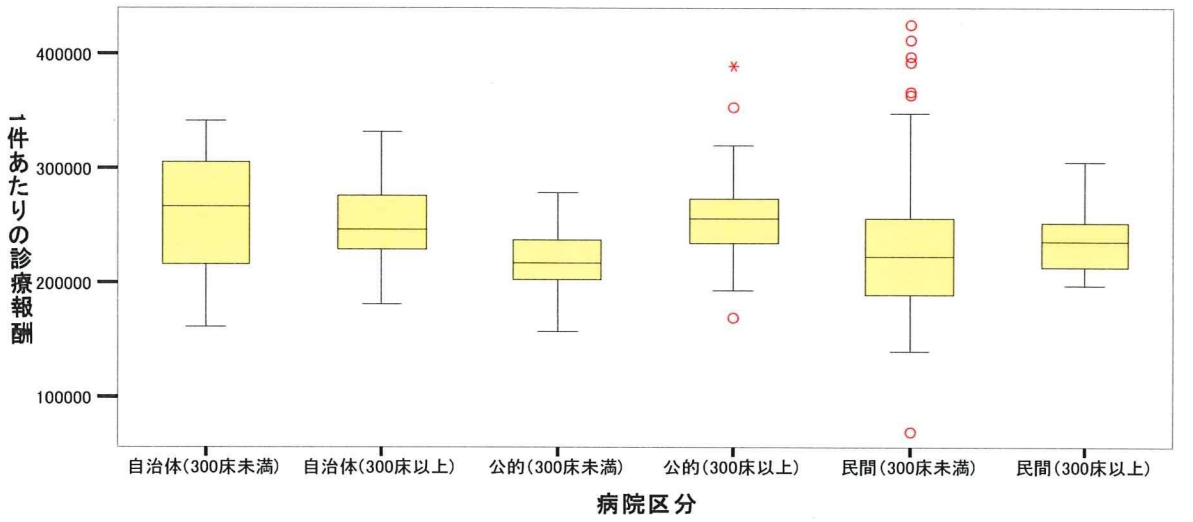
図6 手術の平均難易度と多様性指数

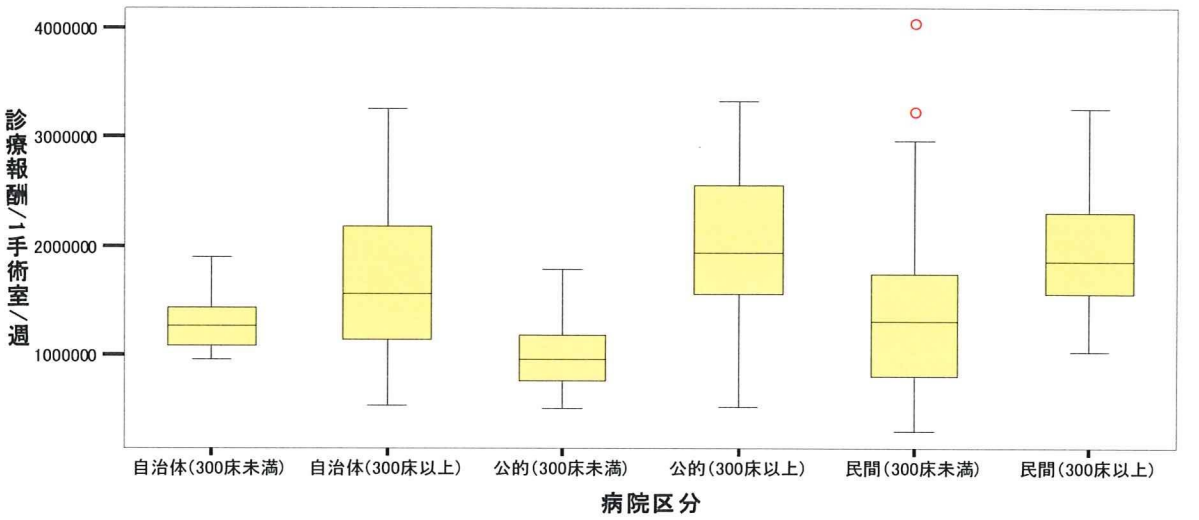


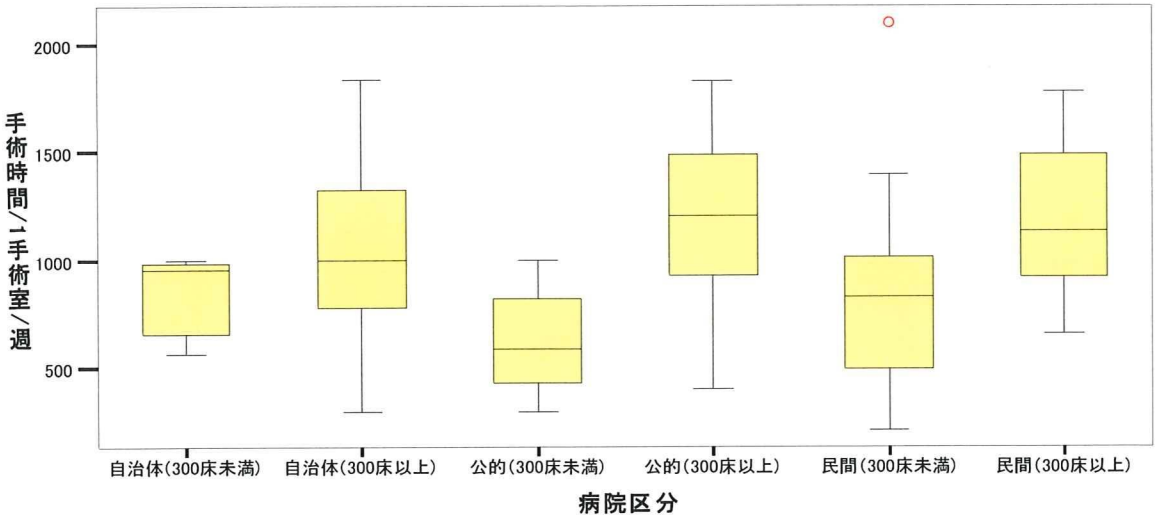
難易度と複雑度の関連を示したのが図6ですが、この2つの要因にも明らかな相関はありませんでした。

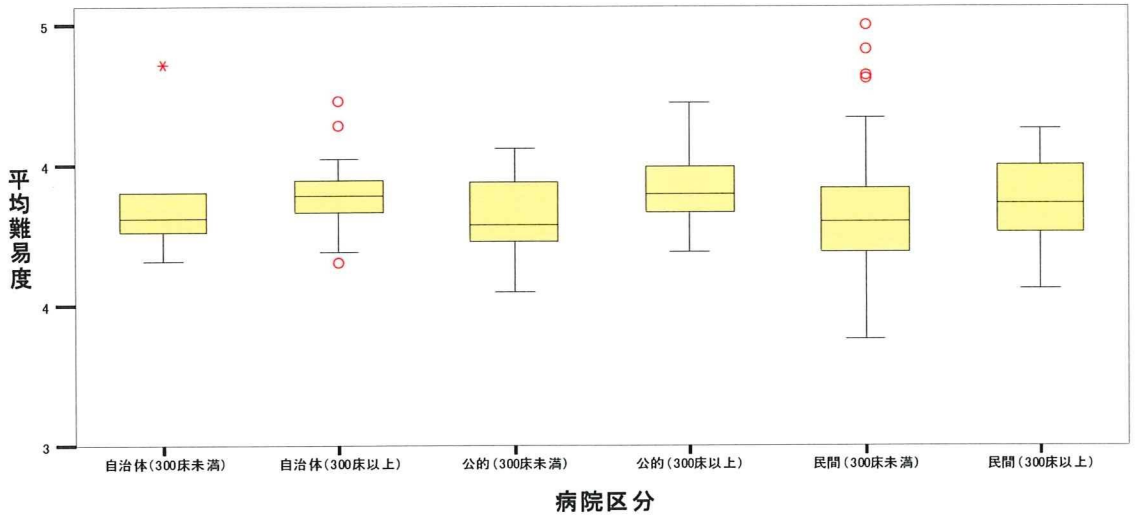
設立主体・病床規模別手術室利用の指標の比較

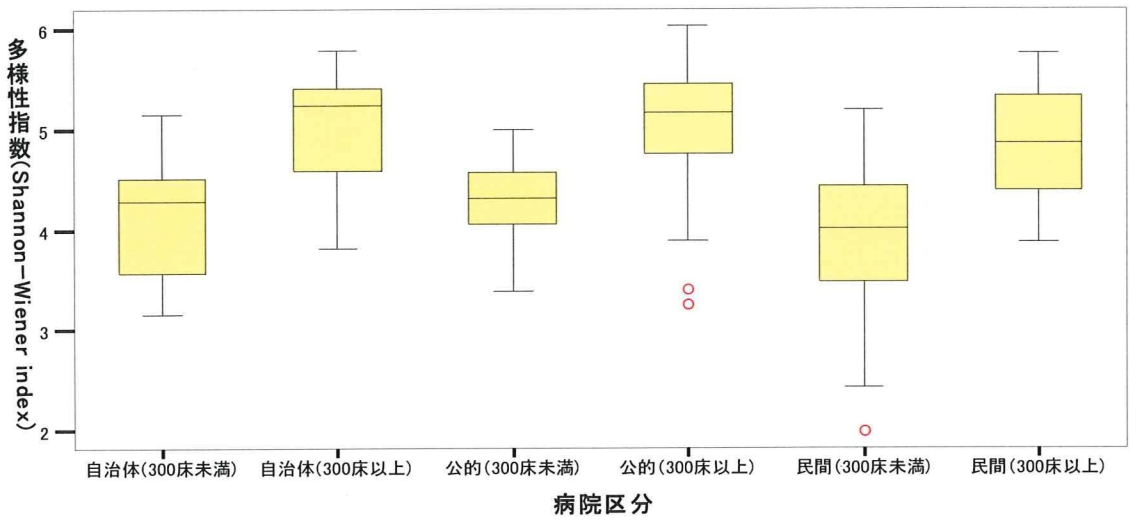







手術時間/1手術室/週
2000
1500
1000
500
自治体(300床未満)
自治体(300床以上)
公的(300床未満)
公的(300床以上)
民間(300床未満)
民間(300床以上)
病院区分


平均難易度
5
4
4
3
自治体(300床未満)
自治体(300床以上)
公的(300床未満)
公的(300床以上)
民間(300床未満)
民間(300床以上)
病院区分


多様性指数(Shannon-Wiener index)
6
5
4
3
2
自治体(300床未満)
自治体(300床以上)
公的(300床未満)
公的(300床以上)
民間(300床未満)
民間(300床以上)
病院区分

Antibiotic prescription patterns for children hospitalized with pneumonia and compliance to guidelines in Japan: A multicenter study.

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Key words: antimicrobial prescription, children, guideline, pediatric, pneumonia

Antibiotic prescription patterns for children hospitalized with pneumonia and compliance to guidelines in Japan: A multicenter study.

Abstract

Introduction: Guidelines for the treatment of pediatric respiratory infections were published in Japan in 2004, with a focus on care of pneumonia. Assessing the antibiotic prescription patterns for pediatric pneumonia, and whether these patterns are consistent with the published guidelines, is critical.

Methods: The study population included children with pneumonia who were admitted to six participating hospitals between April 2006 and March 2007. These hospitals voluntarily provided administrative healthcare data. Multiple logistic regression analysis was performed with the use of macrolides as a dependent variable. The explanatory variables included age, hospital, the use of oxygen inhalation treatment, and length of hospital stay.

Results: Age and hospital were both statistically significant predictors of macrolide use. The odds ratios for the hospitals are much larger than those for the age groups. These results suggest variation in antimicrobial prescription patterns across the hospitals, thus suggesting inconsistencies with compliance of the guidelines.

Discussion: This study demonstrates variations among hospitals in antimicrobial prescription patterns for pediatric pneumonia. The observed practice variations suggest room for improvement and a requirement for the standardization of antimicrobial prescribing practices.

Key words
antimicrobial prescription, children, guideline, pediatric, pneumonia

Introduction

Ensuring that antimicrobial prescription patterns are appropriate is clinically important. Improper use, such as frequent prescription of a wide spectrum of antimicrobial agents, or prescribing them for excessively long periods of time, is a waste of health resources. Moreover, the increased probability of resistant bacteria and the enormous resources required for development of new medication suggest a substantial economic loss due to these negative externalities [1]. This problem is especially serious from the perspective of the medical care economy. Thus far, guidelines for proper antimicrobial prescription patterns have been published in several countries [2-4].

In Japan, a sustained tendency of improper antimicrobial use has been observed, including overuse as well as frequent use of a wide spectrum of agents [5]. However, actions to control the use of antimicrobials have yet to be witnessed. In 2001, the Japanese Association for Infectious Diseases and Japan Society of Chemotherapy prepared a document titled "The guidebook on the use of antimicrobial agents" [6].

Recently, the pediatric field has joined the movement for promotion of proper use of antimicrobials. In 2004, the Japanese Society of Pediatric Pulmonology (JSPP) and the Japanese Society for Pediatric Infectious Disease (JSPID) issued a set of guidelines for the treatment of infant respiratory infectious diseases [7]. A revised edition of these guidelines was released in 2007. While this document provides guidelines related to upper respiratory infection, bronchitis, and bronchiolitis, the main focus is treatment of pneumonia. The guidelines state that penicillin should be prescribed to treat bacterial pneumonia unless the patient is seriously ill. For mycoplasmal pneumonia, either macrolide or tetracycline is recommended. The guidelines suggest that no antimicrobial agent should be used to treat viral pneumonia. In infants below school age, the causative pathogens of pneumonia are usually bacteria and in school-age children, pneumonia is usually caused by mycoplasma. When the causative pathogen is not known, the recommendation for the first choice of antimicrobial is penicillin for children aged less than six years and macrolide or tetracycline for children aged six years or more.

The aim of this study was to assess current antibiotic prescription patterns for the treatment of children hospitalized with pneumonia, since such infections account for 30% of pediatric hospitalization cases. We compare antimicrobial prescription patterns among several institutions and demonstrate heterogeneous prescription practices.

Methods

The data used in this study were obtained from the Quality Indicator/Improvement Project (QIP). The aim of QIP is to evaluate medical care from qualitative and economic perspectives. Many large teaching hospitals, widely scattered throughout Japan, voluntarily provide administrative healthcare data to QIP. Some hospitals provide data for the entire year while others do so for specific time periods only. Since pneumonia in infants is caused by different pathogens depending on the season, this study included only the six institutions that provided data for the whole year.

The five inclusion criteria for participation in the study were as follows: 1) The patient was hospitalized in one of the six participating hospitals, with a discharge date between 1 April 2006 and 31 March 2007. 2) The patient was under fifteen years of age at admission. 3) The

patient was diagnosed with pneumonia, acute bronchitis, or acute bronchiolitis and thus had a Diagnosis Procedure Combination code of "040080". This coding is the Japanese version of the Diagnosis-related group used in the US. 4) The patient received antimicrobials from the first day of hospitalization. 5) The patient had healing status at discharge. Patients who received artificial respiration for treatment were excluded from the study.

The distribution of the causative pathogens for infant pneumonia changes by patient age. Thus, the data was stratified into the following three age groups: 1) under 2 years, 2) between 2 and 5 years, and 3) between 6 and 15 years of age. Hospitals were also stratified because variation in antimicrobial prescription patterns was expected across these institutions. The antimicrobials used in the periods of hospitalization were classified as follows: oral penicillin, intravenous penicillin, oral cephalosporine, intravenous cephalosporine, carbapenem, macrolide, tetracycline, and others. The latter group included clindamycin, fosfomycin calcium, and norfloxacin. To ascertain the proportion of patients prescribed each type of antimicrobial, the number of patients prescribed a given antimicrobial was divided by the total number of patients in each age group and hospital.

Multiple logistic regression analysis was performed with the use of intravenous penicillin, the use of intravenous cephalosporine, or the use of macrolide as a dependent variable. The explanatory variables included age, hospital, the use of oxygen inhalation treatment, and length of hospital stay. The latter two explanatory variables were used as proxies for disease severity. The Wald test was used for significance testing of the explanatory variables and the significance level was set at $P<0.05$. Goodness-of-fit was assessed with the Hosmer-Lemeshow test. All statistical procedures were performed using SPSS 15.0J for Windows.

Results

Key characteristics of the 1432 study participants are shown in Table 1. In every hospital except hospital A, the number of participating male patients was larger than that of females. The age distribution was skewed to the right, with most of the patients below school age. This skewed distribution was reflected in the average age exceeding the median age in every hospital. The proportion of patients who received oxygen inhalation varied considerably across the six institutions. Additionally, variations in the length of hospital stay were also observed.

Table 2 shows the number of patients given specific pharmacological classes of antimicrobials by age and hospital. The number in parentheses is the associated percentage. Since patients were sometimes given more than two types of antimicrobials, simultaneously or successively, the aggregate percentages may exceed 100%. The data indicate that the patterns of antimicrobial prescription vary more across hospitals than age groups. However, adjustment for disease severity was necessary to demonstrate the heterogeneity of prescription patterns. This adjustment was performed using multiple logistic regressions.

The results of the multiple logistic regressions to assess predictors of intravenous penicillin, intravenous cephalosporine, and macrolide use are shown in Tables 3 through 5, respectively.

Age was a statistically significant predictor of intravenous penicillin use. The coefficients of the age categories were negative, which is expected since bacterial pneumonia is more prevalent in younger children. The hospitals, except for hospital B, were statistically

significant, thus suggesting variation in antimicrobial prescription patterns. Oxygen inhalation and length of hospital stay were not associated with prescription of intravenous penicillin.

Age was also a statistically significant predictor of intravenous cephalosporine use. For the same reason as indicated above, the coefficients of age categories were negative. In this case, however, only hospital C was statistically significant, thus demonstrating homogeneity of prescription patterns. The variable for oxygen inhalation was significant with a negative coefficient. Finally, disease severity was not found to be associated with intravenous cephalosporine use.

In the logistic regression assessing predictors for macrolide use, the age categories were statistically significant and, in contrast to the above results, had positive coefficients. This difference is because mycoplasmal pneumonia is more prevalent in older children. However, variation in prescription practices across hospitals is demonstrated by the statistically significant hospital variables. In contrast to negative hospital coefficients for the intravenous penicillin regression, hospital coefficients are positive in this regression.

Discussion

This study demonstrates variations in antimicrobial prescription patterns for children hospitalized with pneumonia in Japan. The potential for improper prescription practices was hypothesized, and characteristics of such misuse were assessed. For example, macrolides were prescribed too frequently in younger children below school age. However, penicillin is more appropriate for such children since pneumonia at that age is usually caused by bacteria. Little variation was found in prescription practices for cephalosporin across participating hospitals. Only a small number of patients received carbapenem and no patients were given peptides. Consequently, no overuse was observed with these two classes of antimicrobials.

Generally, identifying the causative pathogens of pediatric pneumonia is not easy since specimen collection is usually difficult in children. Pediatricians usually diagnose pneumonia through clinical symptoms, chest radiographs, and laboratory data such as white blood cell counts, c-reactive protein tests, and erythrocyte sedimentation rates. However, such tools are insufficient to determine the causes of pneumonia. Although an effective procedure for phlegm collection has been proposed [8] , it may not always be successful. Even if phlegm is collected, it takes a few days to identify the causative pathogens, and there is still a chance that the tests may fail to detect these pathogens. Thus, physicians often have to begin treatment in children with pneumonia without an exact diagnosis of the causative pathogens.

Previous studies have indicated that the causative pathogens of pneumonia vary considerably by age[9-12]. The distribution of these pathogens has been consistent across several studies from various countries. A study by Nakamura [12], which supported the Japanese clinical guidelines, described the distribution of causative pathogens for pneumonia in children. Excluding patients in whom the causative pathogens were not known, his study found that approximately 50% of children under two years of age had bacterial pneumonia. About 40% of the remaining children had viral pneumonia and 10% had mycoplasmal or chlamydial pneumonia. Chlamydial pneumonia was observed only in children under one year of age, and all of these infections were caused by *Chlamydia trachomatis*. Of infections in children between the ages of two and five, approximately 40% were bacterial, 20% were viral, and

40% were mycoplasmal. In children aged six and over, about 10% of infections were bacterial, 10% were viral, and 80% were mycoplasmal.

The guidelines for treating pneumonia in children recommend doctors to consider the age of their patients when choosing which antimicrobial to prescribe [3,4,13]. The guidelines published by JSPP and JSPID recommend different antimicrobial treatments for children under six and children of six or more when the causative pathogen is unknown [7]. For the younger group, the guidelines suggest treating the infection as bacterial pneumonia.

However, this study found that the ages of patients were not sufficiently considered before prescribing treatment. For example, macrolides were prescribed for the majority of patients under the age of two in hospitals C, E and F. The odds ratios for the hospitals were much larger than for the age and oxygen inhalation variables in the associated logistic regression. These results indicate variation in antimicrobial prescription practices across the participating hospitals. As such, there may be some room for improvement and a greater need to standardize antimicrobial prescription practices for pediatric pneumonia.

This study has several limitations. First, the data were administrative rather than clinical. Thus, disease severity was based on oxygen inhalation and the length of hospital stay. For pneumonia in children, however, the causative pathogen and severity of infection are difficult to assess even with white blood cell counts, c-reactive protein tests, and chest radiograph images. Second, the DPC code (040080) used in the study includes acute bronchitis or acute bronchiolitis in addition to pneumonia. To attenuate this problem, the inclusion criteria included the condition that patients were treated with antimicrobials from the first day of admission. Since acute bronchitis and acute bronchiolitis are almost always caused by viruses, these infections do not require antimicrobial treatment. Thus, we aimed to select pneumonia patients who needed antibiotics, namely patients with bacterial or mycoplasmal pneumonia. Finally, standards for hospitalization may differ by hospital and disease severity of inpatients may not be equivalent across the hospitals. Since most severe cases requiring beta-lactam and macrolide simultaneously are usually rare, the large number of macrolide prescriptions in some hospitals cannot be fully explained by variations in disease severity.

Conclusion

This study elucidates the existing variations amongst hospitals in antimicrobial prescription patterns for pediatric pneumonia in Japan. Macrolides were found to be prescribed for many infants below schooling age in some of the sampled hospitals. These prescription patterns do not comply with practice guidelines, which recommend penicillins for the first choice in treatment for these infants. The existence of such variations suggests that adherence to antimicrobial prescribing guidelines may be improved, and that greater standardization is necessary. A multicenter analysis such as this can make practice variations between institutions more visible, and therefore emphasize the need to promote compliance with the guidelines.

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Table1: The descriptive statistics of the patients in each hospital

hospital	The number of patients	The proportion of males (%)	The mean of patients' age (year)	The standard deviation of patients' age (year)	The median of patients' age (year)	The mean of length of stay (day)	The standard deviation of length of stay (day)	The proportion of patients given oxygen (%)
A	95	49.5	3.5	2.5	3.0	5.9	2.6	0
B	146	54.1	2.9	2.4	2.2	8.0	3.3	40.4
C	228	51.3	3.8	3.2	2.8	9.4	2.9	53.1
D	306	55.2	2.7	3.0	1.6	6.9	4.0	0.7
E	106	53.8	3.4	3.2	2.3	9.6	3.2	63.2
F	551	50.8	2.6	2.4	1.7	4.9	1.6	0

Table2 : The number and proportion of the patients prescribed each class of antimicrobial by age and hospital

antibiotics / hospital age group	oral penicillin	intravenous peniccilin	oral cephalosporine	intravenous cephalosporine	carbapenem	macrolide	tetracycline	others	total
A <2	26(62%)	37(88%)	2(5%)	6(14%)	0(0%)	1(3%)	0(0%)	0(0%)	42
2-5	24(62%)	29(74%)	2(5%)	9(23%)	0(0%)	6(15%)	0(0%)	1(3%)	39
6+	5(36%)	9(64%)	0(0%)	5(36%)	0(0%)	4(29%)	0(0%)	0(0%)	14
B <2	1(1%)	61(87%)	3(4%)	7(10%)	0(0%)	26(37%)	0(0%)	2(3%)	70
2-5	3(5%)	43(74%)	7(12%)	7(12%)	0(0%)	29(50%)	0(0%)	0(0%)	58
6+	2(11%)	11(61%)	1(6%)	1(6%)	0(0%)	11(61%)	1(6%)	0(0%)	18
C <2	20(22%)	28(31%)	3(3%)	5(6%)	1(1%)	84(92%)	0(0%)	1(1%)	91
2-5	15(17%)	24(26%)	0(0%)	2(2%)	0(0%)	89(98%)	0(0%)	8(9%)	91
6+	5(11%)	8(17%)	0(0%)	1(2%)	0(0%)	42(91%)	21(46%)	0(0%)	46
D <2	16(8%)	62(32%)	84(43%)	68(35%)	1(0%)	109(56%)	0(0%)	11(6%)	194
2-5	6(8%)	18(24%)	28(37%)	20(27%)	0(0%)	52(69%)	2(3%)	8(11%)	75
6+	1(3%)	4(11%)	4(11%)	8(22%)	1(3%)	28(76%)	16(43%)	5(14%)	37
E <2	0(0%)	20(41%)	20(42%)	19(40%)	2(4%)	40(83%)	0(0%)	2(4%)	48
2-5	1(3%)	14(37%)	10(26%)	11(29%)	2(5%)	31(82%)	0(0%)	4(11%)	38
6+	0(0%)	5(25%)	3(15%)	6(30%)	2(10%)	19(95%)	1(5%)	3(15%)	20
F <2	15(5%)	9(3%)	91(29%)	95(30%)	0(0%)	223(71%)	0(0%)	14(5%)	314
2-5	15(8%)	6(3%)	37(20%)	39(21%)	0(0%)	151(81%)	0(0%)	14(8%)	186
6+	1(2%)	1(2%)	5(10%)	8(16%)	0(0%)	46(90%)	0(0%)	1(2%)	51

Table3: The explanatory variables of the use of intravenous penicillin for pediatric pneumonia patients

Explanatory variable	coefficient	Standard error	Wald statistics	Odds ratio	95% confidence interval	P value
Age group <2	0			1		
Age group 2-5	-0.40	0.17	5.55	0.67	0.49 – 0.94	0.02
Age group 6+	-1.04	0.24	18.45	0.36	0.22 – 0.57	0.00
Hospital A	0			1		
Hospital B	0.08	0.34	0.06	1.08	0.56 – 2.12	0.81
Hospital C	-2.24	0.32	49.01	0.11	0.06 – 0.20	0.00
Hospital D	-2.46	0.29	71.39	0.09	0.05 – 0.15	0.00
Hospital E	-1.73	0.36	23.69	0.18	0.09 – 0.36	0.00
Hospital F	-4.98	0.36	186.71	0.01	0.00 – 0.01	0.00
No oxygen inhalation	0			1		
oxygen inhalation	-0.36	0.22	2.69	0.70	0.46 – 1.07	0.10
Length of stay	0.02	0.02	0.47	1.02	0.97 – 1.06	0.50

Hosmer-Lemeshow test: $\chi^2=7.81$ (df=8), P=0.45

Table4: The explanatory variables of the use of intravenous cephalosporine for pediatric pneumonia patients

Explanatory variable	coefficient	Standard error	Wald statistics	Odds ratio	95% confidence interval	P value
Age group <2	0			1		
Age group 2-5	-0.38	0.15	6.44	0.68	0.51 – 0.92	0.01
Age group 6+	-0.58	0.23	6.14	0.56	0.36 – 0.89	0.01
Hospital A	0			1		
Hospital B	-0.92	0.39	5.50	0.40	0.18 – 0.86	0.02
Hospital C	-2.12	0.47	20.36	0.12	0.05 – 0.30	0.00
Hospital D	0.36	0.29	1.60	1.44	0.82 – 2.52	0.21
Hospital E	0.62	0.38	2.66	1.87	0.88 – 3.95	0.10
Hospital F	0.35	0.28	1.57	1.41	0.82 – 2.43	0.21
No oxygen inhalation	0			1		
oxygen inhalation	-0.66	0.32	4.31	0.52	0.28 – 0.96	0.04
Length of stay	0.13	0.03	21.46	1.13	1.08 – 1.20	0.00

Hosmer-Lemeshow test: $\chi^2=3.90$ (df=8), P=0.87

Table5: The explanatory variables of the use of macrolide for pediatric pneumonia patients

Explanatory variable	coefficient	Standard error	Wald statistics	Odds ratio	95% confidence interval	P value
Age group <2	0			1		
Age group 2-5	0.60	0.15	16.34	1.82	1.36 – 2.43	0.00
Age group 6+	1.01	0.23	18.79	2.76	1.74 – 4.36	0.00
Hospital A	0			1		
Hospital B	1.62	0.38	17.74	5.03	2.37 – 10.67	0.00
Hospital C	4.51	0.45	100.92	91.27	37.83 – 220.18	0.00
Hospital D	2.69	0.35	59.10	14.68	7.40 – 29.12	0.00
Hospital E	3.39	0.45	56.39	29.71	12.26 – 72.00	0.00
Hospital F	3.44	0.35	99.01	31.32	15.89 – 61.73	0.00
No oxygen inhalation	0					
oxygen inhalation	0.56	0.27	4.41	1.76	1.04 – 2.98	0.04
Length of stay	0.04	0.03	2.59	1.04	0.99 – 1.10	0.11

Hosmer-Lemeshow test: $\chi^2=11.49$ (df=8), P=0.18

Risk-adjusted assessment of blood product use in acute-care hospitals in Japan: an analysis using administrative data

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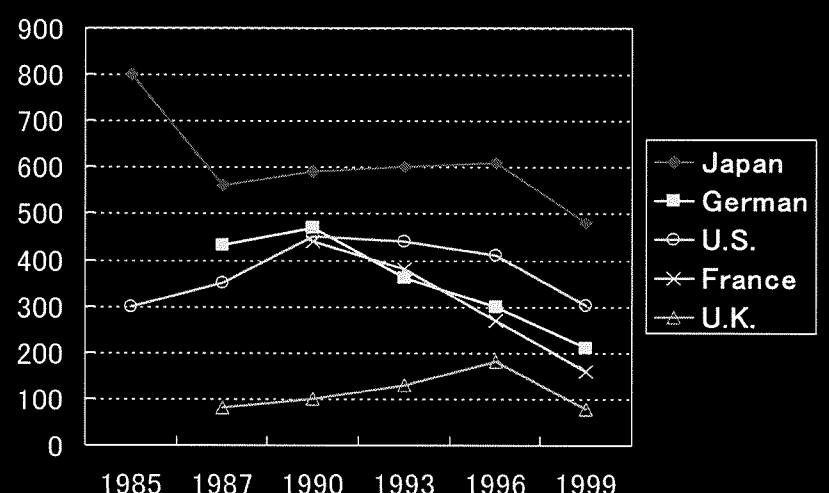
Background

- Importance of using the minimum amount of blood necessary for each transfusion
  - *Increases in transfusion-transmitted viral infections*
  - *Insufficient blood supply due to increasing demand for transfusions*
- Guidelines for the use of blood components and products
  - *Adherence to guidelines is often poor*
  - *Great variations in the use of blood products by physicians and hospitals*

Use of albumin (Kg) per 1,000,000 population



Approaches to promote appropriate transfusions

- System approaches
  - Guidelines, education, retrospective audits, and approval of transfusion orders
- Clinical audits of blood use and feedback
  - *Effectively decrease inappropriate blood transfusions*
  - *Limited availability of experts and funding*

Alternative approaches to monitor overuse of blood products

- Utilize administrative data to evaluate hospital-wide use of blood products
  - *Concepts of patient classification system*
  - *Patients within the same diagnostic group are considered to have similar resource (e.g., blood product) utilization*
  - *A patient classification system may be employed for risk-adjusted assessment of hospital-wide blood use*

Objectives of the study

- Retrospective audits of blood use at two hospitals
  - *Examine underlying conditions for blood use*
  - *Judge appropriateness of blood use in each hospital*
- Development of multivariate regression models to predict hospital-wide use of blood products
  - *Assess risk-adjusted, hospital-wide use of fresh frozen plasma (FFP) and albumin at the hospitals studied*
  - *Compared the risk-adjusted use of FFP and albumin with proportions of appropriate use at each hospital*

Administrative data of Japan

- Diagnosis Procedure Combination (DPC) data
  - *A new medical payment system based on a unique patient classification system: DPC*
  - *Hospitals that utilize DPC for medical payment produce administrative data: DPC data*
  - *DPC data include clinical data and medical claim data*
- Information extracted from DPC data
  - *Specific conditions for the use of transfusions*
  - *Type, amount, and timing of blood products use*

Materials and Methods

Methods
Retrospective audits of blood use

- Chart reviews at 2 hospitals by the researchers
  - *Teaching hospitals with more than 500 beds*
- Consecutive patients who were administered albumin or FFP and were discharged from the hospitals between July and Sep 2006
- Appropriateness of use was judged based on the "Guidelines for blood transfusions" *(Japanese Ministry of Health, Labor, and Welfare)*

Case-mix adjustment models to predict hospital-wide use of albumin and FFP

- 587,045 cases provided by 73 hospitals
- Development of a case-mix adjustment models
  - *Use the distribution of diagnostic groups to predict the total amount of albumin or FFP used at each hospital*

Expected total amount used (Expected Value)
$$= \sum_{i=1}^{W} \{Q(i) \times N(i)\}$$

Observed/Expected Ratio (O/E ratio)
$$= \frac{Observed}{Expected}$$

Q(i): mean units used per case in the ith group
N(i): the number of cases belonging to that group

RESULTS

Characteristics of 73 hospitals and the distribution of blood products use in each hospital

	Range	Percentile		
		25%	50%	75%
No of bed	43 – 1,106	239	350	530
Length of stay (days)	9.6 – 41.0	13.2	15.2	18.2
Hospital mortality rate	0.1 - 8.8%	3.4%	4.5%	5.2%
All FFP used (Units/100 beds /M)	0 – 179	10.7	23.0	39.6
All albumin used (G/100 beds/M)	29.7 – 1,424	145	290	441

Results of retrospective audits
Underlying condition of albumin use and its appropriateness

Underlying condition	N (%)	Appropriate
Massive bleeding	20 (8%)	(60%)
Hypoalbuminemia	29 (12%)	(21%)
Cardiovascular surgery	96 (40%)	(20%)
Other surgeries	6 (3%)	(50%)
End-stage/critical illness	35 (15%)	(23%)
Liver cirrhosis	29 (12%)	(10%)
CPR	18 (8%)	(39%)
Others	6 (3%)	(33%)

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Results of retrospective audits
Underlying condition of FFP use and its appropriateness

Underlying condition	N (%)	Appropriate
Bleeding	37 (31%)	(19%)
Perioperative	59 (49%)	(15%)
Prophylactic	25 (21%)	(12%)
All	121 (100%)	(16%)

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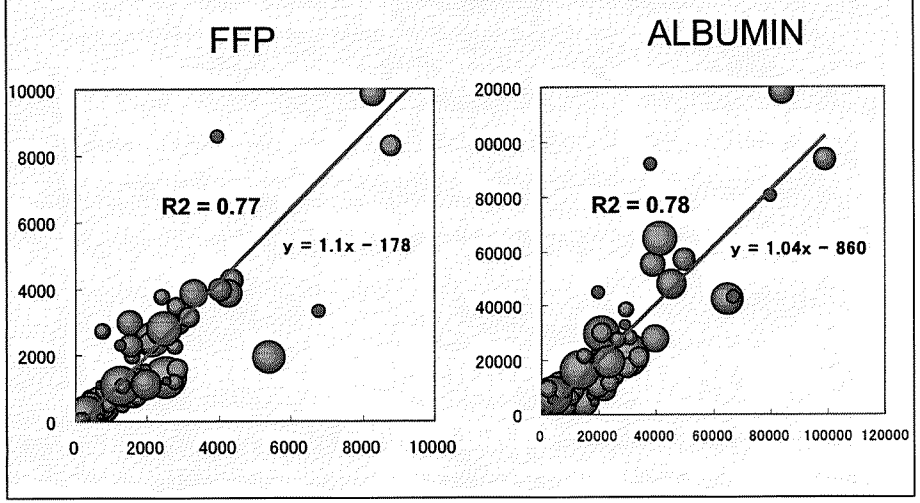
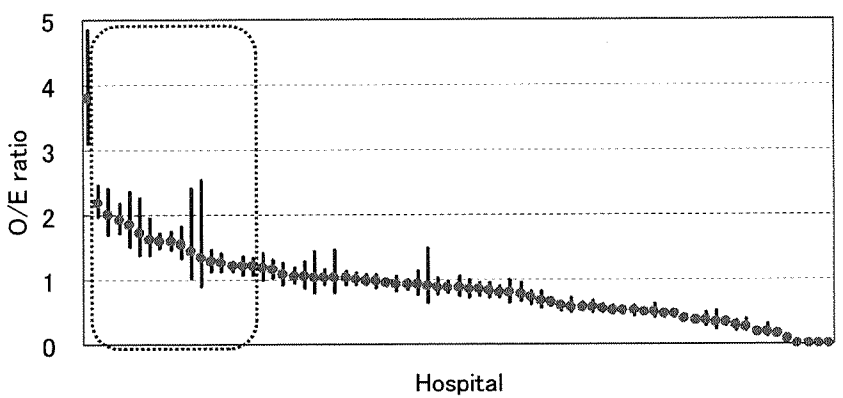
Correlations between expected and observed values of hospital-wide FFP and albumin use



Casemix-adjusted use of FFP
Evaluation by O/E ratios (with 95% CI)



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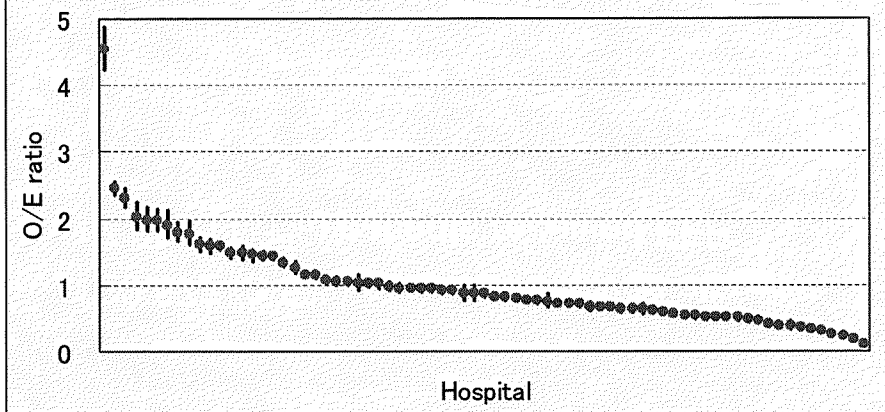
Casemix-adjusted use of albumin
Evaluation by O/E ratios (with 95% CI)



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Comparison between the proportions of appropriate use and O/E ratios at two hospitals

Hospital	Albumin		FFP	
	Appro-priate	O/E Ratio	Appro-priate	O/E Ratio
A	23%	0.62	5%	1.02
B	27%	0.50	33%	0.65

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Case-mix adjusted total use of blood products

- Administrative data with a patient classification system
  - *Identify risk factors of transfusion in each case*
  - *Expect total use of blood products in each hospital from patient risk profiles*
  - *Compare the observed use (O) to the expected use (E) - O/E ratio*
  - *Identify providers with extremely high levels of blood product use*

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Evaluation of blood product use at the hospital level

- DPC data gathers into a unified format the clinical information for all hospitalized patients
- Risk-adjusted assessment of blood product use can contribute towards appropriate use of blood
- Possible to use a shared assessment standard to compare conditions for blood product use between hospitals, and to engage in discussion about clinical standards.

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Conclusions

- We proposed methods utilizing administrative data to evaluate hospital-wide use of blood products in Japan
  - *Index for valid and appropriate transfusions*
  - *Index for blood product use that takes patient risk into consideration*
- Our research strongly indicates that valid comparisons may be made across hospitals in Japan

Conclusions

- We proposed methods utilizing administrative data to evaluate hospital-wide use of blood products in Japan

- 20,572 (3.5%) patients received albumin
- 7,654 (1.3%) patients received FFP

Overuse of fresh frozen plasma (FFP) and albumin products in Japan

Units/1,000 population

	RBC	Plasma	Albumin
Japan	22.8	12.8	59
United States	47.8	8.2	52
France	32.4	4.4	32
United Kingdom	43.7	6.4	14
German	50.2	15.8	37
Italy	38.6	8.8	94

Vox Sanguinis (2009)

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ORIGINAL PAPER

Risk-adjusted assessment of incidence and quantity of blood use in acute-care hospitals in Japan: an analysis using administrative data

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Vox Sanguinis

Background and Objectives Continuous monitoring of blood use and feedback on transfusions are effective in decreasing inappropriate blood transfusions. However, traditional methods of monitoring have practical challenges, such as the limited availability of experts and funding. Administrative data including a patient classification system may be employed for risk-adjusted assessment of hospital-wide blood use.

Materials and Methods We conducted an audit of blood use at two hospitals and determined proportions of appropriate blood use at each hospital. We then used administrative data of 587 045 cases provided by 73 hospitals to develop two mathematical models to calculate risk-adjusted use of blood products. The first model is a logistic regression model to predict the percentage of transfused patients. Patient demographics, surgery and diagnostic groups were utilized as predictors of transfusion. The second model is a case-mix adjusted model which predicts hospital-wide use of units of blood products from the distribution of diagnosis-related groups. For each model, the observed to expected (O/E) ratio of blood use in each hospital was calculated. We compared resultant ratios with proportions of appropriate blood use in two of the hospitals studied.

Results Both models showed good prediction abilities. O/E ratios calculated using the two models were relevant to proportions of appropriate transfusions.

Conclusions Risk-adjusted assessments of blood product use based on administrative data allow hospital-wide evaluation of transfusion use. Comparing blood use between different hospitals contributes toward establishing appropriate transfusion practices.

Key words: administrative data, blood usage, diagnosis-related group, platelets, red cells

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Introduction

The value of blood transfusions to patients with haemorrhage, haematopoietic disorders and other critical illnesses is widely recognized. In recent years, transfusion medicine has faced many issues, including increases in transfusion-transmitted viral infections, as well as insufficient blood supply due to increasing demand for transfusions. From perspectives of patient safety, quality medical care and effective use of limited medical resources, it has become more important to use the minimum amount of blood necessary for each transfusion. Although guidelines have been developed by various organizations in different countries [1–6], adherence to guidelines is often poor. Previous research conducted in Japan and internationally has

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