



Original Article

Association between rapid antigen detection tests and antibiotics for acute pharyngitis in Japan: A retrospective observational study[☆]



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ARTICLE INFO

Article history:

Received 2 July 2018

Received in revised form

11 October 2018

Accepted 12 December 2018

Available online 12 January 2019

Keywords:

Antibiotic prescription

Acute respiratory tract infection

Antimicrobial stewardship

Pharyngitis

Rapid antigen detection test

ABSTRACT

The application and clinical impact of rapid antigen detection test (RADT) in the treatment of acute pharyngitis is unknown in Japan. We aimed to examine the proportions of RADT usage to identify Group A β -hemolytic *Streptococcus* (GAS) in outpatients with acute pharyngitis and evaluate the association between RADT and antibiotic treatment. We analyzed health insurance claims data from 2013 to 2015. Logistic regression models were used to analyze associated factors with RADT, overall antibiotic prescription, or penicillin use. We analyzed 1.27 million outpatient visits with acute pharyngitis, in which antibiotics were prescribed in 59.3% of visits. Of the total visits, 5.6% of patients received RADT, and 10.8% of the antibiotics were penicillin. Penicillin selection rates were higher in cases with RADT (25.4%) than those without RADT (9.7%). Compared to large-scale facilities, antibiotic prescription rates were higher in physicians' offices. For factor analysis, age (3–15 years), diagnosis code (streptococcal pharyngitis), size of the medical facility (large-scale hospitals), and physician's specialty (pediatrics) were associated with RADT use. Penicillin selection rate increased with RADT implementation (25.4% vs. 9.7%: adjusted odds ratio 1.55; 95% CI, 1.50–1.60). At 63% of the facilities, the RADT implementation rate was <5% of acute pharyngitis visits prescribed antibiotics. In conclusion, the proportion of RADT usage for outpatients with acute pharyngitis was low in Japan. With appropriate indication and evaluation, we expect that more utilization of RADT can help promote antimicrobial stewardship for outpatients with acute pharyngitis by prompting penicillin therapy. Further investigation with detailed clinical data are warranted.

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1. Introduction

Acute pharyngitis is one of the most common reasons for visits to primary care physicians, for which antibiotics are frequently prescribed [1]. However, most cases are caused by viruses, such as adenovirus, influenza virus, and enterovirus [2,3], which are self-limiting and usually do not require any antibiotic therapy. Group

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A β -hemolytic *Streptococcus* (GAS) is the most frequent bacterial pathogen of acute pharyngitis and requires antibiotic treatment for the prevention of sequelae such as acute rheumatic fever and peri-tonsillar abscess [4–8]. However, GAS pharyngitis accounts for only one-fourth of pediatric pharyngitis cases and approximately 10% of adult cases [2,3]; furthermore, 41.6%–68% of outpatients with acute pharyngitis undergo unnecessary antibiotic administration [9–12].

For appropriate treatment of GAS pharyngitis, rapid and accurate diagnosis is expected [4,7]. It is difficult to differentiate between bacterial and viral pharyngitis using only clinical findings. To increase diagnostic accuracy, clinical scoring methods, such as the Centor criteria [13] and McIsaac criteria [14], have been developed. However, positive predictive values of the Centor score of 1, 2, 3, and 4 were 6.5%, 15%, 32%, and 56%, respectively [13]. A recent large-scale validation study reported that the accuracy of GAS pharyngitis in patients with a full score (4 scores) was 68% among children aged 3–14 years and approximately 60% in those aged ≥ 15 years [15]. Current guidelines recommend that patients with Centor criteria scores ≤ 2 do not need further examination for GAS infection [5,6]. Therefore, the clinical scoring approach may be useful to exclude pharyngitis other than GAS pharyngitis. However, the scoring method may potentially lead to over-diagnosis, which in turn may facilitate unnecessary antibiotic prescription.

Previous literature has reported that a diagnostic strategy based on an antigen test or bacterial culture, rather than clinical scoring, could reduce antibiotic prescribing [16–21]. A rapid antigen detection test (RADT) can provide a quick result with high accuracy for GAS pharyngitis, which potentially promotes outpatient antimicrobial stewardship. However, other organisms such as Group C/G β -hemolytic *Streptococcus* or *Fusobacterium necrophorum* are known to be common pathogens of acute pharyngitis [22], and the use of RADT may cause physicians to overlook cases of bacterial pharyngitis to be treated by antibiotics. Based on this, currently, there is no complete consensus regarding antibiotic treatment based on the clinical score and implementation of RADT among clinical guidelines or scientific societies [4–6,23,24].

In Japan, the clinical guidelines for antimicrobial stewardship were published in 2017 [25] and recommend the active use of RADT for the accurate diagnosis of pharyngitis. However, the clinical use or impact of RADT in Japanese outpatient settings has yet to be exhaustively uncovered. We aimed to clarify the implementation rate of RADT in outpatients with acute pharyngitis and its influence on antibiotic prescribing, associated factors for RADT use and antibiotic prescribing.

2. Patients and methods

2.1. Data source

For this study, we used data from the Japan Medical Data Center (JMDC) claims database [26]. This longitudinal database contains anonymized health insurance claims data (inpatient, outpatient, and pharmacy) of over 4 million people, which corresponds to approximately 3% of the entire Japanese population. The JMDC is widely used for healthcare research and has been cited in peer-reviewed journals across a broad range of healthcare topics [27,28]. The JMDC database was suitable for use in our study because pharyngitis is routinely diagnosed and treated in a variety of clinical settings, including general hospitals and emergency departments, but most commonly in physicians' offices. The other reason that this database was a good fit for our study is because of the high prevalence of pharyngitis in various populations, including children.

2.2. Study population and definition of acute pharyngitis

This is a retrospective observational study that was conducted for three years between January 1, 2013 and December 31, 2015. The targeted study population was ≤ 74 years of age. We categorized age groups as follows: 0–2 years, 3–5 years, 6–15 years, 16–59 years, and 60–74 years. We defined acute pharyngitis as acute pharyngitis (J02) and acute tonsillitis (J03) using the International Statistical Classification of Diseases and Related Health Problems 10th Revision. Furthermore, acute pharyngitis was classified into three categories according to etiology: (i) unspecified, (ii) other specified organisms, and (iii) streptococcal. These definitions are as follows: “acute pharyngitis, unspecified,” as acute pharyngitis, unspecified (J02.9) and acute tonsillitis, unspecified (J03.9); “acute pharyngitis due to other specified organisms” as acute pharyngitis due to other specified organisms (J02.8) and acute tonsillitis due to other specified organisms (J03.8); and “Streptococcal pharyngitis” as Streptococcal pharyngitis (J02.0), Streptococcal tonsillitis (J03.0), and Streptococcal infection (A49.1) with J02.9 or J03.9. When a visit was assigned to more than two categories of pharyngitis described above, we excluded the case from the analysis. In addition, the visits leading to a diagnosis of acute upper respiratory tract infection (J00, J01, and J04–J06) or bronchitis (J20–J22 and J40) on the same day as the diagnosis of pharyngitis were excluded, because such cases could be treated with antibiotics along with other conditions. Similarly, the visits with otitis (H60–61, H70–74), pneumonia (J13–16, 18), and urinary tract infection (N10–13, 15, 30, 39) diagnosed in the same month as pharyngitis were excluded because of the above reason.

2.3. Antibiotic classifications

We classified oral antibiotics according to the Anatomical Therapeutic Chemical (ATC) codes (World Health Organization). Antimicrobial drugs belonging to the ATC code of J01C (beta-lactam antibacterials, penicillins) were defined as penicillins.

2.4. Statistical analysis

We examined the RADT implementation rate among patients at their first visit to medical facilities for acute pharyngitis. The proportion of visits with RADT were presented as point estimates with 95% confidence intervals (CIs). A multilevel logistic regression model was used to analyze associated factors with RADT, as well as overall antibiotic or penicillin prescribing. Results from the logistic regression analysis were provided as adjusted odds ratio (AOR) with 95% CI, frequency, and percentage. When RADT was set as a dependent variable, age, diagnosis, the number of beds in medical institutions, (0–19, 20–99, 100–199, 200–299, 300–499, ≥ 500 beds), physician specialty (general internal medicine, pediatrics, otorhinolaryngology, others), and visit hours (in-hour, out-of-hours) were introduced as covariates. When antibiotic or penicillin prescribing were set as dependent variables, RADT as well as these covariates were introduced. Data processing and aggregating were administered with Microsoft® Access® 2013. All statistical analyses were performed using R version 3.2.2 [29].

2.5. Ethical statement

The data in this study were completely de-identified, and therefore, informed consent from the subjects was not required. This study was approved by the Okayama University Hospital, Ethics Committee (No. 1706-009). This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.

3. Results

We analyzed 1.27 million outpatient visits with acute pharyngitis from 2013 to 2015. The patients visited centers for general internal medicine (50.1%), pediatrics (36.5%), otorhinolaryngology (4.4%), and other specialties (8.9%). In-hour visits accounted for 81.9% of the cases. Of the total visits, 5.6% patients underwent RADT, and 59.3% (751,195 visits) were prescribed with antibiotics, among which penicillin accounted for 10.8% (81,494 visits). RADT implementation rates among patients given antibiotics and penicillin were 7.0% and 16.5%, respectively.

Among the three categories of acute pharyngitis, 97.5% cases were classified into unspecified pharyngitis, followed by 2.3% as streptococcal pharyngitis (Table 1). Overall RADT implementation rate was 5.6%, while those in unspecified and streptococcal cases markedly differed, with 3.6% and 88.2%, respectively. In patients without RADT, the antibiotic prescription rate was 58.4% (95% CI; 58.3–58.5), while the antibiotic prescription rate among patients with RADT increased to 75.0% (95% CI; 74.6–75.3). With or without RADT, antibiotics were prescribed in most streptococcal cases, and more than half of the cases were unspecified pharyngitis. Penicillin selection rates were higher in cases with RADT (25.4%) than those without RADT (9.7%). However, for streptococcal pharyngitis, penicillin therapy was selected regardless of RADT (AOR 3.93; 95% CI, 3.78–4.08) (Table 3).

Among each age category, RADT was most frequently implemented in 3–5 years (10.2%, AOR 7.15; 95% CI, 6.87–7.45) and 6–15 years (11.1%, AOR 7.74; 95% CI, 7.43–8.05) (Table 2). On the other hand, the RADT was performed for 2.8% in 16–59 years (AOR 2.2; 95% CI, 2.1–2.3) and 0.5% in 60–74 years (AOR 0.46; 95% CI, 0.4–0.5). There was a strong association between the diagnosis code of streptococcal pharyngitis and RADT (AOR 177; 95% CI, 170–184). As for facility scale, RADT was performed at large-scale hospitals rather than physicians' offices. Regarding physicians' specialties, RADT was more frequently performed by pediatricians (AOR 1.24; 95% CI, 1.22–1.27) than general internal physicians (referent) or otolaryngologists (AOR 0.69; 95% CI, 0.65–0.73). Although it slightly differed, RADT was almost equivalently applied at in-hours and out-of-hours.

RADT utilization was associated with penicillin selection (AOR 1.55; 95% CI, 1.50–1.60), as well as antibiotic prescribing (AOR 1.35; 95% CI, 1.32–1.38) (Table 3). More than half the patients aged ≥ 3 years were prescribed antibiotics. Penicillin selection was highest in the youngest age group (0–2 years-old) followed by those aged 3–5 years. However, the proportion of penicillin prescription among those aged >6 years were $<10\%$. Antibiotic prescription (penicillin/all antibiotics, %) rates in unspecified, other specified, and streptococcal pharyngitis were 58.6% (9.8%), 11.2% (14.0%), and 94.6% (37.6%), respectively. Compared to large medical facilities, antibiotic prescription rates at physicians' offices were higher,

while penicillin selection rates were lower. In comparison with general physicians, pediatricians prescribed antibiotics less frequently (AOR 0.70; 95% CI, 0.70–0.71) but chose penicillin more often (AOR 1.51; 95% CI, 1.48–1.54). Otolaryngologists prescribed more antibiotics than did general physicians (AOR 1.08; 95% CI, 1.06–1.11), but penicillin selection rate was highest (AOR 1.81; 95% CI, 1.76–1.87). Median (interquartile ranges) of RADT implementation rate for acute pharyngitis was 2.2% (0, 9.3%) among all medical facilities. Approximately 63% of the facilities performed the RADT in $<5\%$ of acute pharyngitis visits with antibiotic prescribing (Fig. 1).

4. Discussion

In this study, we demonstrated the implementation rates and associated factors for RADT, as well as antibiotic prescribing for outpatients with acute pharyngitis, using health insurance claims data between 2013 and 2015. Of the 1.27 million visits, only 5.6% of the outpatients with acute pharyngitis were examined using RADT. By age group, the RADT implementation rate was the highest among patients aged 6–15 years (11.1%), followed by patients aged 3–5 years (10.2%). Large-scale medical facilities and pediatrics as a specialty were also associated with the frequent use of RADT. Penicillin selection was associated with the implementation of RADT. Based on these results, we concur that accurate diagnosis of acute pharyngitis is essential to promote antimicrobial stewardship. For that purpose, promotion of RADT use in outpatient settings should be considered in Japan.

In comparison with previous studies conducted in western countries, the RADT implementation rate for acute pharyngitis visits in Japan was low. The median proportion of RADT use to antibiotic prescription for acute pharyngitis was 2.2%, and approximately 63% of facilities performed the test at a rate of 5% or less. According to a national pediatric survey performed between 1997 and 2003 in the United States, clinicians performed RADT in 53% of outpatients with sore throat [21]. Another study from France in 2012 reported that approximately 60% of general practitioners used RADT for diagnosis of acute pharyngitis in children aged between 3 and 16 years [30]. A possible explanation for the difference of RADT implementation rate between Japan and other countries includes a disparity of healthcare insurance systems. In Japan, a universal health insurance coverage is well established, and especially for children, a majority of local municipalities provides special financial assistance. With these social backgrounds, we assume that Japanese people tend to seek for medical consultation even with mild symptoms. Thus, the number of individual visiting healthcare facilities in Japan and those in abroad may largely differ, and this discrepancy possibly makes it difficult to compare the RADT implementation rate among countries with different insurance systems.

Table 1

Percentage of rapid antigen detection tests (RADT) for Group A beta-hemolytic *Streptococcus* in three types of acute pharyngitis, and prescribing rates of any antibiotics or penicillin depending on the use or non-use of RADT.

Diagnosis	Visit with pharyngitis, (%)	Proportion used RADT, %	Rapid antigen detection testing (RADT) to identify group A beta haemolytic <i>Streptococcus</i>			
			Proportion of visits prescribed an antibiotic		Proportion prescribed penicillins/visits with an antibiotic	
			without RADT, % (95% CI)	with RADT, %, (95% CI)	without RADT, %, (95% CI)	with RADT, %, (95% CI)
Unspecified acute pharyngitis	1,234,915 (97.5)	3.6	58.4 (58.3–58.5)	63.1 (62.6–63.5)	9.6 (9.6–9.7)	14.8 (14.4–15.2)
Pharyngitis due to other specified organisms	2365 (0.2)	17.7	10.0 (8.7–11.4)	16.5 (12.9–20.0)	10.3 (6.0–14.5)	24.6 (14.5–34.8)
Streptococcal pharyngitis	29,300 (2.3)	88.2	82.7 (81.4–84.0)	96.2 (96.0–96.5)	39.6 (37.8–41.4)	37.3 (36.7–37.9)
Total	1,266,580 (100.0)	5.6	58.4 (58.3–58.5)	75.0 (74.6–75.3)	9.7 (9.7–9.8)	25.4 (25.0–25.8)

Table 2
Factors associated with the use of rapid antigen detection test (RADT) to identify Group A beta-hemolytic *Streptococcus*, using multilevel logistic regression analysis.

Characteristic	Visits with pharyngitis (N = 1,266,580)	Proportion of visits, %	RADT		
			Visits with RADT, %	AOR	95% CI
Age category, y					
0–2	238,352	18.8	1.5	Referent	
3–5	209,762	16.6	10.2	7.15	(6.87–7.45)
6–15	280,892	22.2	11.1	7.74	(7.43–8.05)
16–59	497,625	39.3	2.8	2.22	(2.13–2.32)
60–74	39,949	3.2	0.5	0.46	(0.39–0.53)
Diagnosis code					
Acute pharyngitis, unspecified	1,234,915	97.5	3.6	Referent	
Acute pharyngitis due to other specified organisms	2365	0.2	17.7	4.58	(4.09–5.13)
Streptococcal pharyngitis	29,300	2.3	88.2	177	(170–184)
Beds					
0–19	1,143,571	90.3	5.3	Referent	
20–99	23,556	1.9	5.8	1.54	(1.44–1.64)
100–199	29,964	2.4	5.6	1.57	(1.48–1.66)
200–299	13,349	1.1	7.6	2.10	(1.94–2.26)
300–499	28,251	2.2	11.1	3.34	(3.19–3.50)
≥500	27,889	2.2	8.1	2.41	(2.29–2.54)
Specialty					
General internal medicine	634,909	50.1	4.8	Referent	
Pediatrics	462,660	36.5	7.2	1.24	(1.22–1.27)
Otorhinolaryngology	56,069	4.4	3.5	0.69	(0.65–0.73)
Others	112,942	8.9	4.0	0.86	(0.83–0.90)
Visit hour					
In-hour	1,037,535	81.9	5.5	Referent	
Out-of-hours	229,045	18.1	5.9	1.10	(1.07–1.12)

The contribution of RADT in reducing antibiotic prescribing is a point of discussion. The results of a study from the United States indicated that there was a significantly lower chance for antibiotic prescribing when testing was implemented [21]. Moreover, according to the French study, general practitioners who did not use

RADT prescribed antibiotics in 50.2% of the cases, while those who used the test prescribed antibiotics in 30.5% of the cases [30]. On the contrary to these previous studies, use of RADT was associated with a higher rate of antibiotic prescribing in Japan; the proportions of prescribing with and without RADT were 75.0% and 58.4%,

Table 3
Factors associated with antibiotic prescribing and penicillin selection for pharyngitis, using multilevel logistic regression analysis.

Characteristic	Visits with pharyngitis (N = 1,266,580)	Proportion of visits, %	Antibiotic prescribing (N = 1,266,580)			Penicillins selection (N = 751,195)		
			Visits with antibiotics, %	AOR	95% CI	Penicillins/all antibiotics, %	AOR	95% CI
RADT								
Without	1,196,147	94.4	58.4	Referent		9.7	Referent	
With	70,433	5.6	75.0	1.35	(1.32–1.38)	25.4	1.55	(1.50–1.60)
Age category, y								
0–2	238,352	18.8	39.3	Referent		21.2	Referent	
3–5	209,762	16.6	57.1	1.92	(1.89–1.94)	15.4	0.58	(0.57–0.59)
6–15	280,892	22.2	63.3	2.31	(2.28–2.34)	9.6	0.34	(0.33–0.35)
16–59	497,625	39.3	68.1	2.87	(2.83–2.90)	7.4	0.36	(0.35–0.37)
60–74	39,949	3.2	53.2	1.58	(1.54–1.62)	5.3	0.27	(0.25–0.28)
Diagnosis								
Acute pharyngitis, unspecified	1,234,915	97.5	58.6	Referent		9.8	Referent	
Acute pharyngitis due to other specified organisms	2365	0.2	11.2	0.14	(0.12–0.16)	14.0	0.78	(0.55–1.11)
Streptococcal pharyngitis	29,300	2.3	94.6	10.5	(10.0–11.1)	37.6	3.93	(3.78–4.08)
Beds								
0–19	1,143,571	90.3	61.3	Referent		10.5	Referent	
20–99	23,556	1.9	49.8	0.51	(0.49–0.52)	11.7	1.39	(1.31–1.47)
100–199	29,964	2.4	48.8	0.47	(0.46–0.48)	14.2	1.92	(1.83–2.02)
200–299	13,349	1.1	48.5	0.49	(0.47–0.51)	15.6	1.92	(1.79–2.06)
300–499	28,251	2.2	34.4	0.28	(0.27–0.29)	19.2	2.26	(2.14–2.38)
≥500	27,889	2.2	27.5	0.21	(0.20–0.21)	18.9	2.37	(2.23–2.52)
Specialty								
General internal medicine	634,909	50.1	64.1	Referent		8.1	Referent	
Pediatrics	462,660	36.5	52.1	0.70	(0.70–0.71)	15.5	1.51	(1.48–1.54)
Otorhinolaryngology	56,069	4.4	68.6	1.08	(1.06–1.11)	13.4	1.81	(1.76–1.87)
Others	112,942	8.9	57.5	0.81	(0.80–0.83)	9.1	1.16	(1.13–1.19)
Visit hour								
In-hour	1,037,535	81.9	59.9	Referent		11.0	Referent	
Out-of-hours	229,045	18.1	56.5	0.85	(0.84–0.86)	10.2	1.00	(0.98–1.02)

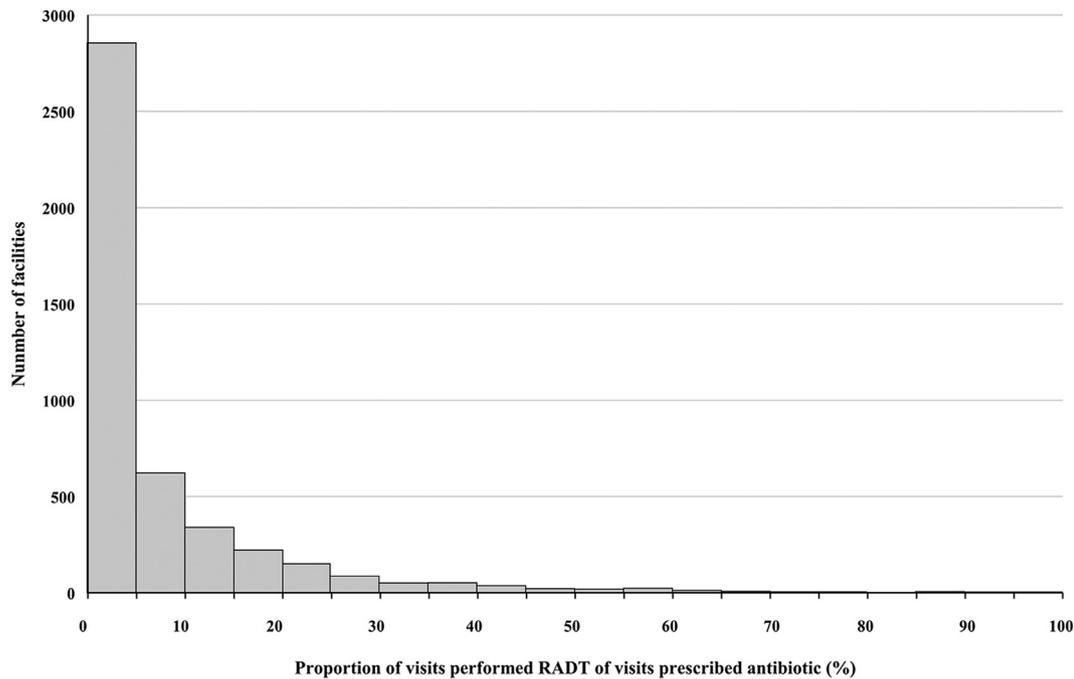


Fig. 1. Distribution of proportions in rapid antigen detection tests implementation to antibiotic prescribing for acute pharyngitis. Medical facilities where there were ≥ 30 visits of acute pharyngitis with an antibiotic prescription from 2013 to 2015 were included (4528 facilities).

respectively (AOR 1.35, 95% CI 1.32–1.38). These contrasting results are possibly due to the inappropriate or biased use of RADT in Japan. The low RADT implementation rate obtained in this study indicates that the test is performed selectively for specific cases with high suspicion of GAS pharyngitis. This means that cases where RADT was applied have high pre-test probabilities, and therefore, doctors prescribe antibiotics regardless of the test result. Due to a lack of clinical data, we cannot conclude our conjecture. However, since RADT has high sensitivity and specificity (approximately 90% each) [31], most cases confirmed to be RADT-negative are usually not indicative of the requirement for antibiotic treatment. We thus believe the more active use of RADT can lead to a decrease of over-prescription of antibiotics for outpatients with acute pharyngitis. On the other hand, heavy use of RADT may result in more detection of colonizing organisms, and consequently over-prescription of antibiotics. Future studies should properly evaluate the results of RADT to determine indications for antibiotic treatment.

Optimization of diagnostic and therapeutic approaches in primary care settings, rather than in larger hospitals, is important for outpatient antimicrobial stewardship in Japan. The proportion of visits at physician's offices was 90.3%, whereas the percentage of RADT implementation was the lowest at 5.3%. A possible reason for the low RADT implementation rate at physician's offices or small-scaled hospitals could be that the test kit is in the first place not placed there. By physician specialty, pediatricians performed RADT most frequently and prescribed antibiotics less frequently in comparison with others. Still, only 7.2% of pediatric cases underwent RADT, and more than half of patients aged 3 years and above were prescribed any antibiotics, with low penicillin selection rates of 9.6% in the 6–15 years age group. Better utilization of RADT and improvement in proper antibiotic prescribing should be emphasized among general internal physicians and otolaryngologists.

Our study also suggested that RADT implementation leads to etiological diagnosis of acute pharyngitis, which promotes appropriate antibiotic selection. Compared to unspecified pharyngitis,

the antibiotic prescription rate in cases with other-specified pharyngitis was considerably lower (AOR 0.14; 95% CI, 0.12–0.16), indicating that specific microbiological diagnosis of pharyngitis can reduce antibiotic prescribing. Our data also showed that penicillin was more likely to be prescribed for cases with streptococcal pharyngitis, though the penicillin selection rate was still only 37.6%. Even considering the possibilities of allergy or other adverse drug effects, our data suggested that penicillin therapy is infrequently given to patients with pharyngitis. This implies that patients with streptococcal pharyngitis are treated using broader-spectrum antibiotics in Japan.

The strength of the study is that this was the first and largest-scale study for three years and revealed the relationship between RADT use and antibiotic selection in detail by age, diagnosis, the scale of the medical facility, physician specialty, and patient's visit hour. However, several limitations of our study should also be mentioned. First, differential diagnoses of acute pharyngitis could not be considered because of lack of clinical data. Second, the possibility that the diagnoses in the health insurance claims data may not correspond to the clinical diagnosis was not considered. Accuracy of diagnostic codes for pharyngitis in the claims data might be low. However, the high positive predictive value for the diagnosis of acute pharyngitis can solve this issue [32,33]. Third, data regarding the bacterial culture examination results were unavailable. In cases where RADT results are negative, bacterial culture is recommended by the IDSA (Infectious Diseases Society of America) guideline for the identification of causative organisms. However, the Japanese health insurance system does not allow medical fee payment for culture examination performed on the same day of RADT. Therefore, data regarding the culture test on the same day could not be used. Fourth, due to the retrospective nature of the study, a causal relationship between RADT and antibiotic prescription could not be shown. There may be a possibility of bias in that the patients with higher pre-test probability for GAS pharyngitis may have undergone RADT. Fifth, the JMDC database includes over 4 million individuals in the Japanese population, which,

however, does not represent the entire Japanese population, primarily because it does not include data of older patients aged 75 years or over. Thus, results of the present study may only apply to the population aged <75 years. Finally, physicians' attitudes toward the proper use of antibiotics could be a potential confounding factor. Regardless of these limitations, the results provide prominent evidence to promote RADT use and appropriate antibiotic use in acute pharyngitis therapy in Japan.

5. Conclusion

The present study demonstrated that RADT use for the diagnosis of acute pharyngitis was less common in Japan. Our data suggested that implementation of RADT may not contribute in decreasing antimicrobial prescribing; however, it may optimize antimicrobial therapy, *i.e.*, prompting penicillin treatment rather than treatment with other antibiotics, by helping to identify the etiology of infections. Overuse of broad-spectrum antibiotics increases antimicrobial resistance and possibly exposes patients to unnecessary adverse effects. With proper use and evaluation of the point-of-care testing, we believe that antimicrobial therapy for outpatients with acute pharyngitis can be further optimized.

Conflicts of interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jiac.2018.12.005>.

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