

# 한국의 중이염 질병부담

천 병 철<sup>1\*</sup> · 손 우 연<sup>2</sup> · 정 원 주<sup>2</sup> · 이 환 종<sup>3</sup> | <sup>1</sup>고려대학교 의과대학 예방의학교실, <sup>2</sup>GlaxoSmithKline Biologicals Asia Pacific, <sup>3</sup>서울대학교 의과대학 소아과학교실

## Economic burden of otitis media and a survey of physicians for its practice and claim codes in Korea

Byung Chul Chun, MD<sup>1\*</sup> · Woo Yun Sohn, MD<sup>2</sup> · Wonjoo Jung, MSc<sup>2</sup> · Hoan Jong Lee, MD<sup>3</sup>

<sup>1</sup>Department of Preventive Medicine, Korea University College of Medicine, Seoul, Korea, <sup>2</sup>GlaxoSmithKline Biologicals Asia Pacific, Singapore,

<sup>3</sup>Department of Pediatrics, Seoul National University College of Medicine, Seoul, Korea

\*Corresponding author: Byung Chul Chun, E-mail: [chun@korea.ac.kr](mailto:chun@korea.ac.kr)

Received December 3, 2012 · Accepted December 6, 2012

Otitis media (OM) is one of the most common pediatric infectious diseases. The burden of OM is known in many countries, but data for Korea has not been collected. The primary objective of this study was to evaluate the disease burden of OM in both children and adults. The Health Insurance Review and Assessment database study was analyzed to estimate the clinical and economic burden of OM and acute OM (AOM) for 2004. OM was defined as all cases coded H65, H66, or H67 and AOM cases coded H65, H65.0, H65.1, H65.9, H66, H66.4 or H66.9. For AOM, repeated visits within 30 days were considered to be one episode. Age specific incidence, and direct and indirect costs were estimated. A survey on pediatricians and otolaryngologists who most frequently diagnosed OM was carried out. The objective was to evaluate the accuracy of the claims made for OM and to examine the diagnosis and treatments of OM. A total of 5,964,587 claims for OM and 2,924,532 AOM episodes were reported. The incidence of outpatients presenting AOM was 60.9/1,000. The incidence of AOM was highest in children aged 1 year (736.9/1,000). The overall hospitalization rate due to AOM was 2.8/10,000, with a peak of 29.4/10,000 (1 year). The total cost incurred by AOM in Korea was estimated to be around 606.3 billion Korean won (KRW; 1,000 KRW is approximately US\$1.00). The total cost of admissions was approximately 22.9 billion KRW, and the average cost of admission per person was about 1,690,000 KRW in a year. The cost of outpatient visits was 583.4 billion KRW, and 199,000 KRW per person. According to a survey of pediatricians and otolaryngologists on the accuracy of the OM diagnostic code, treatment, and prescription habits, the first-line diagnosis of AOM seemed to be fairly accurate. OM, including AOM, causes a considerable clinical and economic burden in Korea.

**Keywords:** Otitis media; Economic burden; Epidemiology

### Introduction

Otitis media (OM) is inflammation of the middle ear. It is not only a common disorder that occurs in children after respiratory infection, but also the most frequent disease requiring antibiotics and surgery [1-4]. OM

can be divided into suppurative and non-suppurative OM. Suppurative OM occurs as acute OM (AOM) while non-suppurative OM occurs as OM with effusion (OME) which is caused by the accumulation of effusion fluid in the middle ear cavity. AOM and OME regress spontaneously in most cases, and in general complete clinical recovery

© Korean Medical Association

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

occurs within one to two weeks in 70% of pediatric patients [5]. However, AOM also recurs frequently. It has been reported that 50% to 65% of pediatric patients three to five years of age had three or more recurrent episodes and that in pediatric patients 24 months of age or younger the recurrence rate of OME was 50% [6].

OM occurs most frequently in infants or young children. Approximately two-thirds of children experience one episode of AOM by the time they reach two years of age and 50% at least twice, but the incidence falls dramatically after six years of age [1]. According to other reports on the incidence of OM, over 80% of children experience OM at least once before they reach three, with an average of 1.9 times a year between six and eleven months of age and an average of 1.7 times a year between twelve and twenty three months of age and an average of 1.1 times a year between twenty three and twenty six months of age [5]. OM has a high frequency of outpatient visits and antibiotic prescribing rate. It may be accompanied by sequelae, such as chronic OM, hearing difficulty and can negatively impact the quality of life thus increasing the burden of disease [7]. In the US, the annual cost of OM is estimated to be three to five billion dollars [8], but if we take the indirect cost incurred by the families of pediatric patients, such as lost productivity, into account, the actual burden would be heavier [7].

OM is a common disease in Korea, but data on the burden of disease, such as the incidence, prevalence, and cost are limited. This lack of data greatly limits evaluations of related policies and vaccines. The objective of this study is to estimate the incidence of OM and burden of disease in Korea. The study was conducted in two ways: one was by analyzing the health insurance data and the other was by carrying out a survey on doctors. The health insurance data include most of the national medical insurance claims data, however, it has

always been a problem how well the classification of diseases in the claims would match the actual diagnosis, in particular with infectious diseases. This study aims also to explore the accuracy of health insurance data of OM indirectly, based on the survey on doctors.

## Materials and Methods

### 1. Estimation of otitis media cases

We assessed and analyzed National Health Insurance Review and Assessment (HIRA) database of 2004. Korea has unique universal national medical insurance system, so all insured medical services and expenditures in Korea must be reported to HIRA in order to be reimbursed. HIRA database is representative of the disease and health care of Korean population and is the most frequently used database for disease burden studies in Korea. OM was defined as cases claimed for H65 (nonsuppurative OM), H66 (suppurative and unspecified OM), H67 (OM in disease classified elsewhere) codes. AOM was defined as cases claimed for H65 (nonsuppurative OM), H65.0 (acute serous OM), H65.1 (other acute nonsuppurative OM), H65.9 (nonsuppurative OM unspecified), H66 (suppurative and unspecified OM), H66.0 (acute suppurative OM), H66.4 (suppurative OM specified H66.9 OM unspecified). All persons registered in the national health insurance system from January 01, 2004 to December 31, 2004 were considered as population at risk for OM. Repeated visits of the same cases within one months after 1st visit of any medical facilities due to AOM were considered one episode [9]. Age-specific incidence rate was defined as the total number of new episodes per 1,000 populations by age.

### 2. Estimation of the costs

The financial burden of OM was also estimated by

calculating the direct and indirect cost due to OM related outpatient visits and hospitalizations. Direct cost is cost for hospitalization and visiting outpatient clinic to manage the disease. Includes medical cost (both covered by health insurance and private expense), pharmaceutical cost, transportation cost and nursing fee.

Direct cost and cost of work loss were defined as below.

Direct hospitalization and outpatient cost =

$$\sum_i^n \left\{ \frac{E_i}{(1-\alpha)} + \frac{OE_i}{(1-\beta)} \right\} + \sum_i^n (N_i \times I) + \sum_i^n (O_i \times M), \text{ where}$$

$i$ : age (0,1,2...n)

$\alpha$ : percentage of hospitalization fee not covered by national health insurance

$\beta$ : percentage of outpatient fee not covered by national health insurance

$E_i$ : hospitalization cost

$OE_i$ : outpatient cost

$O_i$ : duration (days) of outpatient visit

$M$ : average round trip transportation fee

$N_i$ : duration (days) of hospitalization

$I$ : average daily nursing fee

Cost of work loss due to hospitalization and outpatient visit =  $\sum_{ij}^n \{ (N_{ij} + \delta \times O_{ij}) \times P_{ij} \times e_{ij} \times Y_{ij} \}$  where,

$i$ : age (0,1,2...n)

$j$ : sex (1,2)

$N_{ij}$ : duration (days) of hospitalization

$\delta$ : the proportion rate of outpatient vs. hospitalization

$O_{ij}$ : duration (days) of outpatient visit

$P_{ij}$ : rate of participation in financial activity

$e_{ij}$ : employment rate

$Y_{ij}$ : average daily income

Non-productive days for inpatient was calculated as

number of days hospitalized and for outpatient number of outpatient visits multiplied by 1/3. This was in reference to previous study hypothesizing that a doctor's productivity for one inpatient equals three outpatient visits [10,11]. We assumed that cost of loss of productivity did not apply to pediatric patients between 0 and 19 years of age and elderly patients 65 years of age or older. However, by hypothesizing that their families (guardians) in these age groups are females (1 to 19 years of age: mothers, 65 years of age: daughters and daughter-in-laws), and their age is placed between 30 and 49 years of age, we estimated the cost of lost productivity, by applying the average hourly and daily wage of the females in this age group [11]. The economic activity participation rate and employment rate by age group were referenced from the Ministry of Labour's 2004 data. Any loss incurred due to premature death was not included in the indirect cost. The estimated cost was viewed from sociological perspective. All used variables and data sources are presented in Table 1.

### 3. Survey on pediatricians and otolaryngologists

The survey on pediatricians and otolaryngologists was conducted between 21 June 2010 and 31 July 2010 by mail. The questions included individual characteristics such as specialty and experiences, diagnostic method of AOM, differentiation between acute suppurative and non-suppurative otitis media (OME), and classification of AOM used for health insurance claims. Such questions were prepared to indirectly evaluate the significance of differences between the classification of AOM used in health insurances and the patients actually diagnosed with OM. Apart from questions, information regarding the incidence of invasive treatments (myringectomy, v-tube insertion), duration of antibiotic use, and also pneumococcal vaccination were included in the survey,

**Table 1.** Each cost variable and its data source

Classification	Variable	Data source
Medical service fees	Inpatient medical service fee	National Health Insurance Corporation. 2004 National health insurance statistical yearbook [12]
	Percentage of uninsured out-of-pocket cost of admissions	National Health Insurance Corporation. A case study for insured patient's out-of-pocket medical service fees 2004 [13]
	Outpatient medical service fee	National Health Insurance Corporation. 2004 National health insurance statistical yearbook [12]
	Percentage of uninsured out-of-pocket cost of outpatient visits	National Health Insurance Corporation. A case study for insured patient's out-of-pocket medical service fees 2004 [13]
Travel cost	Inpatient visit days	National Health Insurance Corporation. 2004 National health insurance statistical yearbook [12]
	Outpatient visit days	National Health Insurance Corporation. 2004 National health insurance statistical yearbook [12]
	Average two-way travel cost	Korea Institute for Health and Social Affairs. 2004 National health and nutrition survey [14]
Nursing cost	Inpatient visit days	National Health Insurance Corporation. 2004 National health insurance statistical yearbook [12]
	Average daily nursing cost	Hanna care. Fee for care [15]
Indirect cost	Economic activity participation rate, employment rate, and average annual income by age and gender groups	Ministry of Labor. 2004 Survey report on wage structure [16]
	Average life span by age group	Statistics Korea. 2004 Demographic data [17]

since a pneumococcal vaccine can prevent OM caused by certain types of *Streptococcus pneumoniae*.

#### 4. Statistical analysis

To analyze the incidence of AOM, basic descriptive epidemiological analysis and frequency analysis were used. To obtain the total cost for all patients and by age groups, the direct cost and indirect cost incurred by inpatients and outpatients were calculated per person by age groups, and then multiplied by the numbers of outpatients and inpatients. In an item analysis, basic frequency analysis and chi-square test were used for discrete variables between pediatricians and otolaryngologists. The significance test was carried out by choosing a significance level of 0.05. Necessary data has been retrieved from the health insurance data for the statistical analysis by applying SAS ver. 9.2 (SPSS Inc.,

Chicago, IL, USA) and SPSS ver. 12.0 (SPSS Inc.) for the item analysis.

## Results

### 1. Disease burden of otitis media

A total of 5,964,587 claims for OM and 2,924,532 AOM episodes were reported. Incidence of outpatients presenting AOM was 60.9/1,000 (Table 2). The incidence of AOM was highest in children aged 1 year (736.9/1,000), followed by 552.5 (2 years), 518.2 (3 years), 445.1 (4 years), and 434.8 (0 year). The overall hospitalization rate due to AOM was 2.8/10,000, with a peak of 29.4/10,000 (1 year), followed by 22.6 (<1 year) 15.1 (2 years), 12.2 (3 years), 11.5 (4 years), and 4.5 (5 to 9 years).

The total cost incurred by AOM in Korea was

**Table 2.** Rates of outpatient visits and inpatient admissions due to otitis media by age

Age (yr)	Outpatient		Inpatient	
	No. of outpatients	Rate of outpatient visits (per 1,000)	No. of inpatients	Rate of inpatient admissions (per 10,000)
0	208,753	434.8	1,085	22.6
1	363,348	736.9	1,452	29.4
2	293,172	552.5	799	15.1
3	306,918	518.2	724	12.2
4	276,301	445.1	715	11.5
5-9	593,413	178.8	1,504	4.5
10-16	194,050	41.8	410	0.9
17-64	601,945	18.1	6,457	1.9
65 or older	86,632	20.8	433	1.0
Total	2,924,532	60.9	13,579	2.8

**Table 3.** Direct and indirect cost of inpatients and outpatients due to otitis media by age

Age (yr)	Inpatient		Outpatient		Total		
	Direct cost	Indirect cost	Direct cost	Indirect cost	Inpatient	Outpatient	Total
0	783.8	166.4	28,170.6	11,164.2	950.3	39,334.9	40,285.1
1	1,157.5	143.4	55,176.6	20,868.5	1,300.9	76,045.0	77,345.9
2	636.9	78.9	44,519.9	16,838.0	715.8	61,357.9	62,073.8
3	577.2	71.5	46,607.4	17,627.5	648.6	64,234.8	64,883.5
4	570.0	70.6	41,958.0	15,869.0	640.6	57,827.0	58,467.6
5-9	1,199.0	148.5	90,113.4	34,081.9	1,347.5	124,195.3	125,542.8
10-16	683.3	60.8	19,810.5	11,145.0	744.0	30,955.6	31,699.6
17-64	13,734.8	1,829.6	92,811.3	20,214.9	15,564.3	113,026.2	128,590.6
65 or older	892.9	104.2	11,284.2	5,137.1	997.1	16,421.2	17,418.3
Sum	20,235.3	2,673.8	430,451.9	152,946.1	22,909.1	583,398.0	606,307.1

Unit: 1 million Korean won.

estimated to be around 606.3 billion Korean won (KRW) (Table 3). The total cost of admissions was approximately 22.9 billion KRW, and the average cost of admission per person was about 1,690,000 KRW in a year. The cost of outpatient visits was 583.4 billion KRW, and 199,000 KRW per person. By age group, the highest

number of outpatient visits was observed in patients 1 year of age (77.3 billion). The cost of patients between 0 year of age and 4 years of age was 244.6 billion KRW, which takes up 40.3% of the total cost.

## 2. Results of survey of pediatricians and otolaryngologists on the accuracy of the otitis media diagnostic code, treatment and prescription habits

Out of 700 survey subjects, 259 people responded to the survey (37.0%), and among them a total of 258 responders (36.9%) were chosen for an analysis excluding one insincere responder. 107 of them were pediatricians and 151 were otolaryngologists. Out of 258 responders, 87.2% were male and 54.7% were in their 40's (Table 4).

In the diagnosis of pediatric patients 5 years of age and younger with AOM, none of the doctors diagnosed their patients by using only past history and symptoms without otoscopy, 64.7% used past history, symptoms and otoscopy, and 35.3% used additional diagnostic methods (Table 5). Otolaryngologists (85.7%) used more additional tests than pediatricians. In other words, Korean pediatricians and otolaryngologists at least use otoscopy in establishing the diagnosis, and do not rely only on symptoms. In many cases OM is not

accompanied by specific symptoms, such as otalgia or otorrhea. Thus the responders were asked whether or not they perform otoscopy when their patients did not present any specific symptoms of OM. The proportion of doctors who performed otoscopy in patients who made visits due to symptoms, such as cold symptoms and

**Table 4.** General descriptions of responders

Description	Classification	No. (%)
Gender	Male	225 (87.2)
	Female	33 (12.8)
Age (yr)	30-39	26 (10.1)
	40-49	141 (54.7)
	50-59	60 (23.2)
	60-69	23 (8.9)
	70-	8 (3.1)
Specialty	Pediatrics	107 (41.5)
	Otolaryngology	151 (58.5)
Experiences after obtaining medical license (yr)	Less than 10	12 (4.7)
	10-19	117 (45.5)
	20-29	86 (33.5)
	30 or longer	42 (16.3)

fever, without otalgia or otorrhea was high. The proportion of doctors who said they perform otoscopy in over 90% of cases was 73.3% in pediatric patients 0 year of age, 75.6% between 1 and 5 years of age, 67.0% in 5 years of age and older. Since the figure is fairly high, we believe that OM without ear symptoms is being diagnosed most of the cases.

To check the codes that are actually used in insurance claims, we requested them to confirm the codes they use when they diagnose their patients by distinguishing acute suppurative OM and non-suppurative otitis media (OME), and when they do not distinguish between suppurative and non-suppurative OM (Table 6). The most commonly used code for acute suppurative OM was H66.0 (65.6%), 11.6% used incomplete code H66, unspecified suppurative OM (H66.4) and unspecified OM (H66.9) was used in 8.6 and 5.3% of cases, respectively. Among non-suppurative OM claims, acute serious OM (H65.0) was the most frequent (42.8%), and chronic serious OM (H65.2) was the second highest (15.2%). In conclusion, 71% of pediatricians and otolaryngologists distinguish, diagnose and claim for suppurative and non-suppu-

**Table 5.** Methods of diagnosing acute otitis media

Diagnostic methods	Total	Pediatrics	Otolaryngology	P-value <sup>a)</sup>
Past history, symptoms, and otoscopy	167 (64.7)	94 (87.9)	73 (48.3)	<0.001
Past history, symptoms, otoscopy, and additional tests	91 (35.3)	13 (12.1)	78 (51.7)	
Total	258 (100.0)	107 (100.0)	151 (100.0)	

Values are presented as number (%).

<sup>a)</sup>Chi-square test.

ative OM separately, and in most cases they made claims according to the diagnosed disease. However, 29% answered that they mostly do not distinguish suppurative and non-suppurative OM, and in such cases they usually made claims as unspecified OM (44.0%), while some used chronic serious OM and chronic suppurative OM (13% each) for claims.

When patients with AOM needed antibiotic prescriptions, the most common length of antibiotic treatment was ten to fourteen days (60.3%), followed by six to nine days (26.1%) (Table 7). The weighted average duration of antibiotic treatment was 11.4 days and none were prescribed for duration of less than three days or over thirty days. Although most of the responders (43.3%) responded that less than one percent of patients required myringotomy another 16.3 percent answered that over six percent of patients needed myringotomy, and the weighted average was 2.7 percent. Most responders (46.1%) said the rate of patients who required v-tube insertion was less than one percent, and the weighted average was 2.2 percent.

## Discussion

It is well established in other countries that AOM is

**Table 6.** Codes used for claims after diagnosing acute suppurative OM

Disease code	Disease name	Diagnosed as acute suppurative OM <sup>a)</sup>	Diagnosed as non-suppurative OM (OME) <sup>b)</sup>	Suppurative and non-suppurative not distinguished <sup>c)</sup>
H65	Non-suppurative OM	1 (0.4)	18 (7.4)	6 (2.8)
H650	Acute serious OM (with effusion)	7 (2.9)	104 (42.8)	29 (13.3)
H651	Other acute suppurative (effusion, serious, allergic) OM	2 (0.8)	16 (6.6)	13 (6.0)
H652	Chronic serious OM	0 (0.0)	37 (15.2)	7 (3.2)
H653	Chronic mucoid OM	0 (0.0)	7 (2.9)	4 (1.8)
H654	Other chronic non-suppurative OM	0 (0.0)	4 (1.6)	4 (1.8)
H659	Non-suppurative OM, unspecified	1 (0.4)	27 (11.1)	9 (4.1)
H66	Suppurative and unspecified OM	28 (11.6)	0 (0.0)	7 (3.2)
H660	Acute suppurative OM	160 (65.6)	3 (1.2)	28 (12.8)
H661	Chronic tubotympanic suppurative OM	0 (0.0)	0 (0.0)	0 (0.0)
H662	Chronic atticotympanic suppurative OM	0 (0.0)	0 (0.0)	0 (0.0)
H663	Other chronic suppurative OM	8 (3.3)	0 (0.0)	1 (0.5)
H664	Suppurative OM, unspecified	21 (8.6)	1 (0.4)	9 (4.1)
H669	OM, unspecified	13 (5.3)	20 (8.2)	96 (44.0)
Combination of above codes and others		3 (1.2)	6 (2.5)	5 (2.3)

Values are presented as number (%).

OM, otitis media; OME, otitis media with effusion.

<sup>a)</sup>14 Non-responses, <sup>b)</sup>15 non-responses, <sup>c)</sup>15 non-responses, and excluding 41 responders who answered that they do distinguish between suppurative and non-suppurative OM.

particularly common in children and the burden of disease is high. The causative organisms of AOM are diverse, but bacteria such as *S. pneumoniae* (30% to 50%), *Hemophilus influenza* (20% to 30%), *Moraxella catarrhalis* (1% to 5%), and *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella*, *Pseudomonas aeruginosa* are known as causative organisms [1]. Because of the structure of a child's middle ear and the various causative organisms including viruses, OM not only occurs frequently in children but also recurs commonly and in

some cases it may become chronic or develop complications. Although antibiotics has significantly reduced the frequency of complications associated with suppurative OM various complications may occur including persistent OM with effusion (10% to 25%), hearing difficulty, perforation of tympanic membrane, chronic OM and mastoiditis, cholesteatoma, labyrinthitis, petrositis, tympanosclerosis, facial nerve palsy, meningitis and even brain abscess [1]. Although it is widely regarded that OM is very common and incurs a heavy burden on patients, it was difficult to find relevant studies in Korea. Because epidemiologic studies that prospectively assess incidence and prevalence of OM are lacking, and there are limitations in using health insurance data as secondary data. The question was, how well the OM patients who made claims would correspond to their actual diagnosis.

The incidence of AOM varies

greatly depending on assessment methods or countries. This study found that the number of outpatient visits made annually due to AOM per person was 0.74 times for patients 1 year of age, 0.55 for patients 2 years of age, and an average of 0.53 for patients between 0 and 4 years of age. According to a British study that surveyed children between 1 and 4 years of age in 2003 [18], the number of visits per person was around 0.4 times, while a study by Eskola et al. [19] that surveyed children 2 years of age and younger in 2003 noted that the annual



**Table 7.** Treatments of acute otitis media

Treatment method	Classification	No. (%)
Duration of antibiotic therapy (day)	Less than 3	0 (0.0)
	3-5	3 (1.2)
	6-9	67 (26.1)
	10-14	155 (60.3)
	15-20	29 (11.3)
	21-29	3 (1.2)
Percentages of patients requiring myringotomy (%)	Less than 1	111 (43.2)
	1-2	52 (20.2)
	3-5	52 (20.2)
	6-9	28 (10.9)
	More than 10	14 (5.4)
Percentages of patients requiring v-tube insertion (%)	Less than 1	118 (46.1)
	1-2	61 (23.8)
	3-5	52 (20.3)
	6-9	17 (6.6)
	More than 10	8 (3.1)

incidence of AOM was 1.24. Meanwhile, a prospective study pointed to a higher incidence, for instance, according to a prospective study in children in Boston stated that children aged 0 year had 1.2 episodes, 1 year 1.1, 2 years 0.7, and 3 years 0.8 [7], and in another study conducted in the US [20], children aged between 3 and 42 months who visited medical institutions due to AOM had 1.8 episodes. A prospective observational study carried out in the US [21] reported that children aged between 6 and 11 months, 12 and 23 months, and 24 and 35 months had 1.9, 1.7 and 1.1 episodes of OM in a year, respectively. Since AOM occurs multiple times in children who cannot express their symptoms, the reported incidence may vary greatly, depending on the interests of their parents and the use of medical institutions.

In using the Korean health insurance data, what worried us at first was that the incidence of OM might be exaggeratedly high, because doctors can use OM for the classification of disease to justify prescriptions of

antibiotics. Such cases may exist in reality, and even if we say that asymptomatic infections take up about fifty percent, the estimated incidence in Korean health insurance data is still lower than that in other countries. Furthermore, based on the survey, we found out that in many cases doctors confirm OM via otoscopy in patients who made visits due to acute respiratory infections. We believe that many cases of OM without its symptoms are included in the health insurance data. Such facts can ground the assumption that the incidence of AOM stated in the Korean health insurance data is not too exaggerated as we feared at first.

There are several limitations in making a direct comparison of the cost of disease between countries, because the definition of each cost included in the cost of disease, level of healthcare cost, level of incomes, and changes in monetary values vary every year in different countries. This study found that the cost of admissions due to OM was 1,690,000 KRW (1,530 US dollar [USD]) in 2004 per person, the cost of outpatient visits was about 199,000 KRW (181 USD) per person. In a study carried out by directly observing patients for three months in the US in 1999 suggested that the cost per person was 1,330 USD (95% confidence interval, 1,008.8 to 1652.4) [22]. Considering that most of patients are outpatients and the data is not observational data for whole year, the cost is extremely high compared to the cost in Korea. Likewise, the cost of disease, which was estimated to be approximately 606.3 billion KRW (551.2 million USD), cannot be compared directed with that of other countries. According to a study conducted in Canada in 1999 [23], which reflected direct and indirect cost of OM by age groups in the data on cost of disease, the cost of OM was 611.0 million USD in 1994, and 70.1 percent (428.4 million USD) of this amount were incurred by children aged under 14 years old. The



present study also argued that the cost incurred by children between 0 and 9 years of age is 428.6 billion KRW, which corresponds to about 70.7 percent of the total cost, and although the ratio was similar across all age groups, we need to consider the following facts, there is a ten year difference between the years assessed; and differences in national incomes.

We believe that at least the first-line diagnosis of AOM is pretty accurate, since almost all doctors used otoscopy for their diagnosis, based on the survey conducted in this study. In particular, we acknowledge that the classifications of diseases used for health insurance claims do match well with the diagnosis, and at least confirmed that chronic OM and AOM have few classification errors. However, when detailed terms such as suppurative OM and non-suppurative OM were categorized, according to the classification of disease for insurance claims, some inaccuracies were found. Taking such facts into account, this study used the code for AOM to minimize errors.

This study was carried out in order to estimate the burden of AOM in Korea. We indirectly examined the

accuracy of AOM presented in the health insurance claims data referred to in this study, by comparing the survey result of doctors and conditions in other countries. However, one limitation of this study is that the accuracy has not been examined directly. In addition, to grasp more accurate incidences and characteristics of AOM, a prospective community study is required.

## Acknowledgement

The authors wish to thank Dr. Young Kyu Shin, Myoungmoon Pediatric Clinic, Dr. Kwon Oh Hwi, Yonsei ENT Clinic and Professor Park Hun Yi, Ajou University Hospital for very helpful comments and discussions.

This study was supported by grant from GlaxoSmith-Kline Biologicals SA, and partly supported by grant of the Transgovernmental Enterprise for Pandemic Influenza in Korea, which part of Korea Healthcare Technology R&D Project by Ministry of Health & Welfare, Republic of Korea (grant no. 2010-E-13).

## 요약

**중**이염은 소아에서 매우 흔한 질환 중의 하나이며, 소아 항생제 처방의 가장 흔한 이유로 알려져 있으나 국내에서는 발생빈도와 질병부담에 대한 연구가 거의 없었다. 이 연구는 우리나라에서 중이염의 빈도와 질병부담을 측정하기 위한 것이다. 중이염의 발생빈도는 국민건강보험자료를 이용하여 인구 1,000명당 1년 중 새로 발생한 중이염으로 인한 외래방문률과 인구 10,000명당 입원발생률로 측정하였다. 중이염은 H65.x, H66.x, H67.x의 코드로 청구된 것으로 정의하였으며, 급성중이염은 H65, H65.0, H65.1, H65.9, H66, H66.0, H66.4 그리고 H66.9의 코드로 청구된 것으로 정의하였다. 동일한 중이염 코드로 30일 이내 재방문한 것은 한 번의 발생으로 간주하였다. 중이염 비용의 측정은 직접비용에 의료비 직접비용(외래 및 입원시 치료비용)과 비의료비 직접비용(의료기관 방문시 교통비와 간병인비), 간접비용에는 질병으로 인한 작업손실비용을 포함시켰다. 건강보험청구자료에 대한 정확도를 평가하고 중이염 진단방법과 청구현황을 파악하기 위하여 소아과와 이비인후과 전문의 각각 350명씩 총 700명을 확률추출하여 설문조사를 하였다. 설문조사는 2010년 6월과 7월에 걸쳐 우편조사로 이루어졌다. 2004년 기준 1년동안 급성중이염 외래방문률은 인구 1,000명당 60.9명이었다. 1세가 1,000명당 736.9명으로 가장 높았고 다음이 2세(552.5명), 3세(518.2명)의 순이었다. 입원발생률은 인구 10,000명당 2.8명이었으며 1세에서 29.4명으로 가장 높았고, 다음이 0세(22.6명), 2세(15.1명)의 순이었다. 급성중이염의 전체비용은 약 6천6억원으로 추계되었다. 입원비용은 약 229억원, 외래는 5,834억원이었으며, 연령별로는 0-9세까지의 비용이 총 4,286억원으로 전체 비용의 70.7%를 차지하였다. 설문조사는 응답자 259명(응답률, 37.0%) 중 258명의 자료를 분석하였는데 소아과 전문의는 107명, 이비인후과전문의는 151명이었다. 응답자 모두 급성중이염의 진단에 최소한 병력, 증상 및 이경검사를 사용하고 있었으며, 응답한 의사의 71%는 급성화농성중이염과 비화농성중이염으로 구분하여 진단하고 청구하며, 이 경우 상당수가 진단한 질병대로 청구하는 것을 알 수 있었다. 중이염은 국내에서도 외국과 유사한 빈도로 매우 높게 발생하며, 질병부담도 매우 크다.

**핵심용어:** 중이염; 질병부담; 역학

## REFERENCES

- Ahn HS. Respiratory disorders. In: Hong CE. Pediatrics. 8th ed. Seoul: Daehan Textbook Publishing; 2005. p. 653-681.
- Freid VM, Makuc DM, Rooks RN. Ambulatory health care visits by children: principal diagnosis and place of visit. *Vital Health Stat* 13 1998;(137):1-23.
- Leibovitz E. Acute otitis media in pediatric medicine: current issues in epidemiology, diagnosis, and management. *Paediatr Drugs* 2003;5 Suppl 1:1-12.
- Pennie RA. Prospective study of antibiotic prescribing for children. *Can Fam Physician* 1998;44:1850-1856.
- Rosenfeld RM, Kay D. Natural history of untreated otitis media. In: Rosenfeld RM, Bluestone CD, editors. Evidence-based otitis media. 2nd ed. Hamilton: BC Decker; 2003. p. 180-198.
- Teale DW, Klein JO, Rosner B. Epidemiology of otitis media during the first seven years of life in children in greater Boston: a prospective, cohort study. *J Infect Dis* 1989;160:83-94.
- Rovers MM. The burden of otitis media. *Vaccine* 2008;26 Suppl 7:G2-G4.
- Schwartz SR, Gates GA. Economic costs. In: Rosenfeld RM, Bluestone CD, editors. Evidence-based otitis media. 2nd ed. Hamilton: BC Decker; 2003. p. 333-341.
- Prymula R, Peeters P, Chrobok V, Kriz P, Novakova E, Kaliskova E, Kohl I, Lommel P, Poolman J, Prieels JP, Schuerman L. Pneumococcal capsular polysaccharides conjugated to protein D for prevention of acute otitis media caused by both *Streptococcus pneumoniae* and non-typable *Haemophilus influenzae*: a randomised double-blind efficacy study. *Lancet* 2006;367:740-748.
- Park CS, Kang HY, Kwon I, Kang DR, Jung HY. Cost-of-illness study of asthma in Korea: estimated from the Korea National Health insurance claims database. *J Prev Med Public Health* 2006;39:397-403.
- Jung YH, Ko S. The socioeconomic cost of diseases in Korea. *J Prev Med Public Health* 2006;39:499-504.
- National Health Insurance Corporation. 2004 National health insurance statistical yearbook. Seoul: National Health Insurance Corporation; 2005.
- National Health Insurance Corporation. A case study for insured patient's out-of-pocket medical service fees' 2004 [Internet]. Seoul: National Health Insurance Corporation; 2005 [cited 2013 Jan 4]. Available from: <http://www.nhic.or.kr>.
- Korea Institute for Health and Social Affairs. 2004 National health and nutrition survey. Seoul: Korea Institute for Health and Social Affairs; 2005.
- Hanna care. Fee for care [Internet]. Seoul: Hanna care [cited 2013 Jan 4]. Available from: [http://hcare.or.kr/html/sub03\\_02.html](http://hcare.or.kr/html/sub03_02.html).
- Ministry of Labor. 2004 Survey report on wage structure. Gwacheon: Ministry of Labor; 2004.
- Korean Statistical Information Service. 2004 Demographic data [Internet]. Daejeon: Statistics Korea [cited 2013 Jan 4]. Available from: [http://kosis.kr/abroad/abroad\\_01List.jsp?parentId=A](http://kosis.kr/abroad/abroad_01List.jsp?parentId=A).
- Melegaro A, Edmunds WJ, Pebody R, Miller E, George R. The current burden of pneumococcal disease in England and Wales. *J Infect* 2006;52:37-48.
- Eskola J, Kilpi T, Palmu A, Jokinen J, Haapakoski J, Herva E, Takala A, Kayhty H, Karma P, Kohberger R, Siber G, Makela PH; Finnish Otitis Media Study Group. Efficacy of a pneumococcal conjugate vaccine against acute otitis media. *N Engl J Med* 2001;344:403-409.
- Fireman B, Black SB, Shinefield HR, Lee J, Lewis E, Ray P. Impact of the pneumococcal conjugate vaccine on otitis media. *Pediatr Infect Dis J* 2003;22:10-16.
- Chonmaitree T, Revai K, Grady JJ, Clos A, Patel JA, Nair S, Fan J, Henrickson KJ. Viral upper respiratory tract infection and otitis media complication in young children. *Clin Infect Dis* 2008;46:815-823.
- Alsarraf R, Jung CJ, Perkins J, Crowley C, Alsarraf NW, Gates GA. Measuring the indirect and direct costs of acute otitis media. *Arch Otolaryngol Head Neck Surg* 1999;125:12-18.
- Coyte PC, Asche CV, Elden LM. The economic cost of otitis media in Canada. *Int J Pediatr Otorhinolaryngol* 1999;49:27-36.



## Peer Reviewers' Commentary

중이염은 소아에서 가장 흔한 질환 중의 하나이고, 항생제 사용과 수술의 가장 흔한 원인으로 알려져 있다. 특히 3세 이하에서는 2/3가 1회 이상 중이염 경험을 하고 그 중의 절반은 2번 이상 경험한다고 보고되어 발생빈도가 매우 높다. 그러나 우리나라에서 중이염의 질병부담에 대한 연구는 이전에 거의 없었다. 특히 건강보험자료만으로 중이염 질병부담을 측정할 경우, 진단의 정확성과 청구코드의 불일치 등의 문제가 예상되는데, 이 연구에서는 소아청소년과와 이비인후과 의사를 대상으로 중이염 진단방법과 청구 시 코드명을 같이 조사해서 건강보험자료만으로 분석할 때의 한계를 극복하고자 한 점이 장점이 있다고 할 수 있다.

[정리: 편집위원회]