

# Validity of Measles Immunization Certificates Submitted upon Enrollment in an Elementary School in Korea

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**Objectives :** To increase the booster vaccination rate, the Korean government legislated a measles vaccination for elementary school students in 2001, requiring parents to submit a certificate of vaccination upon the admission of the students to elementary school. The purpose of this study was to evaluate the validity of measles vaccination certificates which were issued to parents.

**Methods :** Using questionnaire survey data of 890 general practitioners and 9,235 parents in 2005, we investigated the evidence for booster vaccination certificates of measles.

**Results :** In the survey of general practitioners, 59.5% of the certificates depended on the medical records of clinic, 13.5% was immunization booklets, 23.7% was re-immunizations, 1.9% was confirmation of record of other clinics, and 1.4% was parents' statements or requests

without evidence. In the survey of parents, 36.2% of the certificates depended on the medical records of clinic, 43.4% was immunization booklets, 18.0% was re-immunizations, and 2.4% was parents' statements or requests without evidence.

**Conclusions :** Our findings show that a majority of the booster vaccination certificates of measles was issued on the basis of documented vaccinations and it means that the implementation of the law requiring the submission of elementary school students' vaccination certificates has been very successful in Korea.

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**Key words :** Measles, Certificate, Validity

## INTRODUCTION

Before the introduction of the mono-valent measles vaccine in 1965, and the combined measles-mumps-rubella (MMR) vaccine in 1983, an average of 4,000 to 6,000 people caught measles each year at the beginning of the 1980s, at that time measles was endemic in Korea. With the onset of the National Immunization Program against MMR in 1985, the occurrences of measles cases decreased to 1,000 to 2,000 per year but epidemic of measles still continued to occur periodically. In 1997, the Korean Centers for Disease Control and Prevention (KCDC) adjusted the vaccination ages of initial immunization between 12 to 15 months and for booster vaccination between 4 to 6 years, respectively. After the new vaccination program began, the number of measles occurrences had been less than 100 a year but a big epidemic broke out in

late 2000 through early 2001 [1].

The cause of this epidemic was the difficulty in reaching the necessary level of herd immunity due to primary and booster vaccination failures [2,3]. Current estimates of the coverage needed for fully protective herd immunity are 93.5-97.0% [4-6]. The primary vaccination failure occurs at rates of 4-8%, and the booster failure at about 4% [4].

After the big measles outbreak in 2000-2001, the KCDC revised the measles prevention policy from control to elimination. To that end, the KCDC launched a 'Catch-up' measles vaccination campaign in 2001 to vaccinate 5,840,000 students from second graders (8 years old) to first year high school students (16 years old). In order to increase the booster vaccination rate, the Korean government legislated a measles vaccination for elementary school students in 2001, requiring parents to submit a certificate of vaccination upon the

admission of the students to elementary school.

The submission rate for measles booster immunization certificates upon entry into elementary school was 98.9% in 2001, the first year of the program implementation, and 99.9% in 2005 [7]. The high rate of vaccination certificate submission could mean that the measles elimination project will finish sooner than planned if these certificates were issued on the basis of real vaccinations. It could also be a basis for the establishment of another program to require the submission of certificates proving the administration of the Vaccine Preventable Disease.

It is natural that certification of vaccination should be based on fact. However, there is a gap of one to two years between the booster measles vaccination (at the age of 4 to 6 years) and the issuance of the certificates (at the age of 7 years). Moreover, changes may occur to the medical clinic in which the booster was received (moving to another place or closure) or to parents (moving to another place). Parents

may also not keep records over time, so the evidence for the vaccination cannot be available. In fact, some studies have raised the need for the submission of evidence of the measles booster vaccination. Guo et al. [8] reported that less than 50% of the parents could remember what specific vaccines their children had received, although the authenticity of parents' memory on their children's vaccine status was greater than 96%. In Australia, compliance with the immunization certificate legislation is overestimated by the mid-year census because many schools have accepted non-statutory evidence of immunization [9].

Therefore, it is necessary that certificates of booster vaccination should be verified according to a sound evidence. This study investigated how certificates of measles booster immunizations are issued through parents and general medical practitioners so as to evaluate the validity of these certificates.

## MATERIALS AND METHODS

### I. Data and Subjects

A questionnaire survey was conducted for 890 general practitioners (GPs) and 9,236 parents whose children enrolled in an elementary school in 2005. The survey for GPs was carried out in April - May 2005 and for parents in April 2005.

We also used the KCDC database on certificates of measles vaccination to evaluate how representative the survey samples of parents were. Certificates of measles vaccination which were collected at the school were sent to public health centers (first at the end of April, second at the end of May and finally at the end of June 2005). Those data were then transmitted to the KCDC. We obtained KCDC database on certificates of measles vaccination in October 2005.

### II. Methods

#### A. Development of Questionnaires

The questionnaire for GPs focused on the administration of measles vaccination, the

issuance of vaccination certificates, the number of issued vaccination certificates, and the evidence of the issued certificates. The questionnaire for parents centered on the personal information of respondents (relationship with the student, age, education level, residential region), the institute that issuing their vaccination certificate and the evidence of the issuance. Before finalizing the survey questionnaires, pilot tests were run on 5 pediatric specialists and 10 parents by using those survey drafts.

In the survey for GPs, the basis for the issuance of vaccination certificates consisted of the following. First, there were cases with documentary evidence: i) medical records of the booster vaccinations at clinics, and ii) immunization booklet. Second, there were cases without documentary evidence: iii) re-immunizations and tests related to the booster vaccinations still to be made or that lack of record, iv) phone calls confirming a doctor's comments about vaccination of the clinic based on the parents' memory, v) parents' statements on their own memories, and vi) parents' requests.

In the survey of parents, the basis for the issue of vaccination certificates consisted of the following. First, there were cases with documentary evidence: i) medical records at clinics, and ii) immunization booklet. Second, there were cases without documentary evidence: iii) re-immunizations due to lack of documentation, iv) parents' statements on their own memories, and v) parents' requests.

#### B. Questionnaire Surveys

The surveys were conducted by postal mail on a total of 3,662 GPs who composed of 2,499 pediatrician and 1,163 family physician and were registered as of 2004 in the directory of pediatricians and family physician specialists through the Korean Pediatric Society and Korean Academy of Family Medicine across the nation. Eight hundred and ninety GPs responded to the survey, making

the rate of response 24.3%. Out of these respondents, 50 GPs were excluded because they did not issue certificates of vaccinations and 840 respondents were used for the analysis.

The sample size of surveyed parents is targeted 9,900 from 78 elementary schools, based on 1.5% of the 663,100 new students admitted to 5,463 elementary schools nationwide in 2003, in metropolitan cities, cities and rural regions by means of proportional allocation. But the real number of new students in 2005 was 623,272 and the expected sample size was 10,087. Finally, 9,235 parents participated in the survey and the response rate was 91.6%.

### III. Analysis and comparison of data

SAS (version 9.1) was used for the data analysis. The analysis determined the frequency of issuing certificates of vaccination and the demographic characteristics of GPs and parental groups. We compared the regions, submission of certificates, and institute issued vaccination certificate of sampled parents group with ones of the KCDC.

After dividing the response of parents survey into clinic/hospital group and public health one according to the type of institute of issued, we compared the evidence of measles immunization certification between the two groups.

## RESULTS

In GPs survey, 47.4% of the respondents were in their 40s, 70.6% were male, 62.0% were from metropolitan cities and 66.8% were pediatricians. In parents survey, 93.9% of respondents were mothers, 79.7% were in their 30s, and 51.5% were high school graduates (Table 1).

In the distribution of parents' residential region, metropolitan cities accounted for 43.3%, cities 50.3%, and rural area 6.4%, and such distribution was similar to the database of

**Table 1.** Demographic characteristics of study population

Group	Variables	No.	%
General practitioner	Age		
	30 - 39	178	21.2
	40 - 49	398	47.4
	50 - 59	180	21.4
	60 - 69	56	6.7
	Over 70	28	3.3
	Sex		
	Male	593	70.6
	Female	247	29.4
	Region		
	Metropolitan	520	62.0
	Small city	279	33.3
	Rural area	40	4.8
	Speciality		
	Pediatrics	561	66.8
Family medicine	257	30.6	
Others	22	2.6	
Parent	Relationship		
	Father	374	4.2
	Mother	8,403	93.9
	Grandparents	93	1.0
	Others	77	0.9
	Age		
	20 - 29	151	1.7
	30 - 39	7,179	79.7
	40 - 49	1,634	18.1
	50 or older	45	0.5
	Education		
	≤ Middle school	375	4.2
	High school	4,631	51.5
	≥ College or above	3,979	44.3
	Mother's job		
None	5,060	56.9	
Yes	3,826	43.1	

KCDC. In the distribution of the institutes which issued vaccination certificates to parents, clinics were 44.7%, and public health centers were 55.3%. According to the database of KCDC, they were 43.0% and 56.9% respectively, and other foreign medical institutes were 0.1%. The rate of parents who did not submit vaccination certificates for their children was 2.2%, higher than the rate (0.1%)

**Table 4.** Evidence of measles immunization certification in survey of GPs and parents

Items	GPs' survey		Parental survey					
			Total		Clinic/Hospital		Public Health	
	no.	%	no.	%	no.	%	no.	%
Medical record of clinic	19,542	59.5	3,193	36.1	2,428	61.0	765	15.7
Immunization booklets	4,434	13.5	3,840	43.4	884	22.2	2,956	60.8
Re-immunization due to lack of evidence	7,784	23.7	1,587	18.0	625	15.7	962	19.8
Doctor's identification on other clinic's medical record by phone calling	624	1.9						
Parents' statement based on their memory	328	1.0	194	2.2	43	1.1	151	3.1
Parents' request without records	131	0.4	28	0.3	1	0.0	27	0.6
Total	32,844	100.0	8,842	100.0	3,981	100.0	4,861	100.0

GPs: general practitioners

according to KCDC (Table 2).

The regional distribution of GPs who participated in the survey showed that 27.9% of those who participated were from metropolitan cities and 22.7% were from rural areas. The distribution of specialization of those who participated showed that pediatrician accounted for 23.0%, and family medicine 22.8%. These figures were not statistically significant in comparison with those that did not participate in the survey (Table 3).

The 840 GPs who responded to this survey issued a total of 32,844 vaccination certificates for new students who admitted to elementary school in 2005, which equaled 39.1 cases per GP on average (2 cases being the least, 90 cases being the most). The rate of issuance of vaccination certificates according to medical records or immunization booklets was 73.0% (59.5% and 13.5%, respectively). Although there were no records, the rate of vaccination certificates issuance through re-immunization (including booster vaccinations) or the confirmation of vaccination was 25.6% (23.7% and 1.9%, respectively). The rate of issuance of vaccination certificates in accordance to parents' statements or requests without actual records was 1.4% (Table 4).

The responses of the parents showed that the rate of issuance of vaccination certificates according to medical records or immunization booklets was 79.6% (36.2% and 43.4%, respectively). The rate of issuance of vaccination certificates through re-

**Table 2.** Comparison between parents' survey and KCDC database

Variable	Parents' survey		KCDC data	
	no.	%	no.	%
Region				
Metropolitan	3,998	43.3	270,542	43.4
Small city	4,645	50.3	305,171	49.0
Rural area	593	6.4	47,559	7.6
Submission of certificate				
Yes	8,852	97.8	622,773	99.9
No	195	2.2	499	0.1
Type of institute issued				
Clinics / Hospital	3,938	44.7	258,349	43.0
Public health	4,880	55.3	342,091	56.9
Foreign hospital	-	-	359	0.1

Difference of total sum result from missing of data.

KCDC : Korean Centers for Disease Control and Prevention

**Table 3.** Comparison between study participating and non-participating group in GPs

Variables	Total	Study participating group		Study non-participating group		p-value
		no.	%	no.	%	
Region						
Metropolitan	1,863	520	27.9	1,343	72.1	0.87
Small cities	1,623	280	17.3	1,343	82.7	
Rural area	176	40	22.7	136	77.3	
Speciality						
Pediatrician	2,499	575	23.0	1,924	77.0	0.88
Family physician	1,163	265	22.8	898	77.2	

GPs: general practitioners

immunization (including booster vaccinations) due to a lack of documentation was 18.0%, and that of the issuance of vaccination certificates according to parents' statements or requests without actual records was 2.4% (Table 4).

In the response of parents survey according to the type of institute of issued, there was a difference of the evidence between two groups (Table 4). In case of the clinic / hospital group, the rate of issuance of vaccination certificates according to medical records or immunization booklets was 61.0% and 22.2%, respectively. But in case of public health group, the rate of issuance of vaccination certificates according to medical records or immunization booklets was 15.7% and 60.8%, respectively.

## DISCUSSIONS

To evaluate how representative the parental samples were, some characteristics of participants were compared with the ones of the KCDC, and it showed no significant

difference in residential regions or certificate issuing institutes. However, the rate of those who did not submit certificates in this study was significantly higher than one of KCDC because of the time difference between this survey and KCDC database. That means that the former was conducted in April, 2005, and the latter was done after June, 2005.

This research looked into the basis of the certification of measles booster vaccinations. Various models predicted that 93.5% to 97.0% of children need to be immunized to eliminate the transmission of measles [2-4]. Assuming 93.5% immunity as the target, vaccinations with 95% efficacy would need to cover 98% of the population; vaccinations with 98% efficacy would need a coverage rate of 95% [10].

In the survey of GPs, it was found that 73.0% of the certificates were issued based on the vaccination records (medical records and immunization booklets), and 23.7% on re-immunizations. Cases which were confirmed through other clinics accounted for 1.9%. Confirming records of vaccinations at other clinics is also one of the ways to objectively verify the measles vaccinations. Therefore, 98.6% of booster vaccination certificates were issued based on objective evidence. The survey of parents found that 79.6% of the certificates were issued based on vaccination records (medical records and immunization booklets), and 18.0% on re-immunizations. Therefore, 97.6% of booster vaccination certificates was based on objective evidence. One point four percent of the GPs survey and 2.4% of the parents survey were issued based on parental memory or requests without documented evidence. Although undocumented, it cannot be absolutely said that these requests were not based on an actual administration of a measles booster.

In the response of parents survey according to the type of institute of issued, the evidence rate of medical records was more than 3 times than ones of immunization booklets

There is a difference of response rate between

GPs and parents and between types of institute issued. First, it might be caused by the difference of their evidence. Parents who visited the clinic to obtain the certificate might have the immunization booklets of their children. However, GPs wanted to verify the vaccination history, so they might depend on their medical record rather than parents' evidence. Second, we could interpret it as follows. GPs at clinic/hospital tends to issue the certificate depending on the their medical records, on the other hand, GPs at public health tends to issue the certificate depending on the parents immunization booklets.

Anyway, the surveys of these two groups showed that 97.6% or more of elementary school students received a booster measles vaccination before their admission to school. The submission rate of vaccination certificates was high, and the majority of the vaccination certificates were based on a documented evidence for the vaccination. Considering that the efficacy of the vaccines which were used in Korea was 98% or higher [1], it is expected that an epidemic like that in 2000-2001 will not occur again. Re-immunization due to lack of documentation were 23.7% in the GPs' survey and 18.0% in the parents' survey. If the re-immunizations had not been administered, it would have been highly possible that the students could have entered school without being vaccinated, which might have decreased the level of herd immunity against measles.

The purpose of legislation requiring measles vaccination certificates to enroll children in an elementary school is to prevent and eliminate measles by enhancing the rate of booster vaccination. Many studies showed that the submission of vaccination certificate decreases the rate of outbreak of infectious diseases such as measles and mumps [11,12], and that the law requiring the submission of vaccination certificate enhanced the rate of measles booster vaccinations [13-15]. In the U.S., only 28 states and territories had laws for measles immunization by 1972 but by fall 2001, almost

all (53 [98%] of 54) states and territories required a second dose of the measles vaccination upon students' entry to school, at either the elementary school level, the middle school level, or both [16].

However, a law for the submission of a vaccination certificate is not the only method to raise the rate of measles vaccination or to eliminate measles. The achievement of high measles vaccination uptake rate in Sweden (1985, 93%), Norway (1985, 90%), Finland (1985, 81%), and the Netherlands (1983, 93%) without the need for compulsory immunization laws shows that an efficient administration system backed up by the motivation and education of medical and paramedical personnel and the involvement of parents may be sufficient for the containment of measles [10].

This study had some limitations. First, the results of this study reflected the limited participants' opinions. But the demographic distributions of participants were similar to ones of non-participants or whole parents, so the outcomes of this study can be generalized without any large difficulty. Second, this study depended on self-reporting from the study subjects. Medical records on measles booster immunizations or immunization booklets were not personally reviewed. But the certification on measles vaccination which was issued by a practitioner to parents was result of mutual confirmation between GPs and parents.

To improve the validity of measles immunization certificates, systemic complement such as permanent preservation of document on vaccination, electronic inquiry and so on is needed.

This study identified that 98.6% (GPs survey) and 97.6% (parents survey) of booster vaccination certificates was based on documented evidence for the vaccination. Consequently the high rate of vaccination certificate submission, together with the fact that the majority of these certificates were issued on the basis of documented

vaccinations, shows that the implementation of the law requiring the submission of vaccination certificates upon enrollment in an elementary school has been very successful in Korea. To maintain the high validity of measles vaccination certificates, concerns and efforts of stakeholder are needed continuously.

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