農村醫學·地域保健學會誌：第36券 第2號(2011年 6月) DOI: 10.5393/JAMCH.2011.36.2.113
J Agric Med Community Health 2011;36(2):113~119

Evaluation on the Accuracy of Vaccination Card for National Immunization Program in a 2005 Population-Based Survey in Nonsan, Korea

Moo-Sik Lee[1], Jee-Hee Kim[2], Kwang-Hwan Kim[3], Jee-Young Hong[1], Jin-Yong Lee[1], Keon-Yeop Kim[4]

Department of Preventive Medicine and Public Health, College of Medicine, Konyang University[1], Department of Emergency Medical Technology, Kangwon National University[2] Department of Hospital Management, Konyang University[3] Department of Preventive Medicine, School of Medicine, Kyungpook National University[4]

일개 도농복합시 영유아 예방접종 수첩의 정확도 평가

이무식[1], 김지희[2], 김광환[3], 홍지영[1], 이진용[1], 김건엽[4]

건양대학교 의과대학 예방의학교실[1], 강원대학교 응급구조학과[2], 건양대학교 병원관리학과[3], 경북대학교 의학전문대학원 예방의학교실[4]

= Abstract =

목적 : 이 연구는 국가예방접종률 산출 및 조사방법론 개발을 위한 기반을 조성하기 위하여 예방접종률 파악을 위한 자료원 중 영유아 예방접종 수첩기록의 정확도를 평가하기 위하여 수행되었다.

대상 및 방법 : 연구대상은 2005년 1월 31일을 기준으로 충청남도 논산시에 주민등록상 거주하는 생후 12-35개월 영유아 전체로 하였다. 연구대상자가 거주하는 가구를 2005년 2-4월까지 방문하여 보호자의 동의를 얻어 예방접종 수첩기록을 조사하였다. 예방접종 수첩기록의 정확도를 평가하기 위하여 2005년 5-7월까지 예방접종을 시행한 의료기관 및 보건소의 접종관련 기록을 확보하여 예방접종 접종 여부 및 접종 일자의 기록 일치 여부를 확인하였다. 비교 대상 예방접종은 결핵(BCG), B형간염, 디프테리아/파상풍/백일해(DTaP), 홍역/유행성이하선염/풍진(MMR), 폴리오, 일본뇌염, 수두, 인플루엔자, B형 헤모필루스 인플루엔자 뇌수막염(Hib), A형간염, 폐구균으로 총 11종을 대상으로 하였다.

결과 : 예방접종 수첩의 예방접종 여부 및 접종 일시 기록의 정확도는 BCG는 69.5% 및 80.1%였으며, B형 간염은 1차 41.3% 및 89.7%, 2차 76.6% 및 82.1%, 3차 79.7% 및 79.0%였으며, DTaP는 1차 79.9% 및 87.5%, 2차 80.8% 및 87.3%, 3차 82.5% 및 85.1%, 4차 79.9% 및 83.5%였으며, 폴리오는 1차 79.5% 및 88.1%, 2차 79.8% 및 86.2%, 3차 82.1% 및 84.8%였으며, MMR은 83.2% 및 84.0%였으며, 일본뇌염 1차는 80.7% 및 83.1%였으며, 수두는 74.9% 및 83.7%였으며, 인플루엔자는 74.1% 및 55.3%였으며, Hib 1차는 72.7% 및 90.7%였으며, A형 간염 1차는 79.5% 및 88.4%였으며, 폐렴구균 1차는 73.2% 및 90.3%로 나타났다.

결론 : 여러 가지 연구의 제한점에도 불구하고, 예방접종 수첩의 상당한 수준의 신뢰도를 확인하였으나 수첩의 예방접종력 정확도 및 타당도에 대한 추가 연구가 필요할 것으로 판단된다.

Key Words: 예방접종 수첩, 정확도, 예방접종

* 접수일(2011년 5월 2일), 수정일(2011년 6월 20일), 게재확정일(2011년 6월 22일)
* 교신저자: 홍지영, 대전광역시 서구 가수원동 685번지, 건양대학교 의과대학 예방의학교실
Tel: 042-600-6407, Fax: 042-600-6401, E-mail: prvhong@konyang.ac.kr

Introduction

Immunization is the most effective method to control communicable diseases. Immunization eliminates the pain due to diseases and reduces the cost of treatment[1]. Vaccination improves herd immunity so that it can provide the socioeconomic benefit that is not comparable to the common preventive method. Every country is trying to carry out the vaccination for all infants and children[2-4]. For the effective National Immunization Program(NIP), vaccination should be done accurately by immunization schedule and there should be correct recording system of immunization.

However, sources of immunization records in the Republic of Korea were vaccination card, medical record and NIP registry system, and no one knows whether immunization records in these data source coincide. Therefore we carefully considered to ensure more valid and reliable immunization records of vaccination card. Exact identification and confirmation of immunization history assures this evaluation. In order to obtain the accurate access and evaluation of immunization rate, it is essential to get the centralized and population-based registries[5].

The aims of this study were to evaluate the accuracy of personal immunization record and to establish the applicability of personal immunization record for estimating population-based or national-wide immunization rates.

Methods

Study subjects were 1,544 infants and children from 12 to 35 months living in Nonsan, Chungcheongnamdo, as of January 31st, 2005. We conducted face-to-face interviews with subjects' guardians and check record of subject's vaccination card from February to April, 2005[6,7]. We obtained informed consent to subject's guardians after full explanation about this study. After completing household survey, we conducted provider-check survey and check medical records in private medical facilities and NIP registry data in public health center.

Types of vaccination were BCG, hepatitis b(HBV), diphtheria-tetanuspertussis(DTaP), polio, measle-mumps-rubella(MMR), Japanese encephalitis (JBE), chickenpox, influenza, haemophilus influenza type b(Hib), hepatitis A(HAV) and pneumococcal vaccine.

For estimating accuracy of immunization status and dates of immunization, we estimated correspondence rate between data from personal vaccination card and data from medical records and immunization registry data. Accuracy of immunization status and dates of immunization were defined in Equation 1 and 2.

$$\text{Accuracy of immunization status} = \frac{\text{Total cases with corresponsive records of immunization status from both personal vaccination card and other data sources}}{\text{Total cases with identified records of immunization status from both personal vaccination card and other data sources}} \cdots \text{Equation 1}$$

$$\text{Accuracy of date of immunization} = \frac{\text{Total cases with corresponsive records of date of immunization from both personal vaccination card and other data sources}}{\text{Total cases with identified records of date of immunization from both personal vaccination card and other data sources}} \cdots \text{Equation 2}$$

Frequency analysis was used to calculate accuracy of immunization status and date of immunization using SPSSWIN(Version 18.0).

Results

The demographic characteristics of 1,544 respondents were summarized in Table 1. Male were 51.5% of total subjects and female were 48.5%. Age of 19-35 months consisted of 70.3%, 12-15 months was 17.7%, and 16-18 months was 12.0%. The second baby consisted of 43.1%, the first baby was 39.9%, and the third was 17.1%. Two siblings were 52.1% and single birth was 28.4%. Type of health security was national health insurance which showed 96.7% and medical aid was 3.3%.

Accuracy of immunization status were as follow: 69.5% for BCG, 41.3% for first HBV, 76.6% for secondary HBV, 79.7% for third HBV, 79.9% for first DTaP, 80.8% for second DTaP, 82.5% for third DTaP, 79.9% for fourth DTaP, 79.5% for first Polio, 79.8% for second Polio, 82.1% for third Polio, 83.2% for MMR, 80.7% for JBE, 74.9% for Chickenpox, 74.1% for Influenza, 72.7% for first Hib, 79.5% for first HAV and 73.2% for first Pneumococcal(Table 2).

Accuracy of date of immunization were as follow: 80.1% for BCG, 89.7% for first HBV, 82.1% for secondary HBV, 79.0% for third HBV, 87.5% for first DTaP, 87.3% for second DTaP, 85.1% for third DTaP, 83.5% for fourth DTaP, 88.1% for first Polio, 86.2% for second Polio, 84.8% for third Polio, 84.0% for MMR, 83.1% for JBE, 83.7% for Chickenpox, 55.3% for Influenza, 90.7% for first Hib, 88.4% for first HAV and 90.3% for first Pneumococcal(Table 2).

Table 1. Demographic characteristics of study subjects

	Number	%
Gender		
Male	795	51.5
Female	749	48.5
Ages(months)		
12-15	273	17.7
16-18	185	12.0
19-35	1,086	70.3
Residency		
Dong	819	53.0
County	351	22.7
Myeon	374	24.2
Birth siblings		
First	611	39.9
Second	660	43.1
Third	262	17.1
Siblings		
0	438	28.4
1	805	52.1
≥2	301	19.5
Social security		
National health insurance	1,493	96.7
Medical aid	51	3.3
Sum	1,544	100.0

Due to missing data, the sum will be changeable. The other table will be the same result.

Table 2. Accuracy in records of immunization status and date of immunization between vaccination card and other data sources*

Unit: cases of numerator/cases of denominator(%)

Vaccination	Accuracy of immunization status	Accuracy of date of immunization
BCG	835/1,201 (69.5)	661/825 (80.1)
Hepatitis B		
1st	501/1,212 (41.3)	428/477 (89.7)
2nd	1,005/1,312 (76.6)	828/1,008 (82.1)
3rd	1,065/1,336 (79.7)	849/1,074 (79.0)
Diphtheria-tetanus-pertussis		
1st	1,086/1,359 (79.9)	957/1,093 (87.5)
2nd	1,096/1,357 (80.8)	962/1,101 (87.3)
3rd	1,111/1,347 (82.5)	951/1,175 (85.1)
4th	648/811 (79.9)	548/656 (83.5)
Polio		
1st	1,068/1,343 (79.5)	947/1,074 (88.1)
2nd	1,073/1,344 (79.8)	933/1,082 (86.2)
3rd	1,088/1,325 (82.1)	930/1,097 (84.8)
Measle-mumps-rubella	932/1,120 (83.2)	671/798 (84.0)
Japanese encephalitis 1st	499/618 (80.7)	418/503 (83.1)
Chicken pox	610/814 (74.9)	517/617 (83.7)
Influenza	605/817 (74.1)	342/618 (55.3)
Haemophilus influenza type b 1st	312/426 (72.7)	284/313 (90.7)
Hepatitis A 1st	449/563 (79.5)	403/455 (88.4)
Pneumococcal 1st	30/41 (73.2)	28/31 (90.3)

* other data sources refers to medical records in private medical facilities and NIP Program registries.

Discussion

Immunization is cost-effective, reduces morbidity, and prevents further outbreaks of infectious disease. In Korea, NIP has begun 40 years ago. NIP has been carried out on the base of public health center and private medical facilities in Korea[5,8]. The risk of vaccine preventable disease epidemics increases in spite of high national level of vaccination. Understanding on exact vaccination coverage is an important issue. Survey and monitor on the vaccination coverage is fundamental tool for NIP. The vaccination coverage rate can be estimated by population-based surveys or administrative systems such as the nationwide registry for vaccination.

There are variable the survey method for estimating vaccination coverage such as mail, interview, telephone survey, and provider check[9]. Therefore, selecting appropriate methods tailored is important. But basically, the survey will be depend on the accuracy of vaccination record, especially child's vaccination card. And due to insufficient information of vaccination program, it is necessary to provide the right vaccine schedule to the vaccines[10]. So in front of the survey, it is indispensable to confirm the accuracy. The first program was distribution and management of child's vaccination card in the general public and general physicians. In order to

know the immunization rate and establish the immunization certification, it is very useful to make vaccination card. It is necessary to get accuracy of vaccination history.

Results of this study show that accuracy of immunization status range from 69.5% to 83.2% except accuracy of 41.3% for first HBV. Since 2002, the Ministry of Health and Welfare in Korea has started national program for controlling vertical transmission by hepatitis B virus and the first HBV injection was shot to infants born in women with positive HBsAg[11]. We suppose that low accuracy for first HBV results from inaccurately recording in personal vaccination card or medical record of HBV immunization by doctors responsive for delivering. Accuracy of immunization status in this study may contribute to establishing methodology for estimating national immunization rate using records of personal vaccination card. However, inaccuracy of immunization status may result in underestimating immunization rate due to incomplete recording of immunization status.

Accuracy of immunization date of each vaccination was higher than 80% except influenza vaccination. Since influenza vaccination is conducted and the vaccine is produced once annually in epidemic season, timely shot is not an important factor for acquiring immunity, we suppose that record of influenza vaccination in personal vaccination card is inaccurate and therefore accuracy of immunization date for influenza is low(55.3%).

Until 1985, national estimates of vaccination coverage in United States of America were based solely on parental recall[12]. However, since 1991, concern over the accuracy of recall has led to more frequent use of both parent-held vaccination cards and audits of medical record. And the vaccination coverage of some children is doubled-checked against their medical records to improve the accuracy of the data[13,14]. Bolton et al.[15] estimated agreement between vaccination cards and medical records in up-to-date status data of DTaP, polio and MMR vaccine. Among total 175 subjects, agreement rate was 81.1% of DTaP, 81.7% of polio, and 90.1% of MMR. These results correspond with our result, suggesting that vaccination cards are able to be used as data source for estimating national immunization coverage rates.

While data on immunization status and date of vaccination serves as critical source for estimating national immunization rate and timeliness of immunization rate, our results show that there is need to increase accuracy of vaccination record and construct information system for managing vaccination data. Current NIP registry system doesn't cover data on all immunization and so improve to be able to collect data on voluntary immunization shot in private medical facilities.

Estimating accuracy of immunization status and date of immunization in this study partially depend on accuracy of vaccination information in medical record and NIP registry. However, pediatricians in Korea have little motivation to correctly record vaccination information because there in no need to receive the reimbursement from National Health Insurance Corporation. Therefore we had no assurance on accuracy of medical record and NIP registry information and solely focused on agreement of vaccination information between vaccination card and other data sources.

Our data were obtained from one limited area and therefore could not representatives of entire Korea. Our study was focused primarily on the accuracy of vaccination record, therefore, did not

include related many other factors. The findings indicated that a vaccination card should be developed and implemented in order to improve the accuracy of immunization record of vaccination card. In spite of these limitations, this study verified the validity of vaccination record of vaccination card substantially, but suggests more efforts to reassure the validity of vaccination card.

Summary

The aims of this study were to survey, evaluate the accuracy of personal immunization record of vaccination card, and to establish the applicability of personal immunization record for presuming population based immunization rate and evaluation method.

In 2005, a population-based survey of 12-35 months old children was carried out in Nonsan, Korea. We conducted household survey and provider check using questionnaire and checklist to obtain data on immunization status for children. Total 11 vaccinations were checked in vaccination card such as BCG, hepatitis b, polio, chickenpox vaccine. For estimating accuracy of immunization status and dates of immunization, we estimated correspondence rate between data from personal vaccination card and data from medical records and immunization registry data.

Accuracy of the child's vaccination card by type of National Immunization Program vaccine in whole medical institutions were from 41.8% to 83.2%. Accuracy for the date of vaccination of vaccination card in National Immunization Programme vaccine were from 55.3% to 89.7%.

In spite of this study limitations, this study verified the validity of vaccination record of vaccination card substantially, but suggests more efforts to reassure the validity of vaccination card.

References

1. Lee HJ. Immunization schedule recommended by Korean pediatric Society, 2008. *Korean J Pediatr Infect Dis* 2008; 15(1): 1-4 (Korean)
2. Korean Centers for Disease Control and Prevention. Prevention and control of vaccine-preventable diseases, 2006 (Korean)
3. Hong YJ. The Japanese encephalitis vaccine : Worldwide and Korean status. *Korean J Pediatr Infect Dis* 2008; 15(2): 108-114 (Korean)
4. World Health organization. Global Advisory Committee on Vaccine Safety, 12-14, December 2007. *Wkly Epidemiol Rec* 2008; 83: 37-44
5. Kim KH. Reappraisal of live vaccines and immunity in these modern days. *Korean J Pediatr Infect Dis* 2009; 56(1): 24-30 (Korean)
6. Kim EY, Na BJ, Lee MS, Kim KY, Ki M. Hepatitis A Vaccination Rates and Related Factors in a 2005 Population-based Study in Nonsan, Korea. *Epidemiol Health* 2009;31:e2009003
7. Kim EY, Lee MS. Related factors of age-appropriate immunization among urban-rural children aged 24-35 months in a 2005 population-based survey in Nonsan, Korea. *Yonsei Med J* 2011;52(1):104-12
8. National Institute of Health. The 2007 Report of National Institute of Health, Volume 44. 2007 (Korean)
9. Guérin N. Assessing immunization coverage: how and why? *Vaccine* 1998;16(Supplement 1):S81-S83.
10. Lee H, Nahm MH, Burton R, Kim KH. Immune response in infants of the heptavalent pneumococcal conjugate vaccine against vaccine-related serotype 6A and 19A. *Clinical*

Vaccine Immunology 2009; 16: 376-381
11. National Institute of Health. Evaluation of perinatal HBV transmission control program in Korea. 2003 [Korean]
12. Orenstein W, Allman KC, Eddins D, Snyder R, Seastrom G. Preschool immunization-1998. In: Hutton N, editor. Proceeding of the 22nd Immunization Conference; 1998 Jun 20-24; San Antonio, Texas. Atlanta: Center for Disease Control and Prevention; 1988. p. 121-8
13. Vaccination coverage of 2-year-old children--United States, 1991-1992. *MMWR Morb Mortal Wkly Rep* 1994;42:985-9
14. Centers for Disease Control and Prevention. Vaccination coverage levels among children aged 19-35 months--United States, April-June 1994. *MMWR Morb Mortal Wkly Rep* 1995;44(20):396-8
15. Bolton P, Holt E, Ross A, Hughart N, Guyer B. Estimating vaccination coverage using parental recall, vaccination cards, and medical records. *Public Health Rep* 1998;113(6):521-6.