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Seroprevalence of mumps in healthcare workers in South Korea

Mumps is contagious disease and maintaining immunity to mumps in healthcare worker (HCW) is important for preventing transmission in the hospital. We evaluated the seroprevalence of mumps in HCWs in a tertiary care hospital in Republic of Korea. A total of 6,055 HCWs born between 1950 and 1995 underwent antibody testing. The overall seropositivity rate of mumps was 87% (95% confidence interval, 86%–87%). Our data indicates that, in Korean HCWs, testing for mumps antibody followed by mumps vaccination is more appropriate than routine mumps vaccination without testing for mumps antibody.

Keywords: Mumps, Measles-mumps-rubella vaccine, Health personnel, Seroepidemiologic studies

Mumps, a contagious disease, is transmissible by respiratory droplet particles and is vaccine-preventable [1]. The basic reproduction number of mumps is 4–7; therefore, the herd immunity of mumps must be maintained above 75%–86% to decrease its incidence and eradicate the infection from the population [2]. In Korea, the measles-mumps-rubella (MMR) vaccine was incorporated in the National Immunization Program for children in 1985, and the administration of a two-dose MMR vaccination at 12–15 months and at 4–6 years of age, respectively, was recommended in 1997 after outbreaks of measles in 1993–1994 and rubella in 1995–1996 [3,4]. Also, a two-dose MMR vaccination record for preschool students entering elementary school became mandatory since 2001. As a result, a compliance level of >95% for the two-dose MMR vaccination rate has been achieved among preschool children in Korea. Overall, mandatory vaccination against mumps has markedly reduced its incidence [3]. However, both the incidence and the number of reported cases of mumps have persistently increased in Korea since 2007. In 2013, large mumps outbreaks occurred in Korea, affecting more than 17,000 patients. These outbreaks occurred primarily in middle and high school settings and affected vaccinated adolescents, predominantly the male students [3]. Since 2013, more than 17,000 patients have been diagnosed with mumps every year [5]. Despite high vaccination rates, mumps outbreaks continue to occur and many studies have been conducted on mumps seroprevalence in children and adolescents. In comparison, few reports have been published regarding the mumps seroprevalence of healthcare workers (HCWs) in Korea. In 2012, the Korean Society of Infectious Diseases recommended the two-dose MMR vaccination strategy for HCWs

before employment if no prior documentation on two-dose MMR vaccination existed and did not mention regarding the necessity for serologic testing. The Centers for Disease Control and Prevention recommends MMR vaccinations only in HCWs without serologic evidence of immunity or prior vaccination documentation [6]. In this setting, the establishment of a seroprevalence-based vaccination policy is ideal. Hence, the aim of the study is to investigate the seroprevalence of HCWs in Korea.

This study was conducted at Asan Medical Center, a 2,708-bed tertiary care hospital located in Seoul, Korea with a total of 8,329 HCWs. In 2018, we performed mumps antibody testing using chemiluminescence immunoassay (Liason Mumps IgG; DiaSorin, Saluggia, Italy) for existing HCWs, and enzyme-linked immunosorbent assay (Vircell Mumps IgG; Vircell, Granada, Spain) for newly employed HCWs, along with measles and rubella antibody testing. The sample results were classified as positive, equivocal, or negative according to the manufacturer’s instructions. We administered MMR vaccination to all HCWs whose antibody test yielded equivocal or negative results. However, we did not repeat mumps antibody testing after MMR vaccination. The study was approved by the Institutional Review Board of Asan Medical Center (2019-0980) with waiver of consent.

A total of 6,055 HCWs (73%) underwent mumps antibody testing. Birth years of the HCWs ranged between 1950 and 1995, and 4,311 (71%) were women. Fig. 1 shows the mumps seroprevalence data among HCWs stratified by birth cohort. The overall mumps seropositivity rate was 87% (95% confidence interval [CI], 86%–87%). Seropositivity rates of all birth cohorts ranged from 72% to 92%. Mumps seropositivity rates were 88% in HCWs born before 1970, 87% in those born between 1970 and 1989, and 88% in those born between 1990 and 1995 (p=0.59). Mumps seropositivity rates for both women and men HCWs were 87% (3,770/4,311 and 1,517/1,744), respectively; the difference was not statistically significant (p=0.62).

The overall mumps seropositivity rate was 87%. To the best of our knowledge, this is the first report on mumps seropositivity rates among HCWs in Korea. In addition, the seropositivity rates were stratified by birth year, and a large number of HCWs were included in the evaluation.

It is known that crude herd immunity threshold of mumps is 75%–86% [2]. However, mathematical models of impact of vaccination on the incidence of mumps reveal that critical level of vaccine uptake to eliminate mumps virus transmission is predicted to be 85% to 90% by the age of 2 years [7]. Anderson and May [8] calculated that the critical vaccination

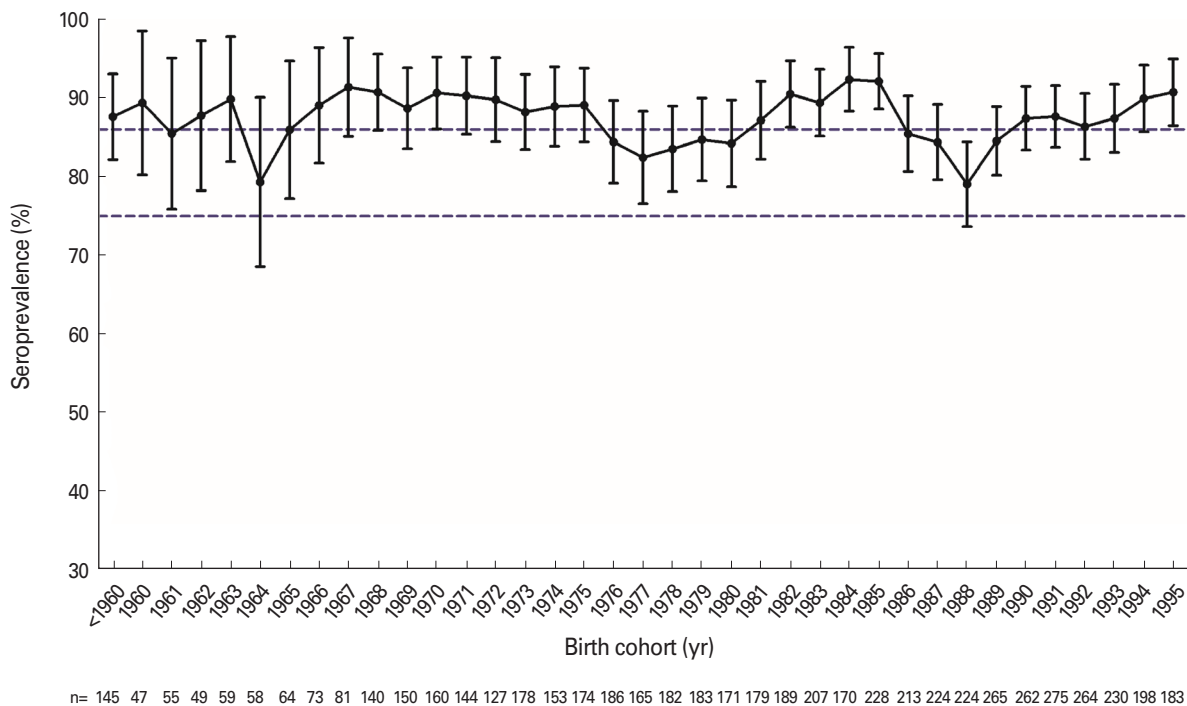


Fig. 1. Seroprevalence of mumps immunoglobulin G antibodies in healthcare workers in 2018. The circles denote the mean seropositivity rate (%) and error bars denote 95% confidence intervals, and the dashed line denotes 75% and 86% seropositivity rates.

coverage needed to block mumps transmission was 90%–92%. Recently, report from Spain indicated that herd immunity threshold in terms of critical prevalence of positive result based on serological assessment was 84%–90% [9]. In Korea, there are limited data regarding herd immunity threshold based on seroprevalence. During the outbreak at kindergarten in 2006, vaccine effectiveness after two-dose MMR was 86%, and the vaccine coverage rate for maintaining the herd immunity is estimated to be above 90.5% [10]. Because of frequent contact with patients and crowdedness, healthcare facilities are susceptible to transmission of mumps and lead to high basic reproduction number in the hospital. We believe that mumps seropositivity of 87% may not be high to block transmission of mumps, and higher seropositivity may be needed. We suggest that mumps vaccination should be administered after testing for mumps antibody instead of administering vaccination universally without screening. Alternatively, selective serologic screening may be performed according to the situation of the healthcare facility for improving herd immunity.

It is notable that young adults born between 1990 and 1995 have similar seropositive rate (88%) with adults born before, which is distinguished from low seropositivity of measles in young adults [11]. As mumps outbreaks have been recorded since 2007 in South Korea, it is plausible that both adolescents and young adults would have been infected with a wild type of the virus resulting natural booster, thus maintaining immunity levels in adults. The recent mumps outbreaks in highly vaccinated populations signify the waning immunity that occurs after mumps vaccination. Previous reports have suggested that the antibody titer decreases below the seropositivity threshold at approximately 10–12 years after mumps vaccination [12,13]. Therefore, if children receive MMR vaccination between 4 and 6 years of age, they may become susceptible to mumps infection between 14 and 18 years of age. Although data on mumps seroprevalence in adults or HCWs in South Korea is limited, recent epidemiologic reports indicated that most mumps patients are children or adolescents, which is in agreement with our findings [14].

Recently, many healthcare facilities in Korea have conducted a measles antibody testing for HCWs, because of measles outbreaks. However, few performed antibody screening for mumps. If HCWs have measles antibody but no mumps antibody, they do not receive MMR vaccination. This policy results in concern about mumps herd immunity. Our data provide information regarding this issue.

This study has several limitations. First, this is a single-cen-

ter study and data from two types of serologic screening tests, depending on the type of HCW employment status, were included. Second, the geometric mean titer or plaque reduction neutralization test outcomes were not analyzed. Nonetheless, the data from this study is seroepidemiologic data in a large cohort of HCWs; therefore, it provides important information for determining policies on healthcare facility vaccination.

In conclusion, our results revealed that the overall mumps seropositivity rate in Korean HCWs was 87% that may not be high to block transmission of mumps in the hospital. On the basis of this finding, MMR vaccination after serologic testing may be a more reasonable approach than universal MMR vaccination alone.

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