

Jiyeon Joo¹, Hyemin Chung², Sun-Kyung Kim¹, Eun Ok Kim¹, Min Jae Kim², Jiwon Jung^{1,2}, Sung-Han Kim^{1,2}¹Office for Infection Control, Asan Medical Center, Seoul, Republic of Korea ²Department of Infectious Disease, Asan Medical Center, University of Ulsan College, Seoul, Republic of Korea

Abstract

Background: After a large measles outbreak in 2000~2001, national measles vaccination program was implemented in South Korea, and more than 95% of people born after 1985 have been vaccinated with 2-dose MMR. But sporadic outbreaks have continued to occur mainly in adults in their 20's and 30's in 2014 and 2019.

Methods: This study was performed in a 2,743-bed tertiary-care hospital in South Korea. At 1-month after MMR vaccination in healthcare workers (HCWs) who were seronegative for measles, we performed measles antibody test (Chemiluminescence immunoassay), IgM/IgG index ratio, and avidity test.

Results: Of the 1,608 new HCWs in 2020 and 1,565 in 2021, 54 HCWs with negative measles IgG at their entering at our hospital were enrolled in this study. Of these, 36 (67%) were female, and the median age was 25 (interquartile range [IQR], 24-27) years. Of 43 HCWs who measured IgM/IgG index 1 month after MMR vaccination, 38 HCWs had IgM/IgG index of less than 1 and remaining 5 had negative IgG results (seroconversion rate of 88%). All 54 HCWs who performed avidity test showed high avidity index. Measles vaccination record in Korea Disease Control and Prevention Agency (KDCA) health management system showed that 46 (85.2%) had documented vaccination record during their childhood (of these, 11 received MMR vaccine again during their adult age) and remaining 8 (14.8%) had no documented vaccination record during their childhood. Of these 8 HCWs without record in their childhood, 2 had a history of vaccination at adult. Analyzing 48 HCWs with vaccination record, they received MMR vaccination median 18 years (IQR, 7-20) before. Therefore, of the 54 seronegative HCWs, at least 48 (88.9%) received at least 2 dose MMR vaccination, and 11 (20.4%) received at least 3 dose MMR vaccination.

Conclusions: Secondary vaccine failure may be the reason for vaccine failure in young adults in Korea. Therefore, HCWs with negative measles antibody who were born after 1985 may receive 1-dose booster vaccination rather than 2-dose vaccination.

Introduction

Although low seroprevalence in young adults have been reported, there are limited data regarding the cause of low seropositivity (primary vaccine failure vs. secondary vaccine failure). We aimed to evaluate the cause of low seroprevalance of measles among young healthcare workers in South Korea.

Methods

Study design

Study Subjects

This study was conducted for new HCWs (healthcare workers) entering in a 2,743-bed tertiary-care hospital in South Korea in 2020-2021.

Laboratory testing

At 1-month after MMR vaccination in HCWs who were seronegative for measles, we performed measles antibody test (Chemiluminescence immunoassay, LIAISON Measles IgG, DiaSorin SpA, Italy), IgM/IgG index ratio, and Measles IgG avidity assay(Euroimmun, Lubeck, Germany).

① IgM/IgG index ratio

We defined that IgM/IgG ratio >1 indicates primary vaccine failure, and IgM/IgG ratio <1 indicates secondary vaccine failure.

② Antibody avidity

Relative avidity index was defined as follows (as per manufacturer's guideline).

$$\text{Relative avidity index(RAI) in \%} = \frac{\text{Extinction of the sample with urea treatment} \times 100}{\text{Extinction of the sample without urea treatment}}$$

- RAI < 40% : indication of low-avidity antibodies
- RAI 40-60% : equivocal
- RAI > 60% : indication of high-avidity antibodies

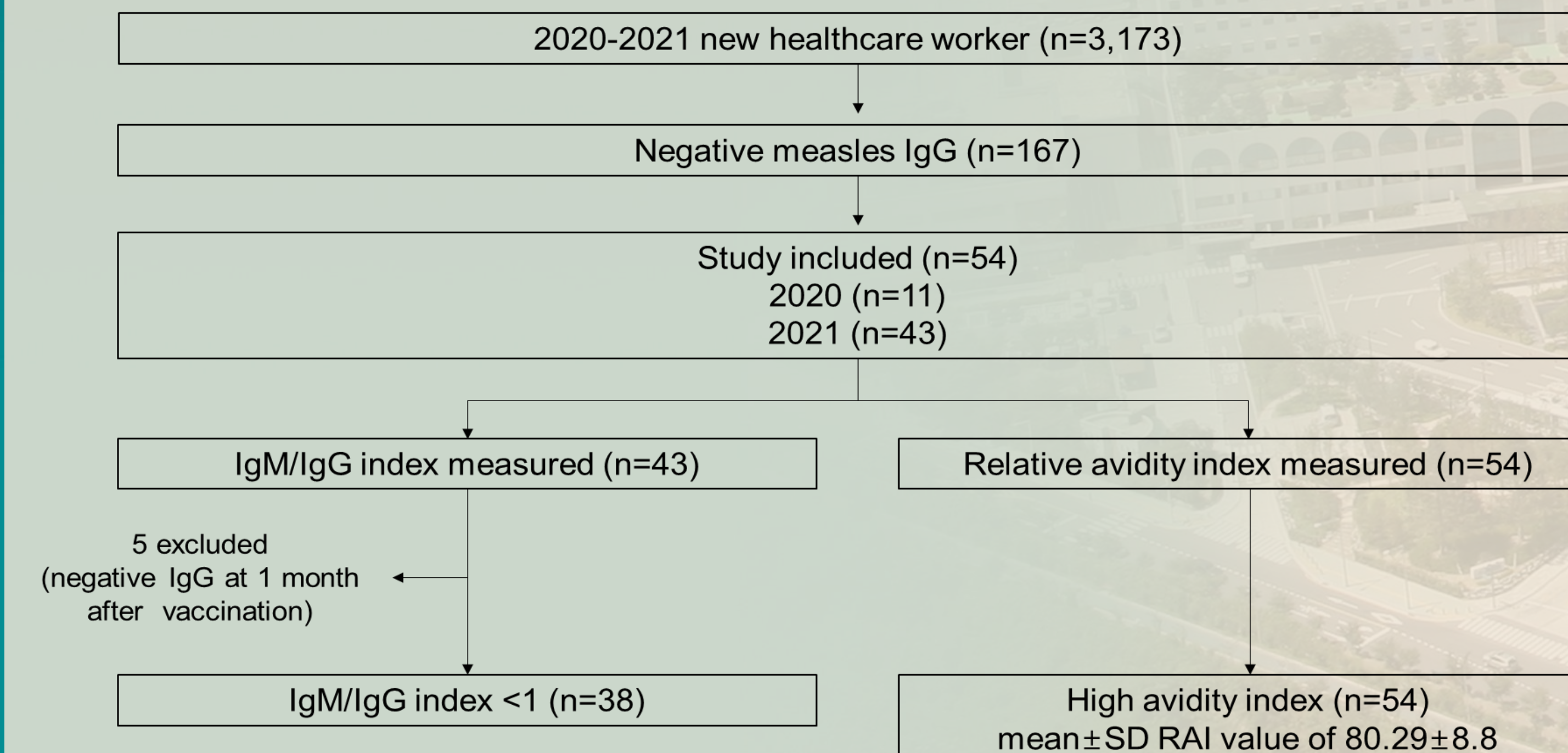
Investigation of prior history of MMR vaccination

The Korea Centers for Disease Control and Prevention health management system was used to investigate the prior vaccination history of HCWs.

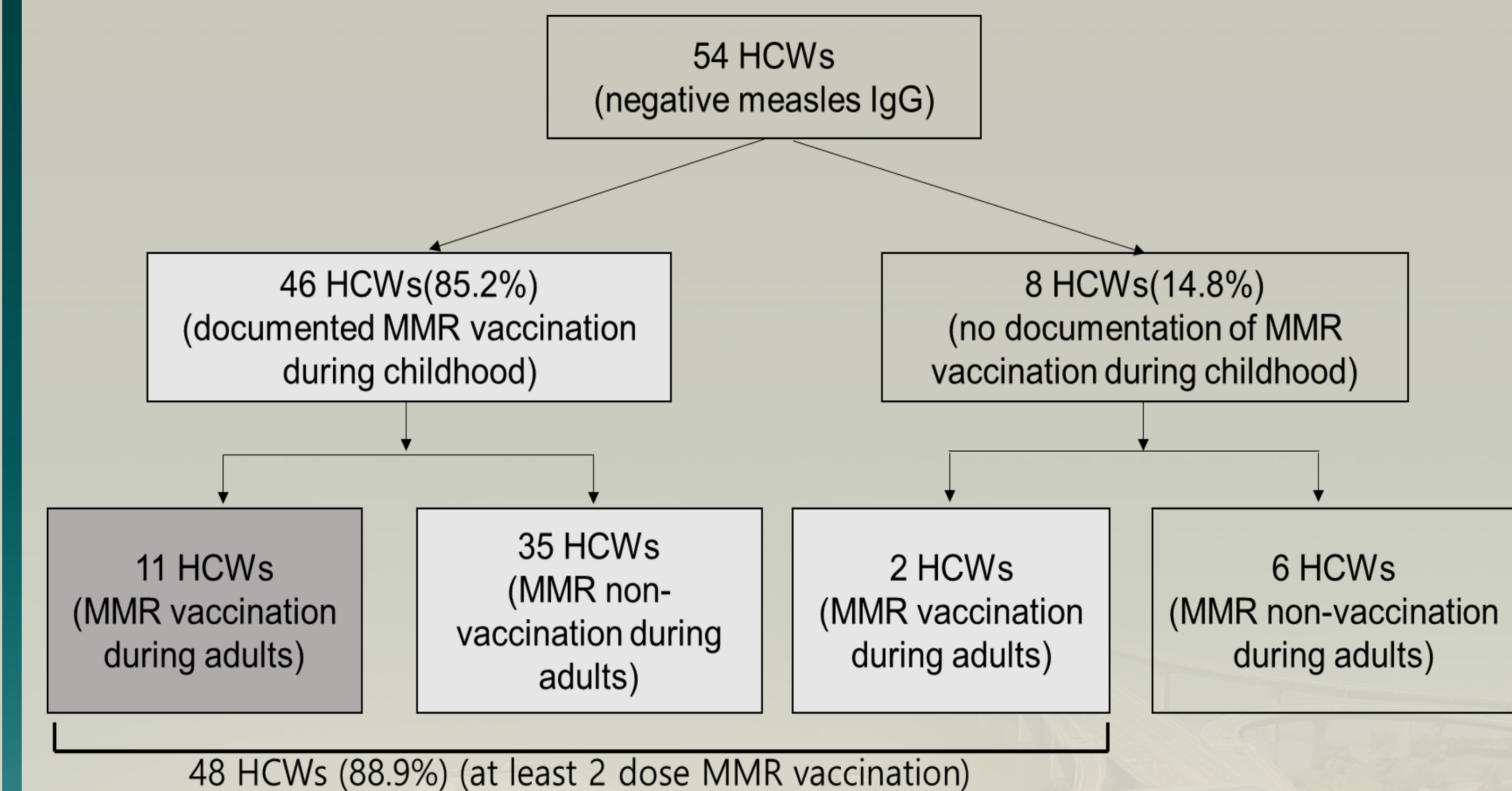
Results

Of the total of 3,173 new HCWs, 167 (5%) had negative measles IgG. Of these, 54 were enrolled in this study. 36 (67%) were female, and the median age was 25 (IQR, 24-27) years.

[Figure 1] Flowchart of the study and the result of IgM/IgG index ratio and avidity test for measles



[Figure 2] Prior vaccination history of the study population



Conclusion

In conclusion, secondary vaccine failure may be the reason for vaccine failure in young adults in Korea. Therefore, HCWs with negative measles antibody who were born after 1985 may receive 1-dose booster vaccination rather than 2-dose vaccination.

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Contact information: Jiwon Jung, MD

Department of Infectious Diseases, Asan Medical Center, University of Ulsan College of Medicine, 388-1 Pungnap-dong, Songpa-gu, Seoul, 138-736, Republic of Korea (trueblue27@naver.com)