



Brief report

Immunity of nursing students to measles, mumps, rubella, and varicella in Yozgat, Turkey



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Measles, mumps, rubella, and varicella (MMRV) are vaccine-preventable diseases. The aim of this study was to determine the vaccination status of first-year nursing students in Turkey. The sample used was 180 students and immunoglobulin G antibodies against MMRV viruses were determined quantitatively by enzyme-linked immunosorbent assay. Immunity rates to MMRV were 82.8%, 83.3%, 98.3%, and 100%, respectively. The results of this study showed that all of the students were immune to varicella and 32.8% of the students were not immune to at least 1 of the viruses covered by the measles, mumps, and rubella vaccine.

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Measles, mumps, rubella, and varicella (MMRV) are vaccine-preventable diseases that may lead to significant morbidity and mortality, especially in adults. Because they are transmitted by the respiratory route, they present a high occupational risk for health care workers (HCWs) and for patients.¹ Nursing students who are not immune to MMRV are at risk of acquiring these diseases, especially in pediatric and infectious disease departments. When infected they may become a potential source for nosocomial transmission during their training period. In the United States and in many countries in Europe, medical and paramedical students are required to show acceptable evidence of immunity or to be vaccinated before their training in medical facilities.^{1,2}

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ÇK participated in study conception/design, data analysis, drafting the manuscript, and revising the manuscript. AE participated in study conception/design, critical revision of important intellectual content, and supervision. ÇK and NKA participated in data collection and analysis, and administrative/technical/material support. ÇK, MFP, and SP participated in study conception/design, data analysis, and critical revision of important intellectual content.

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In Turkey vaccination against measles has occurred since 1970 and was administered as a single dose at age 9 months between 1987 and 1998. The measles, mumps, and rubella (MMR) vaccine has been part of the expanded vaccination program since 2006. Two doses were administered at age 12 months and 6 years, respectively. In 2007 children aged 8 to 13 years were vaccinated for MMR in a catch-up vaccination program.³

There are no regulations for HCWs or medical/nursing students for vaccination against MMRV in Turkey and the number of young adults who are susceptible to 1 or more of these viruses is presently unknown.

The aim of this study was to determine the vaccination and disease history of first-year nursing students and their serologic immunity against MMRV to implement a policy that could provide immunity before training periods in hospitals in Turkey.

MATERIALS AND METHODS

A prospective, cross-sectional study was performed between January 1, 2013, and February 28, 2013. Our target sample was first-year students of the Bozok University School of Health before their training period in the hospital. Blood samples were collected from 180 students and a self-recorded questionnaire was completed that included their demographic characteristics, disease and vaccination history, their socioeconomic background, their region of origin, and their residence. The specific immunoglobulin G antibodies against

Table 1
Declared infection history and serologically confirmed immunity

| Declaration of infection history | Total number | Serologically confirmed immunity n (%) | P value |
|----------------------------------|--------------|----------------------------------------|---------|
| Measles | | | .216 |
| Reported history of infection | 11 | 11 (100) | |
| No history of infection | 169 | 138 (81.7) | |
| Mumps | | | .006 |
| Reported history of infection | 49 | 47 (95.9) | |
| No history of infection | 131 | 103 (78.6) | |
| Rubella | | | 1.000 |
| Reported history of infection | 28 | 28 (100) | |
| No history of infection | 152 | 149 (98) | |
| Varicella | | | – |
| Reported history of infection | 77 | 77 (100) | |
| No history of infection | 103 | 103 (100) | |

MMRV viruses were determined quantitatively by enzyme-linked immunosorbent assay kits (Euroimmun, Lübeck, Germany).

Statistics were run with the STATA 11.0 software package (College Station, Tex).

Before the study process, we obtained approval from the Ethics Committee of Bozok University, Yozgat, Turkey (reference No. 04/01/2012/4).

RESULTS

From January 1, 2013, to February 28, 2013, 180 volunteer first-year nursing students of Bozok University School of Health participated in the MMRV seroprevalence study. The study population included 144 women (80%) and 36 men (20%). The mean age of the participants was 18.9 ± 1.1 years (range, 17–24 years). Before attending the university the participants lived in different cities of Turkey.

Immunity rates of MMRV were 149 (82.8%), 150 (83.3%), 177 (98.3%), and 180 (100%), respectively. Immunity to MMRV viruses were similar in men and women ($P > .05$). Of the study group, 32.8% ($n = 59$) were not immune to at least 1 of the viruses, and 26 student (14.4%) were not immune to measles alone. MMR vaccine is not required for individuals who are immune to all 3 pathogens (62.2%). The history of infection and vaccination were evaluated by self-recorded questionnaires. Among the students who declared that they had received all their childhood vaccines ($n = 147$; 81.7%), 120 (81.6%) had protective antibody titers against measles. History of measles vaccination was present in 84 students (46.7%) and measles vaccination was unknown in 96 students (53.3%). In a vaccinated group 60 students (71.4%) had detectable immunity for measles, whereas 89 students (92.7%) did not have any knowledge of their history of measles vaccination or claimed they had not been vaccinated ($P < .001$).

Although all of the students were immune to varicella, 103 (57.2%) had neither infection nor vaccination history (Table 1).

Serologic immunity status and the questionnaire data were investigated to determine if age, place of residence, parent education level, economic status, housing details, and number of siblings had an influence on the seropositivity status of participants. No significant difference in protection percentage against these diseases was found using any of these parameters ($P > .05$).

The results of this study showed that all of the students were immune to varicella and 32.8% of the students were not immune to at least 1 of the viruses covered by the MMR vaccine. The cost of systematic vaccination of all the students without prior evaluation of their immunity status was compared with that of serologic testing followed by selective vaccination.

Table 2
Cost analysis of alternative vaccination policies for nursing students

| Vaccine | Estimated cost for 100 individuals (\$) | | |
|-----------------------------|-----------------------------------------|-----------------------------------------------|-----------------|
| | Cost for screening + vaccination | Cost for single vaccination without screening | Cost difference |
| Measles, mumps, and rubella | 690 + 165 = 855 | 500 | 355 |
| Varicella | 450 + 0 = 450 | 1,700 | 1,250 |

A single enzyme-linked immunosorbent assay test for MMR costs approximately \$2.30 for each portion and \$4.50 for varicella. A single vaccination for MMR costs \$5, whereas the cost for 1 dose of varicella vaccination is \$17 when supplied by the Turkey Ministry of Health. The results, summarized in Table 2, indicate that for MMR systematic vaccination (\$50/100 individuals) is more cost-effective than serologic testing followed by selective vaccination of susceptible students (approximately \$855/100 individuals). However, for varicella, it would cost less to selectively vaccinate susceptible individuals (approximately \$450) than to blindly vaccinate all students (\$1,700). Systematic vaccination of nursing students for MMR without serologic test is cheaper, whereas for varicella vaccination of only susceptible students is cheaper.

DISCUSSION

The Advisory Committee on Immunization Practices and the Healthcare Infection Control Practices Advisory Committee of the Centers for Disease Control and Prevention have recommended immunization guidelines for HCWs.² These guidelines strongly recommend immunizations against MMRV for HCWs²; however, there is no general agreement on the immunization program. Especially in developing countries like Turkey, the rate of young adults who are still susceptible to MMRV is unidentified and there are no official recommendations for the vaccination of HCWs in most of them.^{1,4}

In this study, immunity rates to MMRV were 82.8%, 83.3%, 98.3%, and 100%, respectively, for the study group and 32.8% were not immune to at least 1 of the MMR viruses, and 14.4% of students were not immune to measles alone.

In our study the immunity rate to MMRV was high among nursing students (82.8%–100%). Cabadak et al⁵ found the immunity rate to MMRV to be 56.5%–96% among medical students in Turkey. Kutlu et al⁶ reported 91.6%–97.2% immunity rate for MMR among female medical students in Turkey. In a previous Turkish study, Celikbas et al⁴ found the immunity rate for MMRV to be 98%, 93%, 98%, and 98%, respectively. They proposed that the vaccination of HCWs for MMR without antibody screening tests would be cheaper if the proportion of immune HCWs was <78%.

In Turkey, mumps and rubella vaccines were included in expanded vaccination program in addition to measles vaccination in 2006 and varicella vaccine was included in 2013. In 2007 children aged between 8 and 13 years were vaccinated against MMR in a catch-up vaccination program.^{3,7} According to vaccination programs that were implemented in Turkey, these students would most likely have had only 1 dose of measles vaccine, and were not vaccinated against mumps, rubella, and varicella. In the following years, probably higher rates of immunity to MMR in this age group will be seen due to the change of the vaccination program. But we believe that the catch-up vaccination program should be reevaluated for this age group.

Serologic screening may not to be performed before vaccinating against MMRV, unless the health care facility considers it cost-

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