

HEALTHCARE WORKERS IN BULGARIA – ARE THEY PROTECTED FROM VACCINE-PREVENTABLE INFECTIONS?

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ABSTRACT

Background: Healthcare workers (HCWs) are at increased risk of exposure to many viral infections, including vaccine preventable diseases (VPDs) such as measles, mumps and rubella (MMR) as compared to non-HCWs. Immunity of HCWs against these viruses is mandatory in a healthcare setting due to possible exposure from patients or colleagues.

Aim: To provide an assessment of anti-measles, mumps and rubella IgG seropositivity among Bulgarian HCWs employed in hospitals and regional health inspectorates (RHI), as an indicator of protective immunity against MMR in this risk group.

Materials and Methods: In the current study, 181 HCWs from Infectious Units in regional hospitals in the country, and HCWs from the RHI, involved in the monitoring and surveillance of MMR cases in Bulgaria were screened. Serum specimens from all participants were tested by a commercial indirect enzyme-linked immunosorbent assay (Anti-Measles, Anti-Mumps, Anti-Rubella IgG EIA-Euroimmun®,

Germany) for presence of IgG antibodies against measles, mumps and rubella, as an indicator of protective immunity.

Results: The study included 181 HCWs, 25 male and 156 female, aged 22 to 66 years. The average protective seroprevalence for measles, mumps and rubella was 82.9%, 76.2% and 92.3% percent, respectively. The highest share of negative results were obtained for mumps-specific IgG – 23.2% (42/181), followed by measles 16.6% (60/181) and rubella-specific IgG 7.7% (19/181). Regarding the age distribution, the highest number of HCWs non-immune to measles and mumps was found among the 31- 40-year olds, and against mumps – among the 41-50-year-olds.

Conclusion: HCWs are at greater risk of contracting infections than the general population because of contact with sick patients or infectious material. Infected healthcare workers can spread nosocomial diseases to vulnerable patients with more severe illness, leading to complications and even death. Therefore, the vaccination status of HCWs must be strictly monitored.

Key words: HCWs, measles, mumps, rubella, IgG immunity

INTRODUCTION

HCWs are exposed to much more viral infections, including VPDs such as measles, mumps and rubella as compared to non-HCWs. Immunity of HCWs against these viruses is mandatory in a healthcare setting due to possible exposure from patients or colleagues [1-3].

The high contagion index (>90% for measles and rubella, and >50% for mumps), the high frequency of severe, debilitating complications and the significant mortality determine the great healthcare and socio-economic importance of these infections. Approximately 30% of reported measles cases have one or more complications, with disabling effects most common in children under five years of age. The public health importance of rubella infection is determined by the teratogenic effect of rubella virus during pregnancy. Rubella is associated with a high rate of miscarriages, stillbirths or congenital rubella syndrome, manifested by blindness, deafness, heart defects and other severe organ damages in the

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newborn. The mumps virus, in turn, is one of the main causes of viral meningitis and meningoencephalitis in about 10 to 30% of infected and non-immune persons. Epidemic outbreaks of MMR are recorded mainly among unvaccinated and non-immune individuals, and nosocomial transmission has also been reported, making it extremely important to maintain optimal immunity among HCWs involved in the care and monitoring of such patients [4]. Because of their professional duties, HCWs are more likely to acquire and transmit vaccine-preventable diseases such as influenza, measles, rubella and whooping cough [5].

In the pre-vaccination era, MMR were endemic in Europe with regular outbreaks occurring each 2–5 years, so that most people would be infected during childhood. In the pre-vaccination era, MMR were endemic in all ages of the world and in all age groups that had immunity to the viruses was acquired through exposure to the disease in infancy or adolescence. In 1998, the Regional Committee of the World Health Organization (WHO) for Europe defined nine vaccine-preventable diseases as the main targets of healthcare policy, including measles elimination, and reducing the incidence of Congenital Rubella Syndrome (CRS) [6]. Since 2004, Bulgaria has been included in the WHO Program for the Elimination of Measles and Rubella (including Congenital Rubella) in the European Region and conducts active seroepidemiological surveillance of all reported cases [7, 8]. In parallel, case-based mumps surveillance is being introduced in the country.

The present study was carried out in 2022, and aims to provide an assessment of anti-measles, mumps and rubella IgG seropositivity among HCWs in Bulgaria, who are employed in hospitals and RHI, as an indicator of protective immunity against MMR in this risk group.

MATERIALS AND METHODS

Study design

The study was focused on medical staff from seven country regions (Sofia capital, Burgas, Blagoevgrad, Dobrich, Pazardzhik, Veliko Tarnovo, and Sofia region) working at the Infectious Units of regional hospitals, and HCWs from the RHI, involved in the monitoring

and surveillance of MMR cases. The samples were taken during the period of measles outbreaks in Bulgaria (2017 – 2020). After the tests, the HCWs were informed about their MMR IgG titers.

MATERIALS

Serum samples collected from 181 HCWs were tested for presence of IgG antibodies specific for measles, mumps and rubella viruses, as an indicator of protective immunity. The laboratory assays were carried out at the National Reference Laboratory "Measles, Mumps, Rubella", Department of Virology, National Center for Infectious and Parasitic Diseases (NCIPD), Sofia.

METHODS

Serological analysis

All serum specimens were tested for the presence of anti-Measles, anti-Mumps and anti-Rubella IgG with a commercial indirect enzyme-linked immunosorbent assay (Anti-Measles, Anti-Mumps, Anti-Rubella IgG EIA-Euroimmun®, Germany). The extinction of each tested sample was divided by the extinction of the calibrator and the results were interpreted qualitatively as positive, negative or equivocal. In accordance with the manufacturer's instructions (a test was considered positive for MMR if the calculated ratio was above 1.1). Quantitative analysis was also performed and the level of protective antibodies was calculated in international units per milliliter (IU/ml) by plotting a standard curve. The assay specificity and sensitivity was more than 95%, respectively according to the manufacturer.

Statistical Analysis

We calculated overall and group-specific percent seropositivity. In order to compare seropositivity among the different groups under investigation, we used the Fisher's exact test and the results were considered as significant if the p-value was ≤ 0.05 .

RESULTS

Characteristic of subjects

The study included 181 participants HCWs, 25 male and 156 female aged 22 to 66 years. The demographic characteristics of the study population are given in Table 1.

Table 1. Demographic characteristics of the study population

Characteristics		N	(%)
HCWs tested		181	(100)
Gender	Male	25	(13.8)
	Female	156	(86.2)
Occupation	Employed in regional hospitals	137	(75.7)
	RHI employees	44	(24.3)
		Median (range):	SD*
SD*:		46.5 (22 – 66)	13.6

*SD – Standard deviation

Overall, protective seroprevalence for measles, mumps and rubella was 82.9% (150/181), 76.2% (138/181) and 92.3% (167/181) percent, respectively. The mumps seronegative HCWs were the highest share 23.2% (42/181), as compared to measles 16.6% (60/181) and rubella- seronegative ones 7.7% (19/181) (Table 2).

Regarding the age groups, the lowest number protected against measles and mumps was found among the 31-40-year-olds (15/26, 57.7% and 16/3, 61.5%), and against mumps – among the 41-50-year-olds (35/47, 74.5%). On the other hand, calculated protective immunity against rubella was lowest in the 20-30-year-olds (23/27, 85.2%) and enhanced with increasing age to 32/33, 97% in those aged above 60 (Figure 1).

The analysis with Fisher's exact test identified statistically significant differences between age-specific positivity and overall positivity for two age groups, regarding measles and mumps : 31- 40 and > 60 (Figure 1). The positivity among the 31-40 year-olds was particularly low (57.7% as compared to the overall 82.9% for measles and 61.5% as compared to the overall 76.2% for mumps). This difference was statistically significant regarding measles ($p < 0.001$). Additionally, the positivity among those >60 years of age (93.9% for measles and 84.8% for mumps)

was higher than the overall positivity which was calculated for these VPDs ($p = 0.1223$ for measles and $p = 0.2601$ for mumps).

DISCUSSION

HCWs are at high risk of contracting serious and sometimes fatal diseases, including VPDs. According to the Center for Disease Control and Prevention (CDC) recommendations if a HCW was born in 1957 or later and has not received MMR vaccine or does not have a positive serological result for the presence of protective MMR IgG antibodies, should receive one or two doses of MMR (1 dose immediately and a 2nd dose at least 28 days later) [9]. The present study involved 181 HCWs whose MMR immune status was determined. The highest IgG seropositivity was calculated against rubella (92.3%), followed by measles (82.9%) and mumps (76.2%). Similar studies from other regions revealed that in Australia 91.5% of HCWs were seropositive to measles, 88.7% to mumps, 91.1% to rubella [10]. In Italy and Turkey, 98.2% and 98.6% were seropositive to measles, 85.9% and 92.2% to mumps, 97.6% and 98.3% to rubella, respectively [11, 12]. In Saudi Arabia, seropositivity rates were shown to be 87% to measles and 90% to rubella [13]. Our MMR seroprevalence results were also similar

Table 1. Seroprevalence for MMR among 181 participants.

Tested VPDs	Positive n (%)	Equivocal n (%)	Negative n (%)
Measles	150 (82.9)	1 (0.6)	30 (16.6)
Mumps	138 (76.2)	1 (0.6)	42 (23.2)
Rubella	167 (92.3)	0 (0)	19 (7.7)

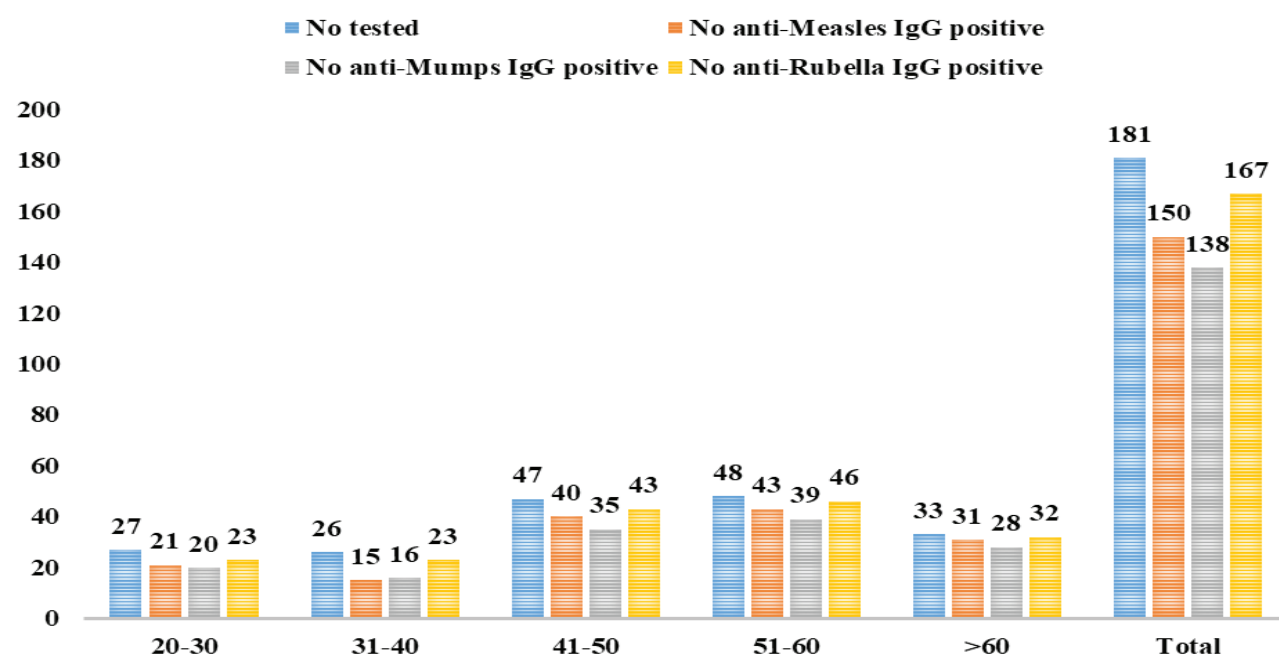


Figure 1. Distribution of the tested HCWs by age groups and the presence of anti-Measles, Mumps and Rubella IgG marker (n=181)

to data obtained with studies performed in HCWs in Japan which showed the highest IgG immunity against rubella [14-16]. There are some differences between regional seropositivity rates which are perhaps attributable to differences in the design of early childhood immunization programmes of each country. The main part of the Bulgarian HCWs included in the study were in the age groups above 20 years (154/181, 85.1%), in which immunizations against mumps and rubella have been selective and the combined MMR vaccine has not been used. For this reason, their MMR immunity could be due to a viral infection. On the other hand, the high percentage of seronegativity against mumps (23.2%, 42/181) can be explained by the lower contagious index of the virus (~ 50%) and its lower spread over the years in the country.

The monitoring of HCWs immunity to VPDs is important to define potential risk groups for the spread of nosocomial infections, such as those recently described in Bulgaria in relation to measles outbreak [17].

A limitation of the present study is the relatively small number of participants included. However, the studied HCWs were staff of Infectious Units in regional hospitals in the country, and RHI, involved in the monitoring and surveillance of MMR cases,

who have primary contact with patients suspected of measles, mumps and rubella infection.

CONCLUSION

HCWs are at a greater risk of contracting infections than the general public because they have contact with sick patients or infectious material. Infected healthcare workers can spread nosocomial diseases to vulnerable patients with more severe illness, complications and even death. Therefore, the HCWs vaccination status must be strictly monitored to limit the spread of nosocomial infections in hospital settings.

Competing Interest

The authors do not have any competing interest.

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