SEROPREVALENCE OF MEASLES, MUMPS AND RUBELLA VIRUS ANTIBODIES AMONG HEALTHCARE PERSONNEL IN SINGAPORE

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BACKGROUND

In Singapore, the trivalent measles, mumps and rubella (MMR) vaccine was introduced as one dose in January 1990 and two-dose in 1998. Measles coverage was maintained around 95% for the 1st dose and 92-95% for the 2nd dose. Notifications of diphtheria and measles immunization are mandatory under the Infectious Disease Act.

By nature of their professional duties, healthcare personnel are at unique risk of exposure to many infectious agents that cause vaccine preventable diseases. Unvaccinated healthcare personnel pose serious risks to their patients and colleagues. Since December 2014, Ministry of Health Singapore has recommended MMR as part of basic immunization for healthcare workers.

OBJECTIVES

The aim of this study was to evaluate the seroprevalence of measles, mumps and rubella (MMR) antibodies in healthcare personnel in Changi General Hospital.

MATERIALS AND METHODS

1. Study population and Specimen collection

   Annual health screening of employees in Changi General Hospital (1000 bedded acute care hospital) was conducted in September 2016. Residual sera from a random sample of healthcare personnel, age 21- 75 years were enrolled in 3 age group strata: 21-60 years, 31-40 years and 41 years and above

2. Enzyme immunoassay for quantification of antibodies.

   Human IgG antibodies against measles, mumps and rubella viruses were measured by using commercial enzyme – linked immunosorbent assay (ELISA) kits, (IBL International GmbH Hamburg, Germany) in accordance with the manufacturer's instructions. The assay cut-off for seropositivity were: 300 mIU/mL for anti-measles antibodies, 12 U/mL for anti-mumps antibodies and 15 IU/mL for anti –rubella antibodies. Equivocal results were considered as negative.

3. Statistical Analysis

   The overall seroprevalence rates of and rubella were reported with the corresponding 95% confidence intervals. The seroprevalence rates of the subjects for each of the defined age groups and ethnic groups were also reported. Logistic regression was used to predict the probability of seroconversion in different age group, gender and ethnic groups. A p-value of <0.05 was considered statistically significant. Statistical analysis was performed with SPSS statistical software, version 19.0 (IBM Corp. Armonk, NY).

RESULTS

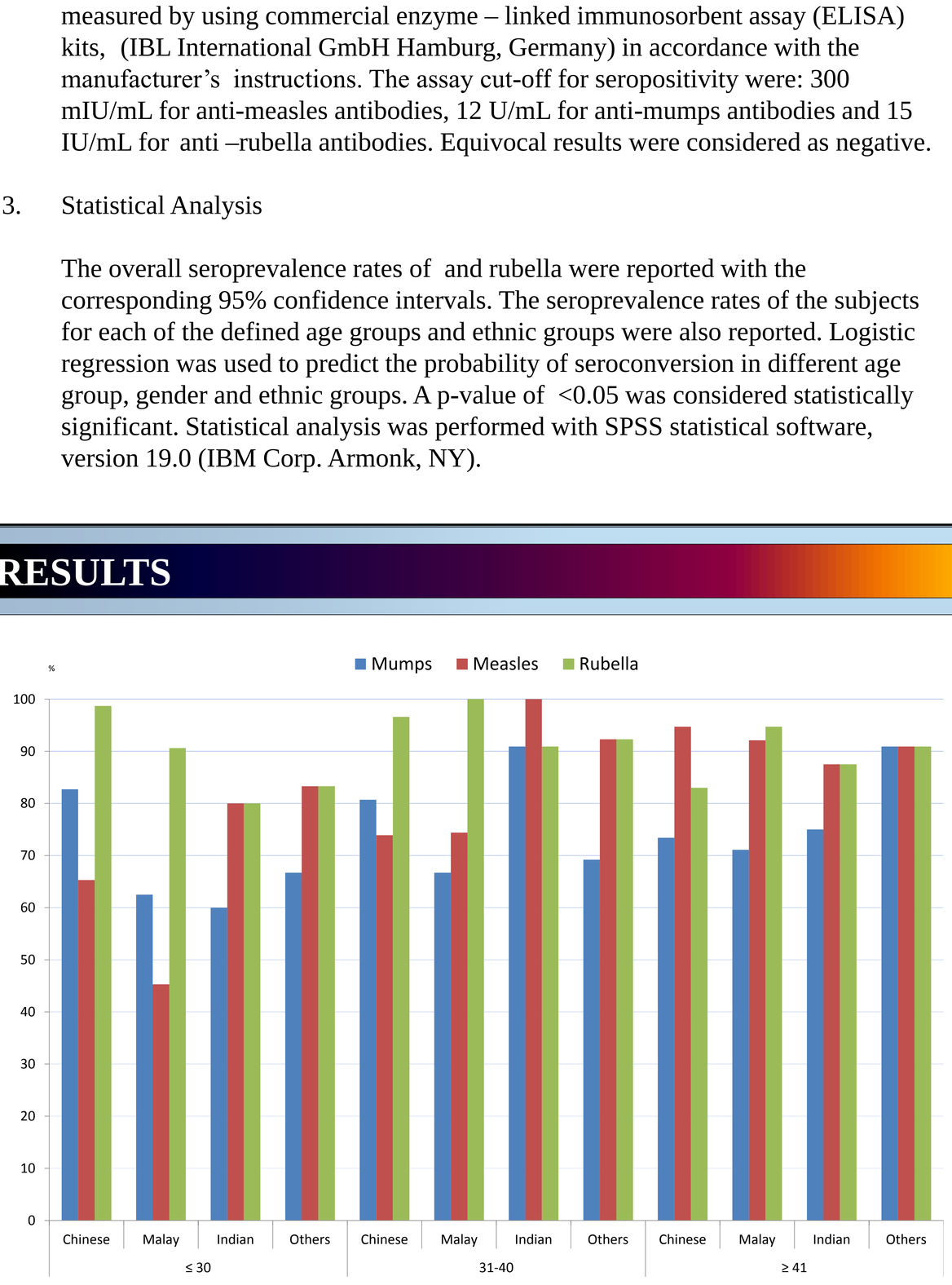

Figure 1. Seroprevalence of Measles, Mumps and Rubella antibodies among healthcare personnel by age and ethnic groups

RESULTS

Table 1. Seroprevalence of Measles, Mumps and Rubella antibodies among healthcare personnel by age group

Vaccine Category	21-30y (n=150)	31-40y (n=151)	≥41 (n=151)
Measles	87 (58%)	117 (71.5%)	141 (93.4%)
Mumps	109 (72.7%)	116 (76.8%)	112 (74.2%)
Rubella	141 (94%)	145 (96.7%)	131 (86.8%)

A total of 452 healthcare personnel were recruited for this study; 150 healthcare personnel in 21-30 year age group, 151 in 31-40 age group and 151 in ≥ 41 year age group. The majority of the healthcare personnel were Singapore citizens with only 13 foreigners (2.9%).

The seroprevalence of antibodies against measles virus was 76.3% (95% CI 72.2%-80.0%). It decreased from 93.4% in ≥41 year age group (aOR 8.9%, 95% CI 4.3-18.4, p<0.001), 77.5% in 31–40 age group (aOR 2.2, 95% CI 1.3-3.7, p=0.002) to 58.0% in 21-30 age group(reference group). The seroprevalence of antibodies against mumps virus was 74.6% (95% CI 70.4%-78.4%) and generally remained above 70% in all the age groups (adjusted p>0.05) The seroprevalence of antibodies against rubella virus was 92.5% (95% CI 89.7%-94.6%)with the lowest seropositive rate (86.8%) in the ≥41 year age group (Table 1). Subjects aged 31 to 40 compared to those aged ≥41 were about 4.5 (95% CI 1.6-12.5) times more likely to have a positive rubella serology.

Differences in measles virus amongst the races revealed lower seropositivity rate (66%) in Malays. Indian and non-local races were more likely to have positive measles serology compared to Malays (adjusted p=0.043 and p=0.044 respectively). Similarly differences in the mumps virus across the races showed a lower seropositivity rate (66.0%) in Malays. Chinese compared to Malays were more likely to have positive mumps serology (aOR 1.9, 95% CI 1.2-3.0, p=0.007) This may suggest a lower humoral response to the measles and mumps vaccine in the Malays (Figure 1). Logistic regression showed that gender had no association with measles, mumps and rubella virus seropositivity.

CONCLUSIONS

The coverage of primary immunization with MMR vaccine in Singapore has been maintained at a high level with routine 1st dose producing 90% of immunized individuals. The absence of large outbreaks (>10 cases) of MMR in Singapore since 2000 provides good evidence that there is herd immunity in the population. The latest seroprevalence survey in adults aged 18-74 years in 2004 showed >95% had sufficient antibody.

A significant proportion of healthcare personnel lacked immunity against measles. The prevalence of antibody against measles was 76.3% with lowest in the 21 – 30 year age group (58%). There is a risk of measles outbreak in hospitals due to residual measles immunity gaps among young adults who are not targeted by the routine childhood immunization programme. Of the 3 major ethnic groups in Singapore, measles seroprevalence in Malays was significantly lower than that of Chinese and Indians. Ethnic differences related to different allele frequencies in immune response genes may account for racial difference in the antibody response to measles component of MMR vaccine

The seroprevalence of rubella was the highest and that of mumps was the lowest. The lower seroprevalence of mumps compared to measles and rubella could be partly attributed to the commercial test kit used for the detection of mumps IgG antibody. Serological studies are needed to identify immunity gaps against measles, mumps and rubella in healthcare personnel and to vaccinate the non-immune personnel to ensure sustained immunity against these vaccine preventable diseases. There appears to be a possible immunity gap among the Malays with regards to measles and mumps virus

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