Measles, Mumps, Rubella, and Varicella Immunity among Nursing Staff in a Major Hospital, Riyadh, Saudi Arabia

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Abstract

Introduction: Measles, mumps, rubella, and varicella (MMRV) represent risk to HCWs. Checking on antibodies against MMRV is an important part of infection control among nursing staff for their own health, their colleagues and for the health of patients. Screening for immunity against MMRV is an initial step before vaccination of nursing staff. This study is to describe immunity status against MMRV by screening nursing staff in a tertiary care hospital in Riyadh. Methods: A cross sectional survey among nursing staff was conducted from July to August 2019 at Prince Sultan Military Medical City. A convenience sampling was used to screen 1534 nursing staff working at several high-risk departments. Record for their immune status and antibody titer for MMRV were reviewed using a data collection form. Results: Screening for immunity among nursing staff found that; 79.3% were immune against measles; 75.5% to be immune against mumps; 95.8% were immune against rubella; and 67% were immune against varicella. The highest proportion of immune nursing staff against measles (96.3%) and varicella (93.5%) was found in Intensive care department while the highest proportion of immune staff against mumps (89.4%) was found in Long Stay department, and against rubella (97.5%) in Hemodialysis department. On the other hand, It was found that Hemodialysis Department had the Highest proportion of non-immune staff against measles (35.6%), mumps (39%), and varicella (56.3%), while Emergency Department had the lowest proportion of immune staff (6%) against rubella. Conclusion: Despite that immunity among nurses screened was good on some departments; however, such results need improvement in these critical areas. These finding emphasize the importance of the currently mandatory screening for MMRV before employment. We suggest conducting comprehensive programs to increase awareness and vaccination coverage in areas with low rates of immunity.

Keywords: Immunity, Major Hospital, measles, mumps, nursing staff, rubella, varicella

Introduction

Nursing staff are exposed to many viral infections, many of these are vaccine preventable diseases such as measles, mumps, rubella, and varicella (MMRV). Immunity of nursing staff against these viruses is mandatory in a healthcare setting due to possible exposure from patients or colleagues. Research work in Saudi Arabia and internationally indicate that Nursing staff at increased risk of infection of MMRV compared to non-HCWs.[¹,²]

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Immunization of nursing staff against MMRV infections is recommended. It's either mass vaccination or its preceded by screening can be implemented according to the cost-effectiveness for decision makers in each healthcare facility. Many studies explained that serology screening pre-vaccination is cost effective. In a study in Turkey in 2012, One thousand two hundred and fifty-five (1255) HCWs were tested. Of those examined, 94% were immune to measles, 97% to rubella, 90% to mumps and 98% to varicella. Mass vaccination without screening was more expensive for varicella, but cheaper for Measles, Mumps and Rubella. However, use of history only will result in that some HCWs (2–7%) would be not immune against MMRV since history is unreliable; and screening of HCWs before vaccination continues to be advisable. Also, in other studies, screening prior to vaccination was found to be cost effective due to high immunity rates in developing countries.

On calculating cost effectiveness we have to consider both direct and indirect costs; for example, direct such as cost of vaccines, doctor, and nursing staff costs, while indirect such as medical care costs including provider visits, tests, and medications should also be considered. Fever, tenderness, redness, rashes, are possible in about 5–15% of those vaccinated, whereas serious reactions such as allergic reaction, encephalopathy, are observed in only one per million doses administered.

Age and working in high-risk departments were important factors associated with sero-positivity. For Measles, age was found to be associated with immunity, while for rubella, working in high-risk department is associated with immunity. In another study from Turkey, immunity rates for Measles (56.5%) and varicella (56.5%) among 177 medical students in their fifth year of medical school, whereas the immunity rates for rubella (96.0%) and mumps (92.1%) were high, this too was found in previous studies.

The aim of this study is to identify pattern of immunity and needs for vaccination against the common vaccine preventable diseases such as MMRV, among Nursing Staff at PSMMC Hires.

**Objectives**

1. To describe the pattern of immunity against MMRV among nursing staff at PSMMC.
2. Identify vaccination needs, and correlation to high-risk departments.

**Methods**

A cross-sectional survey among nursing staff was conducted from July to August 2019 at PSMMC, Riyadh, Saudi Arabia. A convenience nonprobability sampling was used to review records of 1534 nursing staff working at several high-risk departments. Lab results of measles IgG, mumps IgG, rubella IgG and varicella IgG were reviewed using a data collection form.

All nursing staff working in Intensive Care Unit, Emergency Department, Hemodialysis, Oncology, Long Stay, Obstetrics and Gynecology and Pediatrics were included in this study.

**Working definitions**

1. **Immune**: Those who tested positive for IgG antibodies and confirmed by antibody titer through lab testing and or confirmed vaccination using HCWs occupational health clinic records.
2. **Not Immune**: Those who tested negative through lab testing.

**Statistical plan**

Descriptive statistics produced such as frequencies, percentages, and bar charts were produced using SPSS ver. 20.

**Ethical considerations**

PSMMC Institutional Review Board (IRB) committee (HP-01-R079) reviewed the research proposal before starting this research. Ethical approval letter issued number 1163-29 29 January 2019. Records review was anonymous using special code numbers. Data collected were used for this research only and were destroyed after research finalization.

**Results**

From Table 1 and Figure 1; show that; 1160 (79.3%) of nursing staff were immune against measles while 303 (20.7%) nurse were not immune.

From Table 2 and Figure 2; show that; 1115 (75.5%) of nursing staff were immune against mumps while 362 (24.5%) nurse were not immune.

**Table 1: Immunity against measles among nursing staff screened**

|          | Frequency | Valid Percent | Cumulative Percent |
|----------|-----------|---------------|--------------------|
| Immune   | 1160      | 79.3          | 79.3               |
| Not Immune | 303   | 20.7          | 100.0              |
| Total    | 1463      | 100.0         |                    |

**Figure 1: Immunity against measles among nursing staff screened**
From Table 3 and Figure 3; show that; 1470 (95.8%) of nursing staff were immune against rubella while 64 (4.2%) nurse were not immune.

From Table 4 and Figure 4; show that; 986 (67%) of nursing staff were immune against varicella virus while 486 (33%) nurse were not immune.

Table 5 and Figure 5; show that the immunity against measles of nursing staff working in Intensive Care Department is 96.3% which is the highest department immune against measles; while the least rate was in hemodialysis with a 64.4% only.

Table 6 and Figure 6; show that the immunity against mumps of nursing staff working in Long Stay Department is 89.4% which is the highest department immune against mumps, while the least rate was in hemodialysis with a 61% only.

Table 7 and Figure 7; show that Hemodialysis Department is 97.5% immune against Rubella, which is the highest department. While the least rate was in Emergency Department with a 94%.
Table 8 and Figure 8; show that the immunity against varicella of nursing staff working in Intensive Care Department is 93.5% which is the highest department immune against varicella, while the least rate was in hemodialysis with a 43.7% only.

**Discussion**

Review and testing of immune status and susceptibility against MMRV should start as early as on start of employment of HCWs and even should be extended to undergraduate HCWS, since in a study by Torda AJ. In 2008 (18) reported that among medical students non immunity was prevalent that 26% (190/724)
Kofi, et al.: Measles, Mumps, Rubella and Varicella Immunity Among Nursing staff

non-immune to measles, 33% (238/724) non-immune to mumps, 13% (91/724) non-immune to rubella and 10% (75/724) non-immune to varicella; which is a finding that support the practice of immune status screening during pre-employment for Measles, Mumps, Rubella and Varicella, which represents an integral part in preventing outbreaks and illnesses of such vaccine preventable diseases among HCWs, their colleagues and patients.

Kumakura S et al., 2014[11] reported that among 1811 Health Care Workers tested in a major hospital in Japan, 91.8% were seropositive to Measles, 92.1% to mumps, 89.5% to rubella, and 96.3% to varicella, which are comparable to our findings.

Also, Hatakeyama S et al. 2004[12] reported that Among tested Health Care Workers, 98.5%, 85.8%, 90.4%, and 97.2% had immunity to measles, mumps, rubella, and varicella, respectively. Also, Alp E. et al., 2012[13] reported that on screening for immunity among 1255 Health Care Workers, 94% were immune to Measles, 97% to rubella, 90% to mumps and 98% to varicella; which are comparable to our findings in these studies;

While; Abbas M et al., 2007[13] in a study of immunity of HCWs in a tertiary care hospital in Riyadh, among Health Care Workers, 71.8%, 60.3%, 47.9%, and 68.4% reported history of infection or vaccination against measles, mumps, rubella, and varicella, respectively, but serology testing proved that 4.5%, 10.8%, 12.9%, and 11.3% were not immune, respectively; which are higher that our findings,

Also, in same context, Asari S et al., 2003[14] reported that in a major tertiary care hospital in Japan, a 7.4% of the newly hired Health Care Workers were not immune for Measles, 15.9% for mumps; 12.5% for rubella, and 4.1% for varicella; which also higher than our findings. These differences might be due to recent introduction of mandatory screening of HCWs to these vaccine preventable diseases and increased awareness of importance of vaccination of HCWs.

Also in Other study on Health Care Workers in Turkey, Aypak C et al., 2012[15] indicated that his findings are comparable to our, they reported that Health Care Workers in a major hospital who were not immune that to measles, mumps, rubella, and varicella were 26 (9.2%), 18 (6.3%), 7 (2.5%), and 5 (1.8%), respectively; and concluded that that screening and vaccination of susceptible healthcare workers is essential regardless of age, which is similar to our findings.

On the other hand, in a major study in Australia, in 2008, Vagholkar S. et al.,[16] reported that prevalence of immune Health Care Workers to MMRV ranged from 88% to 94% which is comparable to our findings, and warned that those Health Care Workers who are not immune to MMRV represent a risk to themselves and others in the event of an outbreak; also recommended to improve implementation of screening and vaccination policy, including awareness of HCWs about the risks of non-immunity to vaccine preventable diseases. Also, Torda AJ, (2008)[17] alerted to importance of screening and need for vaccination for medical students.

In 2020, Asli and Elcin[18] studied sero-epidemiology of HCWs at Maltepe University Hospital, Istanbul, Turkey, and concluded that there are Low immune rates for measles and, recommended that it would be appropriate for mass vaccination without pre-screening.

Also, a recent recommendation in 2020 by Patricia L Hibberd,[19] in Uptodate about the need for HCWs and nursing staff for the MMRV vaccine.

HCWs and Nursing staff specifically are at high risk since they manage a diversity of patients including children who are not immune against MMRV as explained[20] by Angela Bechini, et al., in 2020, that a large percentage of children in a major university hospital in Italy were not immune against MMRV.

These research findings represent important alert for Primary care physicians to review immune status of nursing staff at pre-employment and even while on job, due to the high risk of transmission from patients to themselves, to colleagues, to their families and to patients, on the other hand this work represents an important step towards, hopefully, police development of implementation of a mass screening and vaccination of all HCWs against MMRV as vaccine preventable viral diseases, in Primary Care Centers, Family Medicine Practices, and Hospitals to protect HCWs and patients, equally.

**Limitations**

All health Care Workers are important to determine their immune status against MMRV, but due to feasibility issues we focused this work on nursing staff. However, nursing staff are a very important core of patients care process and further studies can be done to include other HCWs.

**Conclusion**

Immune status against MMRV is increasingly important among nursing staff to protect them, their colleagues and patients. Despite that immunity among nurses screened was good on some
departments; however, such results need improvement in these critical areas. These findings emphasize the importance of the currently mandatory screening for MMRV before employment. We suggest conducting comprehensive programs to increase awareness and vaccination coverage in areas with low rates of immunity.

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Conflicts of interest
There are no conflicts of interest.

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