

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

Mostafa Kofi<sup>1,2</sup>, Abdulaziz Bin Rasheed<sup>1</sup>, Saad AlBattal<sup>1</sup>, Abood Al Abood<sup>1</sup>, Abdulmajeed Alshowair<sup>1</sup>, Abdulaziz AlQahtani<sup>1</sup>, Mohie Selim<sup>1</sup>, Yasser Yousef<sup>1,2</sup>, Tarek ElSaid<sup>1,3</sup>, Abdulrahman Alkhalifah<sup>1</sup>

<sup>1</sup>Department of Family and Community Medicine, PSMCM, Riyadh, Saudi Arabia, <sup>2</sup>Department of Community and Occupational Medicine, Faculty of Medicine, Suez Canal University, Egypt, <sup>3</sup>Department of Family Medicine, Faculty of Medicine, Suez Canal University, Egypt

## 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

**Address for correspondence:** Prof. Mostafa Kofi

F&CM Dept., Prince Sultan Military Medical City, PSMCM, Riyadh, Saudi Arabia.

E-mail: moustafafouad@yahoo.com

Received: 18-05-2020

Revised: 19-06-2020

Accepted: 21-06-2020

Published: 30-10-2020

### Access this article online

#### Quick Response Code:



**Website:**  
www.jfmpc.com

**DOI:**  
10.4103/jfmpc.jfmpc\_906\_20

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.<sup>[1,2]</sup>

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

**For reprints contact:** WKHLRPMedknow\_reprints@wolterskluwer.com

**How to cite this article:** Kofi M, Rasheed AB, AlBattal S, Al Abood A, Alshowair A, AlQahtani A, *et al.* Measles, mumps, Rubella, and Varicella Immunity among Nursing Staff in a major hospital, Riyadh, Saudi Arabia. J Family Med Prim Care 2020;9:5339-44.

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.<sup>[2]</sup> Many studies explained that serology screening pre-vaccination is cost effective.<sup>[2-4]</sup>

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.<sup>[2]</sup> Also, in other studies, screening prior to vaccination was found to be cost effective due to high immunity rates in developing countries.<sup>[3-6]</sup>

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.<sup>[7,8]</sup> 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.<sup>[8]</sup>

Age and working in high-risk departments were important factors associated with sero-positivity.<sup>[8-10]</sup> 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.<sup>[10]</sup>

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.

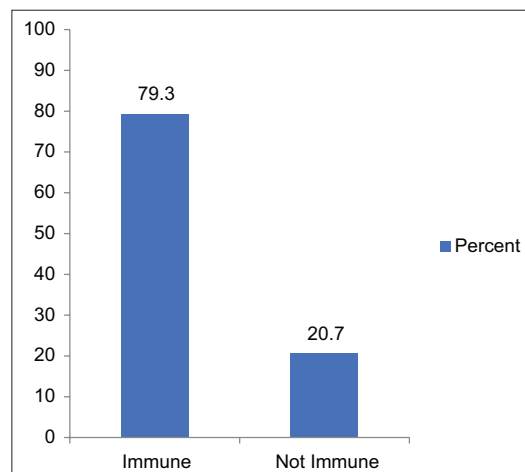
### Results

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.

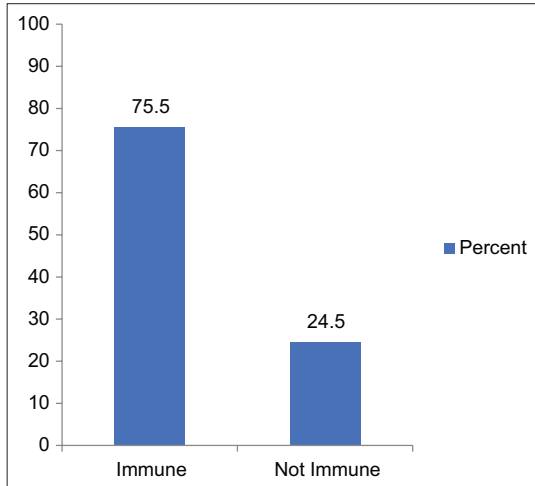


Figure 2: Immunity against mumps among nursing staff screened

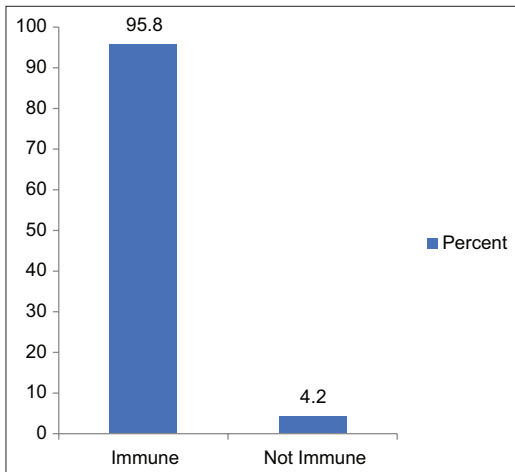


Figure 3: Immunity against rubella among nursing staff screened

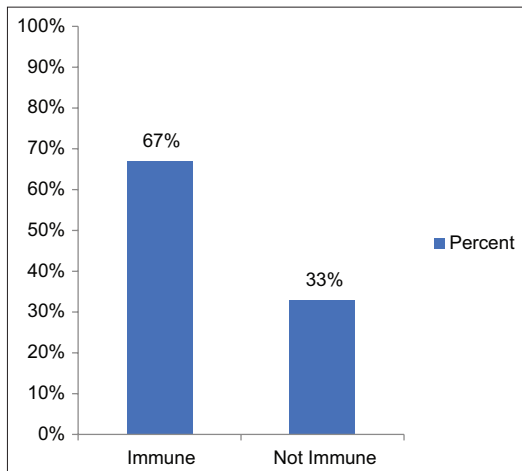


Figure 4: Immunity against varicella among nursing staff screened

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 2: Immunity against mumps among nursing staff screened

	Frequency	Valid Percent	Cumulative Percent
Immune	1115	75.5	75.5
Not Immune	362	24.5	100.0
Total	1477	100.0	

Table 3: Immunity against rubella among nursing staff screened

	Frequency	Valid Percent	Cumulative Percent
Immune	1470	95.8	95.8
Not Immune	64	4.2	100.0
Total	1534	100.0	

Table 4: Immunity against varicella among nursing staff screened

	Frequency	Valid Percent	Cumulative Percent
Immune	986	67	67
Not Immune	486	33	100.0
Total	1472	100.0	

Table 5: Immunity against measles among nursing staff according to high risk departments

Department	Immune	Not Immune	Total
Emergency	310	13	323
	96%	4%	100.0%
Intensive Care	180	7	187
	96.3%	3.7%	100.0%
Long Stay	85	9	94
	90.4%	9.6%	100.0%
Obs.& Gynecology	172	71	243
	70.8%	29.2%	100.0%
Pediatrics	155	74	229
	67.7%	32.3%	100.0%
Hemodialysis	121	67	188
	64.4%	35.6%	100.0%
Oncology	137	62	199
	68.8%	31.2%	100%
Total	1160	303	1463
	79.3%	20.7%	100.0%

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

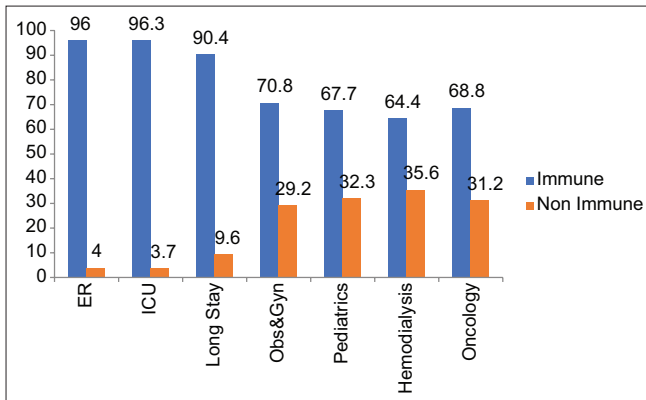


Figure 5: Immunity against measles among nursing staff according to high risk departments

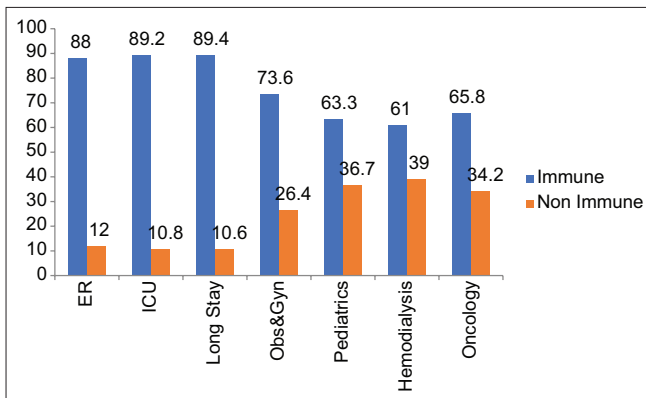


Figure 6: Immunity against mumps among nursing staff according to high risk departments

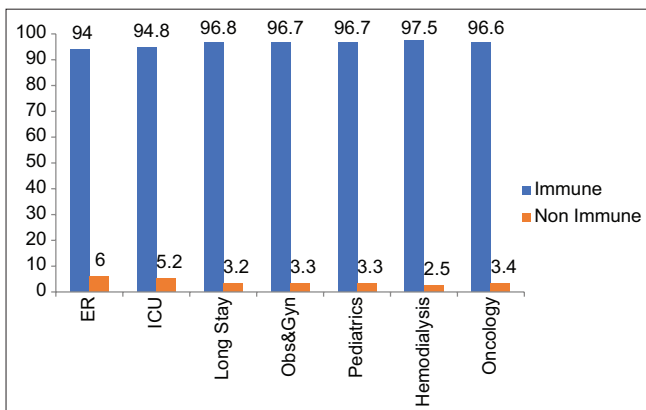


Figure 7: Immunity against rubella among nursing staff according to high risk departments

a study by Torda AJ. In 2008 (18) reported that among medical students non immunity was prevalent that 26% (190/724)

Table 6: Immunity against mumps among nursing staff according to high risk departments

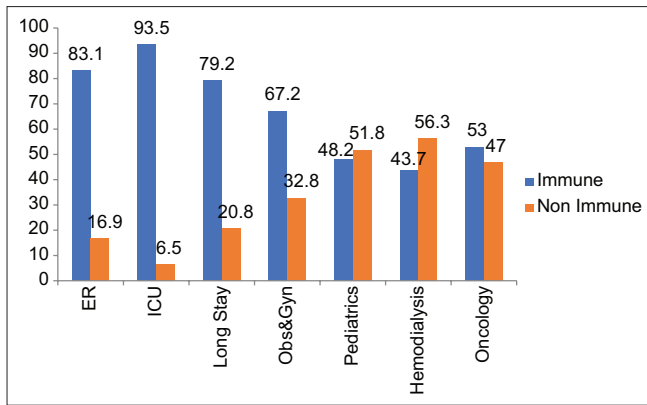
Department	Immune	Not Immune	Total
Emergency	284	39	323
	88%	12%	100.0%
Intensive Care	166	20	186
	89.2%	10.8%	100.0%
Long Stay	84	10	94
	89.4%	10.6%	100.0%
Obs.& Gynecology	192	69	261
	73.6%	26.4%	100.0%
Pediatrics	152	88	240
	63.3%	36.7%	100.0%
Hemodialysis	106	68	174
	61%	39%	100.0%
Oncology	131	68	199
	65.8%	34.2%	100%
Total	1115	362	1477
	75.5%	24.5%	100.0%

Table 7: Immunity against rubella among nursing staff according to high risk departments

Department	Immune	Not Immune	Total
Emergency	314	20	334
	94.0%	6.0%	100.0%
Intensive Care	183	10	193
	94.8%	5.2%	100.0%
Long Stay	92	3	95
	96.8%	3.2%	100.0%
Obs.& Gynecology	264	9	273
	96.7%	3.3%	100.0%
Pediatrics	231	8	239
	96.7%	3.3%	100.0%
Hemodialysis	189	7	196
	97.5%	2.5%	100.0%
Oncology	197	7	204
	96.6%	3.4%	100%
Total	1470	64	1534
	95.8%	4.2%	100.0%

Table 8: Immunity against varicella among nursing staff according to high risk departments

Department	Immune	Not Immune	Total
Emergency	270	55	325
	83.1%	16.9%	100.0%
Intensive Care	173	12	185
	93.5%	6.5%	100.0%
Long Stay	76	20	96
	79.2%	20.8%	100.0%
Obs.& Gynecology	160	78	238
	67.2%	32.8%	100.0%
Pediatrics	109	117	226
	48.2%	51.8%	100.0%
Hemodialysis	93	111	197
	43.7%	56.3%	100.0%
Oncology	105	93	198
	53%	47%	100%
Total	986	486	1472
	67%	33%	100.0%



**Figure 8:** Immunity against varicella among nursing staff according to high risk departments

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<sup>[11]</sup> 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, Hatakayama S *et al.* 2004<sup>[12]</sup> 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<sup>[1]</sup> 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<sup>[13]</sup> 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 than our findings,

Also, in same context, Asari S *et al.*, 2003<sup>[14]</sup> 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<sup>[15]</sup> 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.*,<sup>[16]</sup> 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)<sup>[17]</sup> alerted to importance of screening and need for vaccination for medical students.

In 2020, Asli and Elcin<sup>[18]</sup> 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,<sup>[19]</sup> 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<sup>[20]</sup> 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 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.

### Acknowledgement

Thanks to PSMMC Preventive Medicine Nursing Staff, especially Ms. Charmaine M Macadangdong Charge Nurse of Preventive Medicine for assisting in data collection of this study. Also, Thanks to Dr. Yasser Ali Ebeid PSMMC, FCM Dept. for his support in data management.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

### References

- Alp E, Cevahir F, Gökahmetoglu S, Demiraslan H, Doganay M. Pre vaccination screening of health-care workers for immunity to measles, rubella, mumps, and varicella in a developing country: What do we save? *J Infect Public Health* 2012;5:127-32.
- Centers for Disease Control and Prevention: Vaccine side effects, adverse reactions, contraindications, and precautions, recommendations of the advisory committee on immunization practices (ACIP). *MMWR Recomm. Rep.*, 1996;45:1-35.
- Celikbas A, Ergonul O, Aksaray S, Tuygun N, Esener H, Tanir G, *et al.* Measles, rubella, mumps, and varicella sero-prevalence among health care workers in Turkey: Is pre-vaccination screening cost-effective? *Am J Infect Control* 2006;34:583-7.
- Chodick G, Ashkenazi S, Livni G, Lerman Y. Cost-effectiveness of varicella vaccination of healthcare workers. *Vaccine* 2005;23:5064-72.
- Fedeli U, Zanetti, Saia B. Susceptibility of healthcare workers to measles, mumps, rubella and varicella. *J Hosp Infect* 2002;51:133-5.
- Almuneef M, Dillon J, Abbas MF, Memish Z. Varicella zoster virus immunity in multinational health care workers of a Saudi Arabian hospital. *Am J Infect Control* 2003;31:375-81.
- Nichol KL, Mallon KP, Mendelman PM. Cost benefit of influenza vaccination in healthy, working adults: An economic analysis based on the results of a clinical trial of trivalent live attenuated influenza virus vaccine. *Vaccine* 2003;21:2207-17.
- Centers for Disease Control and Prevention vaccine side effects, adverse reactions, contraindications, and precautions recommendations of the advisory committee on immunization practices (ACIP). *MMWR Recomm Rep* 1996;45:1-35.
- Kanbur NO, Derman O, Kutluk T. Age-specific mumps sero prevalence of an unvaccinated population of adolescents in Ankara, Turkey. *Jpn J Infect Dis* 2003;56:213-5.
- Alp H, Altinkaynak S, Ertekin V, Kilicaslan B, Giraksin A. Sero-epidemiology of varicella-zoster virus infection in a cosmopolitan city (Erzurum) in the eastern Turkey. *Health Policy* 2005;72:119-24.
- Kumakura S, Shibata H, Onoda K, Nishimura N, Matsuda C, Hirose M. Seroprevalence survey on Measles, mumps, rubella and varicella antibodies in healthcare workers in Japan: Sex, age, occupational-related differences and vaccine efficacy. *Epidemiol Infect* 2014;142:12-9.
- Hatakeyama S, Moriya K, Itoyama S, Nukui Y, Uchida M, Shintani Y, *et al.* Prevalence of measles, rubella, mumps, and varicella antibodies among healthcare workers in Japan. *Infect Control Hosp Epidemiol* 2004;25:591-4.
- Abbas M, Atwa M, Emara A. Seroprevalence of measles, mumps, rubella and varicella among staff of a hospital in Riyadh, Saudi Arabia. *J Egypt Public Health Assoc* 2007;82:283-97.
- Asari S, Deguchi M, Tahara K, Taniike M, Toyokawa M, Nishi I, *et al.* Seroprevalence survey of measles, rubella, varicella, and mumps antibodies in health care workers and evaluation of a vaccination program in a tertiary care hospital in Japan. *Am J Infect Control* 2003;31:157-62.
- Aypak C, Bayram Y, Eren H, Altunsoy A, Berktaş M. Susceptibility to measles, rubella, mumps, and varicella-zoster viruses among healthcare workers. *J Nippon Med Sch* 2012;79:453-8.
- Vagholkar S, Ng J, Chan RC, Bunker JM, Zwar NA. Healthcare workers and immunity to infectious diseases. *Aust N Z J Public Health* 2008;32:367-71.
- Torda AJ. Vaccination and screening of medical students: Results of a student health initiative. *Med J Aust* 2008;189:484-6.
- Karadeniza A, Alaşehirb EA. Seroepidemiology of hepatitis viruses, measles, mumps, rubella and varicella among healthcare workers and students: Should we screen before vaccination? *J Infect Public Health* 2020;13:480-4.
- Patricia L Hibberd MD. Measles, mumps, and rubella immunization in adults. *UptoDate*. March 2020. <https://www.uptodate.com/contents/measles-mumps-and-rubella-immunization-in-adults/print>. [Last accessed on 2020 Jun 21].
- Bechini A, Boccalini S, Alimenti CM, Bonanni P, Galli L, Chiappini E. Immunization status against measles, mumps, rubella and varicella in a large population of internationally adopted children referred to Meyer Children's University Hospital from 2009 to 2018. *Vaccines* 2020;8:51.