

Susceptibility and Vaccination Coverage of Vaccine Preventable Diseases among Health Care Workers in a Paediatric Tertiary Hospital, Egypt

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Received: July, 2018 Accepted: September, 2018

Abstract

Background: Health-care workers (HCWs) represent a high risk group for acquiring vaccine-preventable diseases (VPDs). **Objective:** to determine susceptibility and vaccination coverage rates against VPDs among a group of health care workers in a tertiary care paediatric hospital, Egypt. **Method:** A cross sectional study was conducted at the Paediatric hospital of the Faculty of Medicine, Ain Shams University from July 2017 to November 2017. A Structured self-administered questionnaire including Socio-demographic characteristics, exposure to occupational VPDs infections and vaccination coverage was used. **Results:** Out of the 110 HCWs enrolled, 50.0% were physicians, 34.5% were nurses and 15.5% were house keepers. The reported vaccination coverage rate was highest for Tuberculosis (95.5%) followed by Hepatitis B (86.4%) and lowest for chickenpox (9.1%). HCWs reporting no history of disease or vaccination were considered as “potentially susceptible HCWs”: 69.1% to rubella, 63.6 % to mumps, 58.2% to measles, 54.5% to chickenpox, 13.5% to hepatitis B and 1.8% to tuberculosis. The main reasons for non-immunization were lack of vaccine provision by the hospital (from 63.6% for influenza to 53.5% for hepatitis B), lack of knowledge of vaccine recommendation (from 89.5% MMR to 43.2% for influenza), fear of vaccine side effects (from 33.3% for hepatitis B to 4.5% for influenza) and 10.2% reported that they don't get influenza vaccine because they think that it is not a serious disease. Compared with nurses and housekeepers, physicians were more likely to have been vaccinated for hepatitis B, MMR and chickenpox ($P < 0.01$). **Conclusion:** The current study revealed that the vaccination coverage for most of the VPDs is generally below expectations. Raising awareness of the recommended vaccines in addition to providing them free of charge or at a reduced price by the hospital administration can improve the vaccination coverage among HCWs.

Keywords: *Health Care Workers; Vaccination coverage; Vaccine Preventable Diseases; Vaccine Preventable Diseases susceptibility*

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Introduction

Health-care workers (HCWs) represent a high risk group for acquiring vaccine-preventable diseases (VPDs).¹ Healthcare workers comprise all personnel who have contact with patients including a variety of professionals with different levels of exposure and patient contact, such as doctors, nurses, physiotherapists, laboratory technicians, dietitians,

cleaning and catering.^{2,3} The World Health Organization (WHO) estimates that globally around 59 million HCWs are daily exposed to a multitude of occupational hazards. The most prevalent hazard is the risk of exposure to occupational infections as a result of exposure to infected patients and/or infectious materials.^{4,5}

The logic for immunization of HCWs relies on two basic pillars: The first one is the fact that HCWs are at increased risk for acquiring occupational VPDs. Previous studies reveal higher risk for acquisition of measles and influenza compared to adults working in non-healthcare settings.^{6,7} In the current vaccine era, the national expanded program of immunization resulted in decrease of VPDs. As a result average patient age has increased in many developed countries, shifting from the first to the third decade of life; thus, it is expected that the severity of several formerly childhood VPDs will increase.⁸ Health Care Workers (HCWs) provide health care to many patients with multiple vulnerabilities for a serious disease course, complications, or even death because of their age (e.g., neonates, young infants, elderly) and/or underlying conditions (e.g., pregnancy, immune-compromised status, chronic diseases).⁹ In addition, HCWs have been traced as the primary source of infection in many outbreaks of VPDs, including influenza, pertussis, measles, rubella, varicella, hepatitis A, and hepatitis B.^{9,10-13} Outbreaks of VPDs in healthcare facilities are also associated with absenteeism among HCWs, interruption of health services, costs of testing, prophylaxis, treatment, infection-control measures, and contact tracing.^{10-12,14} Thus immunization of HCWs is justified as a primary prevention measure to prevent the transmission of VPDs to susceptible patients, their colleagues, and families.¹⁵⁻¹⁷

Several researches from different countries reveal significant immunity gaps against most of the VPDs. Susceptibility to infection rates of HCWs varied for different VPDs and among different studies ranging from 4.6% to 17% for measles, 15.7% to 25% for mumps, 4.5% to 18.6% for rubella, 4.1% to 16.7% for chicken pox, 48.3% to 68.8%

for pertussis, 22.6% to 35% for hepatitis B, and 21.2% to 64.3% for tetanus and diphtheria.¹⁸⁻²⁰ Globally, reported vaccination rates are below targets ranging from 18.8% to 70.5% against measles and mumps, 22.2% to 70.5% against rubella, 1.9% to 3% against varicella, 40% to 95% against hepatitis B.¹⁹⁻²³ Similarly reported influenza vaccination uptake by HCWs remains low over the last few years, ranging from 5% to 42% in many countries.^{19, 23}

Health care workers working in paediatric departments get more in contact with many VPDs during their daily patients' contacts. Ensuring that HCWs are immune to VPDs is an essential part of employee health programs. Prevention of illness through comprehensive HCWs immunization programs is by far more cost effective than case management and outbreak control.^{24, 25}

Nationally and regionally available researches on the susceptibility and the vaccination coverage rates among healthcare workers are scarce.

The current study aims to determine HCWs susceptibility and vaccination coverage rates against vaccine preventable diseases among a group of health care workers in a tertiary care paediatric hospital, Egypt.

Method

A cross sectional study was conducted at the Paediatric hospital of the Faculty of Medicine, Ain Shams University, Egypt. It is a tertiary care hospital having nine units with a total capacity of 200 beds (inpatients, incubators and intensive care unit). The outpatient clinic flow is around 77.000 patients per year. The Emergency department receives around 35.000 patients per year and the average number of admissions per year is 8000 patients.

Study population, Sample size and tool: From July 2017 to November 2017 all Healthcare workers (Physicians, nurses and housekeepers) who are in contact with

patients and working for at least 6 months were recruited through visits on 3 days each week to obtain the required information.

A sample of 108 (approximated to 110) HCWs produces a two sided 95% confidence interval with a width equal to 0.2 when the sample proportion is 0.5 % (95% CI 0.4-0.6).

A Structured self-administered anonymous questionnaire was used to collect data from participating healthcare workers (self-administered aided questionnaire for housekeepers only) including Socio-demographic characteristics, occupational vaccine preventable diseases infections exposure and vaccination coverage.

For the calculation of the reported vaccination coverage, the numerator was based on the number of HCWs who reported being vaccinated and the denominator resulted from the number of HCWs who reported no history of disease. Only HCWs reporting no history of disease or vaccination were considered potentially susceptible.

Ethical considerations:

The protocol of the study was submitted to the Ethical Review Committee at the Faculty of Medicine, Ain Sham University prior to the study. It was an exempted research as an anonymous questionnaire was used. A verbal informed consent was obtained from each participant after the explanation of the nature of the study and assuring that participation is voluntary. The confidentiality of data was also assured. An administrative approval from the Paediatric hospital manager was obtained as well.

Data Management:

The collected data was revised, coded, tabulated and introduced to personal computer then analysed using SPSS program (Statistical Package for Social Sciences) for windows Version 20. Qualitative data were presented as frequencies and percentages. Chi square test and fisher exact test were used as tests of significance and $p < 0.05$ was considered significant.

Results:

Table 1: Socio- Demographic and occupation Characteristics of studied HCWs at Pediatric tertiary care hospital, Egypt (N=110)

Characteristics	N	%
Gender		
Male	24	21.8
Female	86	78.2
Age group (Years)		
20–29	71	64.5
30–39	18	16.4
40–49	19	17.3
50+	2	1.8
Profession		
Nurse	38	34.5
Physician	55	50.0
Housekeeper	17	15.5
Duration of professional career (years)		
Mean+ SD	2.9±1.4	

Out of the 110 HCWs enrolled, 78.2% (n=86) were females and 64.5% of the study participants were aged from 20 to 29 years (n=71). Of the studied HCWs 50.0% were physicians, 34.5% were nurses and 15.5% were house keepers. The mean (\pm SD) duration of professional career was 2.9 ± 1.4 years (Table1).

The reported vaccination coverage rate was highest for Tuberculosis (95.5%) followed by Hepatitis B (86.4%) and lowest for chicken pox (9.1%). Potentially susceptible HCWs rate was

Table 2. Reported history of infection, reported vaccination, and HCWs potentially susceptible of studied HCWs at Pediatric tertiary care hospital, Egypt (N=110)

Disease	Reported history of infection	Reported vaccination	HCWs potentially susceptible
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	N (%)	N (%)	N (%)
Hepatitis B	0 (0)	95 (86.4)	15 (13.5)
Measles	12 (10.9)	14 (12.7)	64 (58.2)
Mumps	12 (10.9)	14 (12.7)	70 (63.6)
Rubella	4 (3.6)	12 (10.9)	76 (69.1)
Chicken Pox	35 (31.8)	10 (9.1)	60 (54.5)
Tuberculosis	3 (2.7)	105 (95.5)	2 (1.8)

higher in the case of Rubella (69.1%) followed by Mumps (63.6%). As regards, history of natural infection, a history of measles, mumps, rubella, varicella, hepatitis B or Tuberculosis was reported by 10.9%, 10.9%, 3.6%, 31.8%, 0% and 2.7% of HCWs, respectively reported history of infection. On the other hand, HCWs reporting no history of disease or vaccination were considered as “potentially susceptible HCWs”: 69.1% to rubella, 63.6% to mumps, 58.2% to measles, 54.5% to chicken pox, 13.5% to hepatitis B and 1.8% to tuberculosis (Table 2).

As for the potentially susceptible HCWs (neither history of disease nor reported vaccination) A statistically significant higher percentage of HCWs potentially susceptible to hepatitis B, measles, mumps, rubella and chicken pox was observed in nurses accounting for 60%, 53.1%, 55.7%, 52.6% and 53.3%, respectively ($p < 0.05$). A statistically significant higher percentage (55%) of HCWs potentially susceptible to chicken pox was observed in those having a profession duration of 1-5 years ($p < 0.05$). (Table 3).

The main reasons for no immunization as mentioned by study participants as lack of vaccine provision by the hospital (from 63.6% for influenza to 53.5% for hepatitis B), lack of knowledge of vaccine recommendation (from 89.5% MMR to 43.2% for influenza), fear of vaccine side effects (from 33.3% for hepatitis B to 4.5% for influenza) and 30.7% reported that they don't get influenza vaccine because they think that it is not a serious disease (Figure 1).

Compared with nurses and housekeepers, physicians were more likely to have been vaccinated for hepatitis B, MMR and chicken Pox ($P < 0.01$) (Table 4).

Discussion:

Recently safety in health care facilities has gained great attention and has been a basic component of clinical practice. Vaccination of HCWs is considered for self-protection, as well as for protection of susceptible patients, in addition to providing indirect protection of general population through herd immunity.²⁷⁻²⁸

The findings of the current study show an overall, significant levels of susceptibility and insufficient rates of vaccination for VPDs among a group of HCWs in a tertiary care paediatric hospital. The reported vaccination coverage rate for Hepatitis B was 86.4%. This is much higher than Talaat et al. (2003) study carried out on a sample of HCWs from different types of health care facilities in 2 governorates (one from Nile Delta and the second one from Upper Egypt). In this study hepatitis B vaccination was reported by only 15.8 % of study participants.²⁹ Another study carried among HCWs in general surgery department at Assuit University by Zayet et al. (2015) revealed that 61.4% of HCWs reported hepatitis B vaccination.³⁰

Similarly, the current study finding is higher than what has been shown in studies that enrolled HCWs in Italy and HCWs in a paediatric departments in

Table 3. Potentially susceptible HCWs (neither history of disease nor reported vaccination) of studied HCWs at Pediatric tertiary care hospital, Egypt (N=110)

		Hepatitis B			Measles			Mumps			Rubella			Chicken Pox			Tuberculosis		
		%	X ²	p value	%	X ²	p value	%	X ²	p value	%	X ²	p value	%	X ²	p value	%	X ²	p value
Total		13.6 (n=15)			58.2 (n=64)			63.6 (n=70)			69.1 (n=76)			54.5 (n=60)			1.8 (n=2)		
Sex	Male	20			21.8	0	0.986	21.4	0.017	0.896	21.1	0.084	0.771	31.7	7.506	0.01	0	0.568	0.451
	Female	80	0.034	0.579	78.2			78.6			78.9			68.3			100		
Age (years)	21-30	73.3			60.9			60			61.8			58.3			50		
	31-40	6.7			20.3	3.038	0.388	17.1	2.187	0.535	14.5	3.352	0.325	18.3	2.783	0.433	50	3.565	0.36
	41-50	13.3	3.347	0.335	15.6			20			21.1			21.7			0		
	50+	6.7			3.1			2.9			2.6			1.7			0		
Profession	Physician	6.7			23.4			22.9			27.6			25			50		
	Nurse	60	8.16	0.01	53.1	12.076	0.002	55.7	13.315	0.001	52.6	6.661	0.035	53.3	7.071	0.032	50	0.705	0.796
	Housekeeper	33.3			23.4			21.4			19.7			21.7			0		
Seniority (years)	<1	0			6.3			5.7			5.3			3.3			0		
	1-5	80			54.7			52.9			55.3			55			50		
	6-10	0			7.8			8.6			7.9			10			0		
	11-15	13.3	2.312	0.789	15.6	4.055	0.555	14.3	6.698	0.223	13.2	0.573	0.507	8.3	13.292	0.014	50	4.451	0.653
	16-20	0			7.8			5.7			6.6			8.3			0		
	20+	6.7			7.8			12.9			11.8			15			0		

Table 4. Vaccination coverage rate by professional career of studied HCWs at Paediatric tertiary care hospital, Egypt (N=110)

	Physicians N (%)	Nurses N (%)	Housekeepers N (%)	Fisher's Exact	P value
HB vaccine	37 (97.3)	46 (83.6)	12 (70.6)	8.160	<0.01
MMR vaccine	12 (31.5)	2 (3.6)	0	21.750	<0.01
Rubella vaccine	8 (21.1)	4 (7.3)	0	6.499	0.140
Chicken pox vaccine	8 (21.1)	2 (3.6)	0	8.474	<0.01
TB vaccine	34 (89.5)	54 (98.2)	17 (100)	3.634	0.140
Seasonal Flu vaccine	5 (13.2)	12 (21.8)	5 (29.4)	2.259	0.377

Greece revealing a vaccination coverage rate for hepatitis B of 70.1% and 69.2% respectively.^{21, 26}

On the other hand the current study finding for hepatitis B vaccination coverage rate is slightly lower than the rate revealed by a study conducted in a tertiary care hospital in Riyadh, Saudi Arabia reporting that hepatitis B vaccination coverage was 95% among HCWs.²⁴

The high coverage rate of Hepatitis B vaccine reported in the current study in addition to the increasing trend from previous studies was due to strict regulations and recommendations of HCWs vaccinations by Ministry of Health and population (MOHP) in addition to many hepatitis b vaccination campaigns targeting HCWs especially at university hospitals as well as targeting students of faculty of Medicine and nursing schools. These activities as well as the inclusion of hepatitis B vaccine through the compulsory national expanded program of immunization in 1991 made this increasing trend.³¹

Influenza vaccine has seasonal protection validity. Each year HCWs are required to receive the new vaccine as this is the only vaccine that needs yearly administration. As a result, receiving the influenza vaccine can be a surrogate measure for the "active protection behaviour" among HCWs.¹

In the present study, vaccination coverage for influenza for the preceding year was 20% (data not shown). This finding is much lower than the influenza immunization rate reported from many studies ranging from as low as 24.8% in an Italian study to 50.8% and 80% in a Saudi and Australian studies respectively.^{24, 26, 32}

The results of the current study show that potentially susceptible HCWs (without history of disease or vaccination) constitute significant proportion of the hospital HCWs at the Paediatric university hospital ranging from lowest as 1.8% and 13.5% for tuberculosis and hepatitis B respectively to highest as 69.1% and 63.6% for rubella and mumps respectively. These findings are higher than the results of Taddei et al. (2014) revealing that susceptible HCWs were 19.7% and 25.1% for rubella and mumps, respectively.³⁴

The current study finding is similar to an Italian study¹ revealing that 16.8% of HCWs are susceptible to hepatitis B. Although one of the current study participants reported previous history of hepatitis B infection, lower susceptibility to it may be due to high vaccination coverage rate for hepatitis B that may be explained by the aforementioned reasons. Compared with nurses and housekeepers, physicians were more likely to have been vaccinated for hepatitis B, MMR and

chicken Pox ($P < 0.01$). This finding

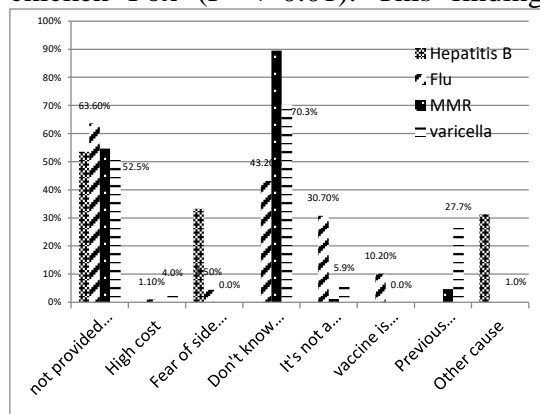


Figure 1. Reported reasons for no vaccination in each disease by studied HCWs at Paediatric tertiary care hospital, Egypt (N=110)

disagrees with Fortunato et al. (2015) revealing that nurses were significantly more likely to have been vaccinated against these three VPDs.²⁶

In the present study the only statistically significant higher percentage of HCWs potentially susceptible to studied VPDs (except for Tuberculosis) was observed among nurses. This agrees with Taddei et al. (2014) study reporting that as regards profession, the percentage of potentially susceptible physicians was lower for only chicken pox ($P < 0.05$) in addition to revealing that males were significantly more susceptible to rubella.³³

The main reported reasons for not receiving the vaccine for each VPDs varied from lack of provision of immunization (ranging from 52.5 % for varicella to 63.6% for influenza), Lack of knowledge that the vaccine is recommended (from 0% for hepatitis b to 43.2% for influenza and 89.5% for MMR). In addition, 10.2% of studied HCWs reported that they don't get influenza vaccine because they think that it is not a serious disease The current study findings suggest that a knowledge gap exist regarding awareness of vaccination recommendations for HCWs except for hepatitis B. Health Care Workers perception of the seriousness of

VPDs can be an important factor in determining uptake of HCWs vaccination and should be considered in awareness programs.

Limitations of the study:

The study results are limited by depending on self-reported vaccination history and previous history of infection in addition, the study population is limited to the HCWs in a tertiary paediatric hospital.

Conclusion

The current study revealed that even though vaccines are available for many infectious diseases, the reported vaccination coverage for most of the VPDs is generally below expectations. Although certain vaccines like hepatitis B had a high coverage other vaccines like measles or influenza showed much lower vaccination rates.

Raising awareness of the recommended vaccines in addition to providing them free of charge or at a reduced price by the hospital administration can improve the vaccination coverage among HCWs. Vaccination rates among HCWs should be regularly measured and reported, this information might be useful to promote compliance with vaccination policies and plan future awareness campaigns. Medical students must be considered a priority group for campaigns promoting vaccination.

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