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Original article

Self-reported histories of disease and vaccination against measles, mumps, rubella and varicella in health care personnel in Japan

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ABSTRACT

Health care personnel are required to be immune against vaccine-preventable diseases, such as measles, mumps, rubella, and varicella. The aim of this study is to evaluate the accuracy of self-reported histories of disease and vaccination against measles, mumps, rubella, and varicella in order to determine the immune status of health care personnel. A self-reported questionnaire of history of previous disease and vaccination against these diseases was administered to a total of 910 health care personnel in Shimane university hospital in Japan, whose results were compared with serological evidences. There were numerous subjects who did not remember a history of disease (greater than 33% each) and of vaccination (greater than 58% each). Self-reported history of disease and vaccination had high positive predictive value against either disease for testing positive for antiviral antibodies. However, a considerable number of false-negative subjects could be found; 88.9% of subjects for measles, 89.3% for mumps, 62.2% for rubella and 96.3% for varicella in the population who had neither a self-reported history of disease nor a vaccination against each disease. In addition, regardless of the disease in question, a negative predictive value in self-reported history of disease and vaccination was remarkably low. These results suggest that self-reported history of disease and vaccination was not predictive to determine the accurate immune status of health care personnel against measles, mumps, rubella, and varicella. A seroprevalence survey, followed by an adequate immunization program for susceptible subjects, is crucial to prevent and control infection in hospital settings.

1. Introduction

Measles, mumps, rubella, and varicella are serious diseases, which can be spread from an infected person to a susceptible person through the air-droplet. Varicella can also be spread through contact with fluid from chickenpox blisters. Measles outbreaks occurred each year in Japan between 1999 and 2003, and there were large measles outbreaks again in 2007 and 2008 [1]. In rubella, large outbreaks occurred in 1976, 1982, 1987 and 1992 respectively, and since 2012 a new rubella outbreak has been spreading rapidly, which poses a crisis in Japan [2]. The occurrence of mumps and varicella is still epidemic in Japan. The National Epidemiological Surveillance of Vaccine-Preventable Diseases in Japan has approximately 3000 pediatric and 450 adult sentinel institutes, which report numbers of patients with infectious diseases. The annual numbers of patients per institute in 2011 were 43.76 and 76.17 for mumps and varicella, respectively [3]. Thus, the control and prevention of these diseases is still critical in Japan.

Health care personnel have a greater risk of being exposed to and acquiring measles, mumps, rubella, and varicella, and therefore all personnel should be immune against these vaccine-preventable diseases. The identification of susceptible personnel to vaccine-preventable diseases, followed by appropriate vaccination programs, is essential to prevent and control infection in hospital settings [4]. Personnel can be considered to be immune when they have documentation of previous disease, documentation of vaccination or serologic evidence of immunity. In this study, we examined the validity of self-reported history of disease and vaccination against measles, mumps, rubella, and varicella to identify the accurate immune status of health care personnel in a Japanese university hospital.

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Table 1A
Self-reported histories of disease and vaccination in health care personnel ($n = 910$).

	Self-reported history, *n* (%)					
	Disease			Vaccination		
	Yes	No	Unsure	Yes	No	Unsure
Measles	400 (43.9)	138 (15.2)	372 (40.9)	163 (17.9)	152 (16.7)	595 (65.4)
Mumps	430 (47.2)	158 (17.4)	322 (35.4)	91 (10.0)	213 (23.4)	605 (66.6)
Rubella	393 (43.2)	178 (19.5)	339 (37.3)	221 (24.3)	165 (18.1)	524 (57.6)
Varicella	525 (57.7)	87 (9.6)	298 (32.7)	93 (10.2)	200 (22.0)	617 (67.8)

2. Material and methods

2.1. Study population and data collection

Health care personnel at Shimane University Hospital, which is a 606-bed, tertiary care hospital, and consists of 26 clinical departments, were enrolled in this study. Since 2005 the Infection Control Committee of Shimane University Hospital has been surveying the immune status of all of health care personnel against vaccine-preventable diseases to control and prevent nosocomial infection. Health care personnel during 2005 were recruited into this study. A self-reported questionnaire of history of previous disease and vaccination was administered to all of health care personnel, and then, after informed consent, sera were collected from health care personnel to determine a seroprevalence against measles, mumps, rubella and varicella.

The questionnaire consists of multiple-choice questions about a history of previous disease and vaccination, with possible answers being "yes", "no" or "unsure". A positive result of self-reported history was defined as a response of "yes". Positive predictive value and negative predictive values of the self-report history was defined as the probability, given an answer of "yes" and "no" about the history of disease or vaccination, respectively, in which serological results were used to confirm immunity as the gold standard.

This study was undertaken by the Infection Control Committee of Shimane University Hospital, in the form of an audit as part of the hospital's safety and clinical service development. All study participants who undertook screening provided written consent prior to the collection of serum.

2.2. Detection of antiviral antibodies

Collected blood samples were centrifuged at 200 $g \times 5$ min to separate serum, which were stored at 4 °C and then tested. To detect the specific IgG antibodies against measles, mumps, rubella and varicella viruses, we used enzyme immunoassay (EIA) that were commercially available VIDAS assay kits; Measles-IgG, Mumps-IgG, RUB-IgG, and Varicella-Zoster IgG (BioMerieux, France). The quantitative cutoff value for seronegative was <0.5 for measles, <0.35 for mumps, <10 IU/mL for rubella and <0.6 for varicella, and titers at ≥0.5 and <0.7 for measles, ≥0.35 and <0.50 for mumps, ≥10 and <15 IU/mL for rubella, and ≥0.6 and <0.9 for varicella were defined as equivocal values. The seropositive cutoff was ≥0.7 for measles, ≥0.5 for mumps, ≥15 IU/mL for rubella and ≥0.9 for varicella. Equivocal values were considered negative. EIA tests were conducted by the staff of the immunoserology unit of the Central Clinical Laboratory at Shimane University Hospital.

3. Results

A total of 910 healthcare personnel participated in the study: 253 physicians; 394 nurses; 103 laboratory technicians; 115 administrative staffs; 45 teaching staffs. Three hundred and four were males and 606 females. The mean age (±SD) was 37.8 (±10.51) years, ranged from 21 to 65 years. Of 910, 265 (29.1%) were <30 years old, and 249 (27.4%) were ≥30 and <39 years, 260 (28.6%) were ≥40 and <49 years, and 125 (13.7%) were ≥50 and <59 years, and 11 (1.2%) were ≥60 years.

Of 910 health care personnel, 372 (40.9%), 322 (35.4%), 339 (37.3%) and 298 (32.7%) subjects reported "unsure" for a history of disease for measles, mumps, rubella and varicella, respectively (Table 1A). Furthermore, 595 (65.4%), 605 (66.6%), 524 (57.6%) and 617 (67.8%) subjects reported "unsure" for a history of measles, mumps, rubella and varicella vaccination, respectively.

The percentage of subjects who reported a history of disease was high in varicella (57.7%), compared with measles (43.9%), mumps (47.2%) and rubella (43.2%)(Table 1A). The percentage of subjects who reported a history of mumps (10.0%) and varicella vaccination (10.2%) was low, compared with measles (17.9%) and rubella vaccination (24.3%).

In measles, among 400 subjects who reported a history of disease, 245 were "unsure" in regards to a history of vaccination, and among 163 who reported a history of vaccination, 40 were "unsure" in regards to a history of disease. On the other hand, among 138 subjects who reported "no" history of disease, 50 were "unsure" in regards to a history of vaccination, and among 152 who reported "no" history of vaccination, 32 were "unsure" in regards to a history of disease (Table 1B). Thus, the number of subjects who remember a history of both disease and vaccination were 243 in the case of measles. Similarly, 249, 292 and 235 subjects remembered a history

Table 1B
Self-reported histories of disease and vaccination in health care personnel.

		n			
		HD			Total
		Yes	No	Unsure	
Measles					
HV	Yes	53	70	40	163
	No	102	18	32	152
	Unsure	245	50	300	595
	Total	400	138	372	910
Mumps					
HV	Yes	41	34	16	91
	No	118	56	39	213
	Unsure	270	68	267	605
	Total	429	158	322	909
Rubella					
HV	Yes	69	93	59	221
	No	93	37	35	165
	Unsure	231	48	245	524
	Total	393	178	339	910
Varicella					
HV	Yes	61	13	19	93
	No	134	27	39	200
	Unsure	330	47	240	617
	Total	525	87	298	910

HD; history of disease, HV; history of vaccination.