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Measles Immunity among New Health Personnel at a Faculty of Medicine in Khon Kaen Province, Thailand, 2019

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Abstract

Measles continues to be an important global health problem despite the implementation of vaccination. Health personnel, a high-risk group, are considered to have immunity to measles. We aimed to investigate the measles immunity status among health personnel during pre-placement at the Faculty of Medicine, Khon Kaen University, northeastern Thailand. The sample included health personnel who were examined in the pre-placement program from October 2018 to September 2019. Data collected included sex, age, department, job characteristic (direct or indirect contact with patients), position, measles immunity status, based on serology tests, history of previous infection, and history of immunization. A total of 652 health personnel were included, of which 53.8% tested positive to measles IgG class antibodies, indicating prior exposure to the virus. Among them, the percentage testing positive to measles immunity was 59.5%. Two-thirds of personnel who could not recall their infection or vaccination history had a positive measles immunity status. A consensus for the definition of acceptable presumptive evidence of measles immunity in Thailand according to context must be stipulated, leading to improved management of measles immunization.

Keywords: measles, immunity, health personnel, Thailand

Introduction

Deaths from the measles virus has decreased worldwide from 2000 to 2018 due to increased coverage of vaccination.[1] However, in the first half of 2019, the United States reported 1,022 new measles cases compared to only 120 cases in 2017 and 372 in 2018. The increase is suspected to be due to outbreaks caused by travelers who visited measles endemic areas and brought the virus back home to non-vaccinated residents.[2] In Thailand, an online measles database showed an increasing trend of cases from 0.4 per million in 2016 to 98.12 per million in 2019.[3]

After a person receives one dose of the Mumps-Measles-Rubella (MMR) vaccine, that person is generally immunized up to 95%, which increases up to 99% after the second dose.[4] A person's immunization status can be verified by evidence of two doses of the MMR vaccine, laboratory confirmation, diagnosis by a physician, or their age - those born before 1957, which was the year that the USA included MMR vaccine in the National Compulsory Vaccination Schedule, are likely to not be immune.[5] Thailand included vaccination for measles in the National Compulsory Vaccination Schedule in 1984. The Bureau of General Communicable Diseases recommends that health personnel, a high-risk group, should receive one dose of MMR vaccine prior to starting work duties regardless of their immunity status.[6] In the case of measles exposure, their immunization history should be noted, but no determination of their immunity status is required. A previous study conducted in South Korea on the measles immunity status of health personnel after the occurrence of a measles outbreak found that 75.9% tested positive.[7]

Since the last outbreak in the Faculty of Medicine, Khon Kaen University, no current measles immunity information on health personnel is available. Health personnel are a high-risk group due to occupational hazards. With their potential to also compromise patient safety, it is therefore important to have up-to-

Table 1 Characteristics of study samples and distribution of serologic measles immunity test by socio-demographic characteristics

Characteristics	Total n (%)	Tested n=351 (53.8%)	Not Tested n=301 (46.2%)
Sex			
Male	192 (29.4)	115 (59.9)	77 (40.1)
Female	460 (70.6)	236 (51.3)	224 (48.7)
Median age in years (Q1-Q3)	24.5 (18-47)	24 (19-43)	25 (18-47)
Age group (years)			
<20	3 (0.5)	2 (66.7)	1 (33.3)
20-24	323 (49.5)	202 (62.5)	121 (37.4)
25-29	212 (32.5)	103 (48.6)	109 (51.4)
30-34	70 (10.7)	34 (48.6)	36 (51.4)
≥35	44 (6.8)	10 (22.7)	34 (77.3)
Job characteristics			
Direct contact	535 (82.1)	322 (60.2)	213 (39.8)
Non-direct contact	117 (17.9)	29 (24.8)	88 (75.2)
Positions			
Registered nurse	199 (30.5)	106 (53.3)	93 (46.7)
Medical physician	198 (30.4)	187 (94.4)	11 (5.6)
General service officer	52 (8.0)	15 (28.8)	37 (71.2)
Nursing assistive personnel	46 (7.0)	17 (37.0)	29 (63.0)
Nurse assistant	19 (2.9)	5 (26.3)	14 (73.7)
Others	138 (21.2)	21 (15.2)	117 (84.8)
Total	652 (100.0)	351	301

date information on the immunity status of health personnel for post-exposure management purpose and primary measles prevention. Therefore, this study aimed to investigate the measles immunity status

Table 2 Distribution of serologic measles immunity among newly employed health personnel categorized by socio-demographic characteristics.

Characteristics	Total n (%)	Measles immunity status, n (%)	
		Positive IgG≥ 250 mIU/ml	Negative IgG< 250 mIU/ml
Sex			
Male	115 (32.8)	80 (69.6)	35 (30.4)
Female	236 (67.2)	129 (54.7)	107 (45.3)
Median age in years (Q1-Q3)	24 (19 -43)	23.5 (19 -43)	24 (19 -42)
Age group (years)			
<20	2 (0.6)	1 (50.0)	1 (50.0)
20-24	202 (57.6)	104 (51.5)	98 (48.5)
25-29	103 (29.3)	67 (65.0)	36 (35.0)
30-34	34 (9.7)	28 (82.4)	6 (17.6)
≥35	10 (2.8)	9 (90.0)	1 (10.0)
Job characteristics			
Direct contact	322 (91.7)	197 (61.2)	125 (38.8)
Non-direct contact	29 (8.3)	12 (41.4)	17 (58.6)
Positions			
Medical physician	187 (53.3)	141 (75.4)	46 (24.6)
Registered nurse	106 (30.2)	39 (36.8)	67 (63.2)
Nurse assistive personnel	17 (4.8)	9 (52.9)	8 (47.1)
General service officer	15 (4.3)	6 (40.0)	9 (60.0)
Nurse assistant	5 (1.4)	4 (80.0)	1 (20.0)
Other	21 (6.0)	10 (47.6)	11 (52.4)
Total	351 (100.0)	209 (59.5)	142 (40.5)

among new health personnel. during pre-placement examination for proper immunization management.

Methods

Study Design and Participants

This descriptive survey study was carried out in the Faculty of Medicine, Khon Kaen University, Thailand from October 2018 to September 2019. The study population consisted of health personnel who were examined in the pre-placement program of Faculty of Medicine, Khon Kaen University and had information on pre-placement examination regardless of the availability of the measles immunity data. With these criteria, we included all (n=652) new health personnel into the study.

Table 3 Distribution of serologic measles immunity status of the new health personnel in accordance with infection and vaccination history

Measles infection and vaccination history		n (%)	Serologic immunity status	
Infection	Vaccination		Positive IgG n (%)	Negative IgG n (%)
Positive	None	4 (1.2)	4 (100.0)	0
Negative	Complete (two doses)	75 (21.4)	46 (61.3)	29 (38.7)
	Incomplete (one dose)	19 (5.4)	18 (94.7)	1 (5.3)
	None	21 (6.0)	10 (47.6)	11 (52.4)
Unknown	Unknown	232 (66.1)	131 (56.5)	101 (43.5)
Total		351 (100.0)	209 (59.5)	142 (40.5)

Data Collection

The data were extracted from the Occupational Health and Safety Office, Faculty of Medicine, Khon Kaen University. Variables were sex, age, department, job characteristic (direct/indirect contact with patients), position, and measles immunity status.

Measurements

Measles immunity status was determined from serology tests, history of previous measles infection, and history of measles immunization. The IgG threshold for measles immunity was 250 mIU/mL using an enzyme-linked immunosorbent assay (ELISA) at the reference laboratory of Srinagarind hospital.

Statistical Analyses

All data were analyzed using SPSS version 20 (IBM SPSS Inc, Chicago, IL). Demographic data, job characteristic, position and measles immunity status were described using frequencies and proportions.

Ethical Approval

The Research Ethics Committee of the Faculty of Medicine, Khon Kaen University, Thailand approved this study on 8 Oct 2019.

Results

The median age of the 652 health personnel in the study was 24.5 years (range: 18-47) and the majority were female (70.6%). 82.1% had job characteristic that involved direct contact with patients. The majority were registered nurses (30.5%) followed by medical physicians (30.4%), and other (21.2%). Of the 535 health personnel who had a job characteristic that involved direct contact with patients, 322 (60.2%) were tested for measles immunity. Almost all (94.4%) physicians were tested for measles IgG, followed by registered nurses (53.3%) and nursing assistive personnel (37.0%). (Table 1)

Of the 351 participants who were tested for IgG, the median age was 24 years (range: 19-43). Most (91.7%) had job characteristic that involved direct contact with patients. Physician was the most common position (53.3%), followed by registered nurse (30.2%) and nurse assistive personnel (4.8%). The overall proportion of personnel with positive measles immunity was 59.5%. The median age of the positive immunity group was 23.5 years (range: 19-43). Personnel whose job characteristic involved direct contact with patients had a higher proportion of positive immunity (61.2%) than those who did not. Nurse assistants had the highest immunity (80.0%), followed medical physicians by (75.4%), and nurse assistive personnel (52.9%). (Table 2)

Table 3 shows the distribution of measles immunity status according to infection and vaccination history. Most (66.1%) could not recall ever having measles,32.8% denied ever being infected, while only 4 (1.2%) reported having had a positive history of measles infection, of which all four tested positives on ELISA. Among the 115 who denied ever being infected, 46 out of 75 (61.3%) health personnel who had a history of complete measles vaccination (2 doses) had positive immunity,18 out of 19 (94.7%) who had partial vaccination (1 dose) had positive immunity, and 10 out of 21 (47.6%) who were not

vaccinated at all had positive immunity. Among 232 personnel who could not recall their infection or vaccination history, 131 (56.5%) had a positive serologic immunity status.

Discussion

This study demonstrated a lower proportion of positive measles immunity (59.5%) when compared to previous studies in 2009 (78.5%) and 2016 (81.0%) in Thailand, both of which used similar thresholds for positive measles (IgG≥ 250 mIU/ml and≥ 255 mIU/ml).[8,9] Immunity to measles can be increased by up to 95% in children who are vaccinated at 12 months, and 98% at 15 months.[4] However, many studies found a decline in the protective measles immunity level.[10-13] The reason for the low proportion of positive measles immunity could be due to the low coverage of vaccination in Thailand when, in 1984, measles vaccination was first included in Expanded Program of Immunization (EPI). Coverage of measles vaccination was only 5% during the initial phase, and the second dose of measles vaccination had only just been recommended by the Ministry of Public Health in 1996, which was given to students in their first year of elementary education.[14]

Another explanation for the inconsistent results of studies in Thailand might be due to the different types of vaccines used. The MMR vaccine was widely used in Thailand in 1997.[14] However, the median ages of the study populations ranged from 20-29 years, and these populations had a lower proportion of positive measles immunity compared to other age ranges. Thus, this might be clarified by other previous studies that this range of age was far from the last dose of vaccination to measles, which is correlated with the lowest proportion of positive measles immunity among the range of age.[9,11,12] Apart from the different vaccines, the strain of measles in the vaccine might also be different, which could affect the vaccine's efficiency. In Thailand, the Schwarz strain of measles virus in the MMR vaccine was still available, while the strain was discontinued in the US in 1976.[5,15]

According to the Advisory Committee on Immunization Practices about measles prevention, the guideline suggests that pre-vaccination testing for measles immunity in health personnel, who had inadequate evidence of immunity, is unnecessary unless the medical facility considered it cost-effective.[4] Although serology testing in two documented doses of MMR vaccine group was, in two studies, reported to be negative, no further vaccination was recommended. This is considered as presumptive evidence of measles immunity.[4,16] In Thailand, there is controversy in the recommendations for measles vaccination. The Bureau of General Communicable Diseases, Department of Disease Control (Thailand) recommends that health personnel without a history of measles infection or vaccination are required to receive MMR vaccine without undergoing a pre-vaccination serology test.[5] However, the guideline for managing infectious diseases in health personnel by the nosocomial infection control group does not include measles vaccination in the EPI. Thus, it is not considered presumptive evidence of immunity to measles. Therefore, the Thai guideline recommends pre-vaccination serology testing before providing vaccines.[17] In addition, the threshold of measles IgG by the immunological basis for immunization series module 7 states that: " when using the 3rd International Standard Reference serum, the level of measles neutralizing antibody that corresponds with clinical protection is ≥120 mIU/mL ".[18] However, this guideline was not widely applied in Thailand considering previous studies. Agreement on a standardized threshold for positive measles IgG should be made.

Since we used secondary data, essential information for presumptive positive immunity was missing. More than two-thirds of health personnel could not recall their infection or immunization history. Those with a complete vaccination history had a lower percentage of positive immunity than those who received partial vaccination. Almost half of those who never received measles vaccination had positive measles immunity. Overall, the percentage of personnel with positive measles immunity in our study was lower than expected. This could be due to recall bias and missed documentation in medical records.

Reliable presumptive evidence of measles immunity is needed for identifying immunity status in order to specify as immunized personnel. The completed history or written documentation of vaccination must be declared. The current measures of measles immunization among health personnel, for instance, vaccination to all new health personnel from pre-placement examination, should be revised. Future studies could include a cost-benefit analysis of the necessity in pre-vaccine serological testing. Furthermore, a study in immunity status among health personnel in accordance with the implementation from the Ministry of Public Health of Thailand would provide useful information to policy makers. In 2015 the ideal age for receiving the second dose of the MMR vaccine was changed from 7 years (1st year of elementary education) to 2.5 years, which

is expected to achieve a target of "not less than 95%" of vaccination coverage as herd immunity.[19] In consequence to the major change of second dose of vaccine, the longer period from the second dose of vaccine to working-age should be a focus of further research. In addition, a previous study found that 3% of vaccinated people can still develop measles infection, so post-exposure management is still recommended. [20]

Conclusion

Due to differences in characteristics of measles vaccine as well as vaccination coverage, the proportion of health personnel who had positive immunity to measles in our study was lower than in previous studies in Thailand. The history and documentation of measles immunization status were only partially available, and were difficult to correlate with actual measles immunity status from serology. The definition of presumptive measles immunity and guidelines for measles immunization among health personnel need to be revised. The consensus for definition in acceptable presumptive evidence of measles immunity must be stipulated according to context, leading to improved management of measles immunization.

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Suggested Citation

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