*Original Article*

# Varicella Zoster Immunity amongst New Health Personnel in a University Hospital in Northeastern Thailand

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***Background:*** Health personnel (HP) are at risk of varicella zoster virus (VZV) infection, thus varicella immunity is needed or serious consequences to HP and patient care can result. A varicella-immunity profile is not routinely checked in our pre-placement program. The aim of the present study was to determine the proportion of new HP with varicella immunity.

***Materials and Methods:*** The research design was a descriptive study. The study population was 258 HP who met the inclusion criteria. The sample of 214 HP (82.9%) participated in the study. Varicella immunity history was obtained using a pre-placement questionnaire. The HP who already had complete vaccination were concluded to be the immunized group without immunologic blood test evidence. Only non vaccinated HP would get serologic test for varicella virus. A serological test for varicella virus was performed using an enzyme-linked immunosorbent assay (Euroimmun, anti-VZV ELISA IgG, Hausen Bernstein Co., Ltd).The proportion of positive immunity was used to describe overall immunity.

***Results:*** Twenty-two percent (47/214) of HP reported having a complete history of varicella vaccination. History of varicella infection was reported in 57.9% (124/214) of participants. The HP who had neither history of infection nor vaccination accounted for 10.7% (23/214). Seven percent of the HP were unsure about their respective infection history (15/214). There were 167 HP who did not have varicella vaccination, 89.2% (149/167) of them were positive to varicella IgG. The total proportion of immunized-personnel was thus 91.6% (196/214).

***Conclusion:*** The majority of new HP had varicella immunity; re-assessing immunity status serologically will prevent unnecessary vaccinations and insure all HP have varicella immunity

***Keywords:*** Varicella zoster, Health personnel, Health worker, Immunity, Fitness to work

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Chickenpox - primary varicella-zoster virus (VZV) infection - is highly contagious and can be contracted by exposure to an individual with chickenpox or with secondary VZV infection (shingles)[1]. The symptoms start with a low grade fever, fatigue, anorexia in children, and high-grade fever with muscle pain in adults. A rash may appear on the first day of fever or one day later. Papules will appear first then become vesicles and pustules. The important complications are secondary bacterial infection, pneumonia, and encephalitis that frequently occurs in adults[2]. In Thailand, 50,000 to 100,000 patients were reported during 2004 to 2014[3]. Prior to the institution of a routine program of childhood varicella vaccination, each year in the United States, four million people were infected with chickenpox, ten thousand are admitted to hospital, and 100 to 150 died[4].

Vaccination is important to protect people from varicella infection. The Centers of Disease Control and Prevention (CDC) recommend varicella vaccination in children below thirteen years of age. The first dose of varicella vaccine should be given between the age of 12 and 15 months and the second dose between the age of 4 and 6 years. Children over 13 years of age without any history of varicella infection and adults who do not have a history of varicella infection and who are high risk populations (i.e., health personnel (HP), immunocompromised, school teacher, and childcare worker) should be vaccinated[5]. Varicella vaccine is not included in the Thai expanded program on immunization (EPI)[6]. The Bureau of General Communicable Disease, Department of Disease Control of Thailand recommends varicella vaccination in HP who have not had varicella infection and no prior vaccination or who have a negative varicella immunity blood test[7,8].

Varicella immunity status should be identified in order to support fitness for work health assessment among new HP. The proportion of personnel who are varicella

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immune is important for estimating the costs of an occupational health program (including immunologic blood testing and vaccination). The current study aimed to identify the proportion of varicella immune personnel among new HP.

### *Research design*

A descriptive study was applied.

## Materials and Methods

The study population included new health personnel (HP) at Srinagarind Hospital examined for varicella immunity between January and September 2017. This task was completed by the Occupational Health and Safety (OH&S) Office, Faculty of Medicine, Khon Kaen University. The tool for collecting data was an Excel spreadsheet containing the variables obtained from existing completed pre-placement examination questionnaire which each participant filled out a history and measurement of immunity done using varicella zoster antibody Immunoglobulin G enzyme-linked immunosorbent assay (Euroimmun, anti-VZV ELISA IgG, Hausen Bernstein Co., Ltd). The IgG cut-off level for the ELISA test was set at 100 IU/L. Any HP with a VZV IgG level <100 IU/L was categorized as non-immune. The HP, who already have complete vaccination by reported or documented, were concluded to be the immunized group without immunologic blood test evidence. Only non-vaccinated HP would be given the serologic test for varicella virus.

We included new HP who had had a pre-placement examination in 2016 to 2017 for a total of 285 personnel. The calculated sample size population was 133 according to the finite population proportion as described by Ngamjarus et al[9]. The inclusion criteria were (a) HP with direct varicella virus contact risk: 258 HP met the inclusion criteria, 214 participated in this study (82.9%).

Descriptive statistics were applied and results presented as frequencies, percentages and *p*-value. All analyses were performed using SPSS (version 19.0, IBM SPSS Inc, Chicago, IL). The study was reviewed and approved by the Khon Kaen University Ethics Committee for Human Research (HE 601508).

## Results

The number of cases studied was 214. The median age of participants was 24 years of age (IQR 24 to 27). The majority was female (62.1%). Most participants were physicians (64.0%) followed by registered nurses (18.7%), and others (17.3%). Due to inclusion criteria, there were statistically significant differences in sex, type of health care personnel, and health personnel role (physician, registered nurse, and others) compared with the non-participation (Table 1).

Only 22% (47/214) of the participants had a complete history of varicella vaccination. There were 167 HP who do not have varicella vaccination, 89.2% (149/167) of them were positive to varicella IgG. History of varicella infection was revealed by 60.3% (129/214). The HP, who had neither history of infection nor vaccination, accounted for 10.7% (23/214), while 7.0% (15/214) was unsure about their infection histories. None of the new personnel had ever been evaluated for varicella immunity by blood titer (Table 2).

The proportion of immune personnel was 91.6% (196/214), including vaccination immunity 24.0% (47/196), and natural immunity 76.0% (149/196) (Table 2), while 11.7% did not reveal infection history. Only 8.4% (18/214) were non-immune, and 16.7% (3/18) of the non-immune HP reported a history of infection. About half (52.2%) (12/23) of HP denied any infection history, but 73.3% (11/15) who were unsure about any infection history already had immunity (Table 2).

Following identified immunity status, physicians had highest proportion of immunity (99.9%) consisted of vaccination for 29.9% and natural immunity for 69.3%. The lowest proportion of immunity was medical assistances

**Table 1.** General characteristics of participants

| Characteristic | Participated, n (%) | Non-participated, n (%) | *p*-value |
|---|---|---|---|
| Amount | 214 | 67 | |
| Sex | | | |
| Male | 81 (37.9) | 10 (14.9) | <0.001 |
| Female | 133 (62.1) | 57 (85.1) | |
| Median age (interquartile range) | 24 (24 to 27) | 25 (23 to 28) | 0.9334 |
| Type of health personnel | | | |
| Direct contact | 214 (100.0) | 44 (65.7) | <0.001 |
| Non-direct contact | 0 (0) | 23 (34.3) | |
| Role | | | |
| Physician | 137 (64.0) | 3 (4.5) | <0.001 |
| Registered nurse | 40 (18.7) | 31 (46.3) | <0.001 |
| Medical assistance | 14 (6.5) | 4 (6.0) | 1.000 |
| Practical nurse | 7 (3.3) | 5 (7.5) | 0.165 |
| Pharmacist | 4 (1.9) | 0 (0.0) | 0.576 |
| Other | 12 (5.6) | 24 (35.8) | <0.001 |

(85.7%); all of them were natural immunized (Table 3).

## Discussion

Varicella immunity assessment is important vis-a-vis fitness for work for new health personnel (HP). Evidence of immunity is needed to confirm that HP had already been immunized. Evidence includes documentation of vaccination or verification of a varicella or herpes zoster infection history as diagnosed by a health provider and/or laboratory[10].

Complete vaccinated personnel were not necessary to do immunologic blood testing as commercial assays are not sensitive enough in all instances to detect antibodies after vaccination[11]. In the current study, 47 HP already had varicella vaccination, so we concluded they would be the immunized group without immunologic blood test evidence.

The verification of varicella infection history followed the CDC recommendation; it included an epidemiologic link to another varicella case or evidence of laboratory confirmation performed at the time of acute disease[10]. In Thailand, laboratory testing is rarely used to diagnose varicella so a records search was not a practicable resource to confirm varicella infection. Moreover, confidence in self-reported infection history is weak.

The majority (60.3%; 129/214) of HP had a history of infection and 97.7% of them had a positive immunologic blood test. Only 2.3% had a negative immunologic blood test without any infection history (3/129). The current study showed that HP, who revealed an infection history, were likely to have positive blood tests. Infection history-taking might be helpful for reducing blood testing and vaccination costs if HP had a positive infection history. Otherwise stated, the 17.7% of HP who did not reveal varicella infection history (38/214) included 10.7% who had neither history of infection nor vaccination (23/214) and 7.0% who were unsure about their infection history (15/214). Half of the HP who denied any infection history (52.2%) and most of the HP who were uncertain of any history (73.3%) had a positive immunologic blood test. These results might explain that the negative or uncertain varicella infection history did not ensure immunity status. Vaccination without immunologic blood testing in negative or uncertain infection history personnel would thus be an inappropriate use of resources.

**Table 2.** Immunity status of the new employees compared with infection history

| History | n (%) | Immunity status | |
|---|---|---|---|
| | | Positive n (%) | Negative n (%) |
| Completed vaccination | 47 (22.0) | Define as immunized 47 (100.0) | |
| Positive infection history | 129 (60.2) | 126 (97.7) | 3 (2.3) |
| Denied infection history | 23 (10.7) | 12 (52.2) | 11 (47.8) |
| Not sure infection history | 15 (7.0) | 11 (73.3) | 4 (26.7) |
| Total | 214 (100) | 196 (91 .6) | 18 (8.4) |

**Table 3.** Immunity status of the new employees compared with characteristics

| Characteristic | Vaccinated immunized n (%) | Natural immunized n (%) | Non immunized n (%) | Total |
|---|---|---|---|---|
| Sex | | | | |
| Male | 21 (25.9) | 56 (69.1) | 4 (4.9) | 81 |
| Female | 26 (19.5) | 93 (7.0) | 14 (10.5) | 133 |
| Age | | | | |
| Median (range) | 24 (21 to 35) | 24 (19 to 35) | 23 (22 to 34) | 24 |
| Less than 20 | 0 | 2 | 0 | 2 |
| 20 to 29 | 41 | 135 | 16 | 192 |
| 30 to 39 | 6 | 12 | 2 | 20 |
| Job | | | | |
| Physician | 41 (29.9) | 95 (69.3) | 1 (0.1) | 137 |
| Registered nurse | 2 (5.0) | 27 (67.5) | 11 (27.5) | 40 |
| Medical assistance | 0 (0.0) | 12 (85.7) | 2 (14.3) | 14 |
| Practical nurse | 2 (28.5) | 5 (71.4) | 0 (0.0) | 7 |
| Pharmacist | 2 (50.0) | 1 (25.0) | 1 (25.0) | 4 |
| Other | 0 | 9 (75.0) | 3 (25.0) | 12 |
| Total | 47 (22.0) | 149 (69.6) | 18 (8.4) | 214 |

A study among health workers (HP) in Taiwan indicated neither a positive nor a negative ensured immunity status[12]. In a study of Korean health workers, the self-reported history did not accurately predict immunity especially among those who had negative or uncertain varicella history[13]. By comparison, in two studies of medical students in Thailand, self-reported varicella infection history had a high positive predictive value but a low negative predictive value[14,15]. Even if the current study had been done among new HP the result would likely have been similar. Such a result suggests that occupational health providers should take a history of varicella infection and immunologic blood test to discover whether new personnel do not have varicella immunity before vaccination.

In another way, although 98% immunity in those with reported history of previous varicella infection might be adequate for herd immunity in the general population, it may not be adequate in the HP population. HP are potentially exposed to primary and secondary varicella. All of HP without completed vaccination should be serological tested.

This study aimed to determine the proportion of varicella-immunized personnel amongst new health care personnel. Most (91.6%) of all new HP already have an immunity to varicella. The result is similar to the respective 91.7%, 96%, 98.8%, 97.4%, and 82.3% in Singapore[16], Korea[13], Japan[17], Bangkok's Chulalongkorn University Hospital[18], and Bangkok's Thammasat University Hospital[15]. The high proportion of varicella immunity suggests that vaccinating new HP without assessing immunity is an inappropriate use of resources.

To consider about vaccination, it is still unclear how long a vaccinated person is protected against varicella. Well protected personal with protective equipment and a post exposure surveillance program are still important.

This was the first study conducted in northeastern Thailand where there may be a demographic information difference with previous studies done in other regions of Thailand. The new information will be helpful for developing occupational health programs vis-a-vis the assessment of immunity and vaccination planning. An interesting next study might be to do a cost-benefit analysis based on these results. Costs should include cost of serologic testing, vaccination, cost to furlough a non-immune HP if exposed to varicella, cost to HP who gets infected with primary varicella.

Even though the study used secondary data, only complete data were included. The study also used quantitative information so as to avoid information bias.

## Conclusion

Most new health personnel had varicella immunity even when history of infection or immunization were refused. Re-evaluating immunization could thus be beneficial for prevention of varicella.

## What is already known on this paper?

The proportion of varicella immunity is high amongst health personnel but the history of varicella infection does not necessarily ensure immunity status.

## What this study adds?

The proportion of varicella immunized new health personnel at a university hospital in northeastern Thailand was high compared to a previous study. The personnel who had an infection history were likely to have a positive varicella immunologic blood test.


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## Potential conflict of interest

The authors declare no conclicts of interest.

## References


1. Centers for Disease Control and Prevention. Transmission [Internet]. 2016 [cited 2017 Nov 18]. Available from: https://www.cdc.gov/chickenpox/about/transmission.html.
2. Leeyaphan C, Ritreungdet R, Maneeprasopchoje P, Boonchai W, Jiamton S. Chicken pox [Internet]. 2017 [cited 2017 Nov 19]. Available from: http://www.si.mahidol.ac.th/sidoctor/e-pl/articledetail.asp?id=1090.
3. Bureau of Epidemiology. Varicella zoster outbreak in 2014 [Internet]. 2014 [cited 2017 Nov 19]. Available from: www.boe.moph.go.th/files/report/20141007_31120488.pdf.
4. Centers for Disease Control and Prevention. Chickenpox vaccine saves lives and prevents serious illness [Internet]. 2014 Nov 4 [cited 2018 Jan 8]. Available from: https://www.cdc.gov/about/24-7/savinglives/chickenpox/index.html.
5. Centers for Disease Control and Prevention. Chickenpox vaccination: what everyone should know [Internet]. 2016 Nov 22 [cited 2017 Nov 19]. Available from: https://www.cdc.gov/vaccines/vpd/varicella/public/index.html.
6. World Health Organization. EPI fact sheet: Thailand. [Internet]. 2016 Aug 31 [cited 2017 Nov 19]. Available from: www.searo.who.int/immunization/data/thailand.pdf.
7. Bureau of General Communicable Disease. Vaccine recommendation for healthcare personnel [Internet]. Nonthaburi: Bureau of General Communicable Disease; n.d. [cited 2017 Nov 19]. Available from: thaigcd.ddc.moph.go.th/mediapublics/download/177..
8. Centers for Disease Control and Prevention. Recommended vaccines for healthcare workers [Internet]. 2017 Apr 20 [cited 2018 Feb 19]. Available from: https://www.cdc.gov/vaccines/adults/rec-vac/hcw.html.
9. Ngamjarus C, Chongsuvivatwong V, McNeil E.

n4Studies: sample Size calculation for an epidemiological study on a smart device. Siriraj Med J 2016;68:160-70.
10. Centers for Disease Control and Prevention. Chickenpox (Varicella) [Internet]. 2016 Jul 1 [cited 2018 Feb 19]. Available from: https://www.cdc.gov/chickenpox/hcp/index.html.
11. Centers for Disease Control and Prevention. Routine varicella vaccination [Internet]. 2016 Nov 22 [cited 2017 Nov 19]. Available from: https://www.cdc.gov/vaccines/vpd/varicella/hcp/recommendations.html.
12. Wu MF, Yang YW, Lin WY, Chang CY, Soon MS, Liu CE. Varicella zoster virus infection among healthcare workers in Taiwan: seroprevalence and predictive value of history of varicella infection. J Hosp Infect 2012;80:162-7.
13. Kang JH, Park YS, Park SY, Kim SB, Ko KP, Seo YH. Varicella seroprevalence among health care workers in Korea: validity of self-reported history and cost-effectiveness of prevaccination screening. Am J Infect Control 2014;42:885-7.
14. Suwanpakdee D, Laohapand C, Moolasart V, Lomtong P, Krairojananan N, Srisawat P, et al. Serosurveillance of varicella and hepatitis B infection after reported cases in medical students and the relationship between past varicella disease history and immunity status. J Med Assoc Thai 2012;95 Suppl 5:S80-5.
15. Srichomkwun P, Apisarnthanarak A, Thongphubeth K, Yuekyen C, Mundy LM. Evidence of vaccine protection among thai medical students and implications for occupational health. Infect Control Hosp Epidemiol 2009;30:585-8.
16. Gorny AW, Mittal C, Saw S, Venkatachalam I, Fisher DA, Tambyah PA. Varicella seroprevalence in healthcare workers in a tertiary hospital: an audit of cross-sectional data. BMC Res Notes 2015;8:664.
17. Kanamori H, Tokuda K, Ikeda S, Endo S, Ishizawa C, Hirai Y, et al. Prevaccination antibody screening and immunization program for healthcare personnel against measles, mumps, rubella, and varicella in a Japanese tertiary care hospital. Tohoku J Exp Med 2014;234:111-6.
18. Anugulruengkitt S, Puthanakit T, Siengboon S, Paitoonpong L, Kowitdamrong E, Pancharoen C, et al. Prevalence and Characteristics of Pediatric Healthcare Workers without Immunity to Varicella zoster Virus. Jpn J Infect Dis 2017;70:216-8.