Common Perceptions of Standard Precautions and Bloodborne Diseases among School Nurse Teachers in Japan

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Abstract: *Objective:* To elucidate the common perceptions of standard precautions and bloodborne diseases, as represented by hepatitis B virus (HBV) and C virus (HCV) infections, among school nurse teachers in Japan.

Material and methods: We conducted a questionnaire survey targeting school nurse teachers who were employed at public elementary or junior high schools. The questionnaire had 2 categories: awareness and implementation of standard precautions in the school setting and the other was awareness and provision for bloodborne diseases.

Results: A total of 63 school nurse teachers were enrolled in the study. Almost all (96.8%) the school nurse teachers had sufficient knowledge of standard precautions and bloodborne diseases according to the responses. When attending students with a common cold or gastroenteritis, all respondents washed their hands thoroughly, and most of them (92.3% and 89.7%, respectively) wore a facemask. They wore gloves more frequently when attending students with gastroenteritis than when attending those with a common cold. Thirty-one (49.2%) had examinations for HBV and 21 (33.9%) for HCV. Only 11 respondents (18.3%) received an HBV vaccination.

Discussion: This study shows that the actual usage of measures for infection prevention and control (IPC) remained incomplete, partly because of the insufficient personal protective equipment in the schools. The appropriate implementation of IPC in the school environment should be done as soon as possible. As school nurse teachers continue to address many pathological agents, they should strictly use standard precautions whenever attending to students. Further investigations in these areas are required.

Keywords: Infection, Personal protective equipment, Transmission, Vaccination.

INTRODUCTION

Children usually perform collective activities in school, which means that once an infection of any form occurs in a school setting, it could have enormous adverse effects on education. Infection prevention and control (IPC) can ensure a safe school environment where children are ready to learn and receive a good education [1, 2]. An infection occurs when pathogenic agents enter in the body, increase in number, and cause a reaction in the body [3]. There are 3 important factors involved for an infection to occur: a pathogenic agent, which can cause an infectious disease; a route of transmission in which the agent can move to an individual person; and a susceptible host who has not been vaccinated or has immunological factors for contracting the disease [3].

Practical IPC measures include diminishing or decreasing pathogenic agents by sterilization, blocking routes of transmission by washing hands, food sanitation for a cleaner environment, and increasing immunological resistance with balanced meals, adequate daily exercise, a regular lifestyle, and prophylactic inoculation (*i.e*., vaccination) [3, 4]. Currently, there are many vaccine-preventable diseases that children, healthcare workers (HCWs), and teachers are strongly recommended to receive vaccinations as much as possible [4].

Standard precautions for IPC are guidelines proposed for the care of patients in hospitals, which are also as important today as in healthcare and school settings [5]. Blood, feces, vomit, and body fluids (secretions and excretions), except sweat, and non-intact skin or mucosal surface can contain infectious agents. Standard precautions to block the transmission of infectious agents include washing hands thoroughly and wearing gloves; in addition, a face mask and goggles should be worn when coming into contact with those which can contain infectious agents [5].

Among the HCWs, a school nurse is a member of a unique discipline of professional nursing and is often the sole healthcare provider in an academic setting; school nursing practice is student-centered, occurring within the context of the student's family and school community [6]. The school nurse system is adopted in many countries [7], but not in Japan. Alternatively, one or 2 school nurse (*Yogo*) teachers (most of them are

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E-ISSN: 2311-8687/20

not registered nurses) are assigned to the schools. A school nurse teacher is a special licensed educator who supports children's growth and development through health education and health services on the basis of health promotion in all areas of educational activities at school, similar to school nurses [8].

Japan is an archipelago located in the Far East, consists of 5 main groups of islands; Hokkaido, Honshu, Shikoku, Kyushu, and Okinawa, and has a population of about 127 million people. The 34th Group of Eight meeting was held in Hokkaido in 2008. Many children in Japan are infected annually with influenza virus, in addition to other common infectious agents. However, there are few studies concerning common perceptions of standard precautions among school nurse teachers in Japan. In the present study, we conducted a survey to elucidate the common perceptions of standard precautions and bloodborne diseases, as represented by hepatitis B virus (HBV) and C virus (HCV) infections, among school nurse teachers in Japan.

MATERIALS AND METHODS

Between July and November 2018, we conducted a survey of school nurse teachers who were employed at public elementary or junior high schools in Ibaraki prefecture (a population of about 2.9 million people) in Japan. At that time, there were 450 school nurse teachers in 472 public elementary schools (1st to 6th grade with total of 139,521 students) and 205 school nurse teachers in 209 public junior high schools (7th to 9th grade with total of 69,690 students) [9]. One hundred eligible subjects for the anonymous, multiple-choice, mail-back questionnaire survey were randomly chosen among a total of 655 school nurse teachers. The Ethical Committee at Ibaraki University College of Education approved this study (approval number: 18P1900).

Just before initiating the questionnaire, we provided explanatory texts of standard precautions and bloodborne diseases on the questionnaire sheets for the purpose of participants' further understanding. We also obtained their consent. The questionnaire had 2 categories: awareness and implementation of standard precautions in a school setting containing 8 items and awareness and provisions for bloodborne diseases containing 10 items.

The former category items included statements-/questions as follows: "You have sufficient knowledge of standard precautions. When attending students with a common cold, gastroenteritis, epistaxis, or wound bleeding, do you wash your hands thoroughly, wear gloves, a face mask, or goggles? When handling vomit, feces, or urine, do you wash your hands thoroughly, wear gloves, a face mask, or goggles? If you do not use standard precautions in the above situations, why? When attending any of the students in the school, you should always use standard precautions." The responses to these statements/questions were recorded using a 5-point scale (4-point Likert scale with the addition of unknown or unsure), or comprised the following choices: not special reason, discourteous, personal protective equipment (PPE) insufficiency, troublesome, rarely infected, and others.

The latter category items included statements/questions as follows: You have sufficient knowledge of bloodborne diseases. Have you ever had examinations for HBV or HCV? If you have had the examinations, why? Have you received an HBV vaccination? If you have received an HBV vaccination, why? You could get to know a student who is a carrier of bloodborne diseases in your school. If a carrier is in your school, do you take special care of that student? Do you hear about school personnel who were infected HBV or HCV related to occupational exposure?" The responses to these statements/questions were recorded using a 5-point scale (4-point Likert scale with the addition of unknown or unsure), or a 3-point scale, or comprised medical reason, carrier in the family, regular health checkup, necessity for the work, screening of donated blood, not special reason, and others (multiple answers were allowed).

RESULTS

A total of 63 (63.0% response rate) school nurse teachers were enrolled in the study. All participants were Japanese women. The most common age group was 20 to 29 years old (20/63, 31.7%) and almost half of the respondents worked as school nurse teachers for less than 10 years (30/63, 47.6%) (Table **1**).

Awareness and Implementation of Standard Precaution

All except 2 (96.8%) respondents reported that they have sufficient knowledge of standard precautions. When attending students with a common cold or gastroenteritis, all respondents washed their hands; most of them wore a face mask, but did not wear goggles. They wore gloves more frequently when

Table 1: Demographic Characteristics of School Nurse Teachers (n=63)

	number (%)
gender	
female	63 (100%)
ethnicity	
Japanese	63 (100%)
age in years	
20 ~ 29	20 (31.7%)
30 ~ 39	14 (22.2%)
40 ~ 49	15 (23.8%)
50 ~ 59	13 (20.6%)
60 ~	1 (1.6%)
years worked	
1 ~ 5	16 (25.4%)
6 ~ 10	14 (22.2%)
11 ~ 20	15 (23.8%)
21 ~ 30	11 (17.5%)
31 ~	7 (11.1%)

attending students with gastroenteritis than when attending those with a common cold (45/58, 77.6% and 15/58, 25.9%, respectively). When attending students with epistaxis or wound bleeding, almost all the respondents washed their hands, but most of them did not wear a face mask and goggles. They wore gloves more frequently when treating epistaxis than wound bleeding (48/57, 84.2% and 42/58, 72.4%, respectively). When handling vomit, feces or urine, almost all the respondents washed their hands and wore gloves and a face mask, but not goggles (Figure **1**). The reasons as to why the respondents did not use standard precautions were ranked as "PPE insufficiency" (28/54, 51.9%), "not special reason" (11/54, 20.4%), and "troublesome" (6/54, 11.1%). Two of them felt themselves being rarely infected in school. Forty-six of them (75.4%) agreed or strongly agreed with using standard precautions whenever attending any of the students in school (Figure **2**).

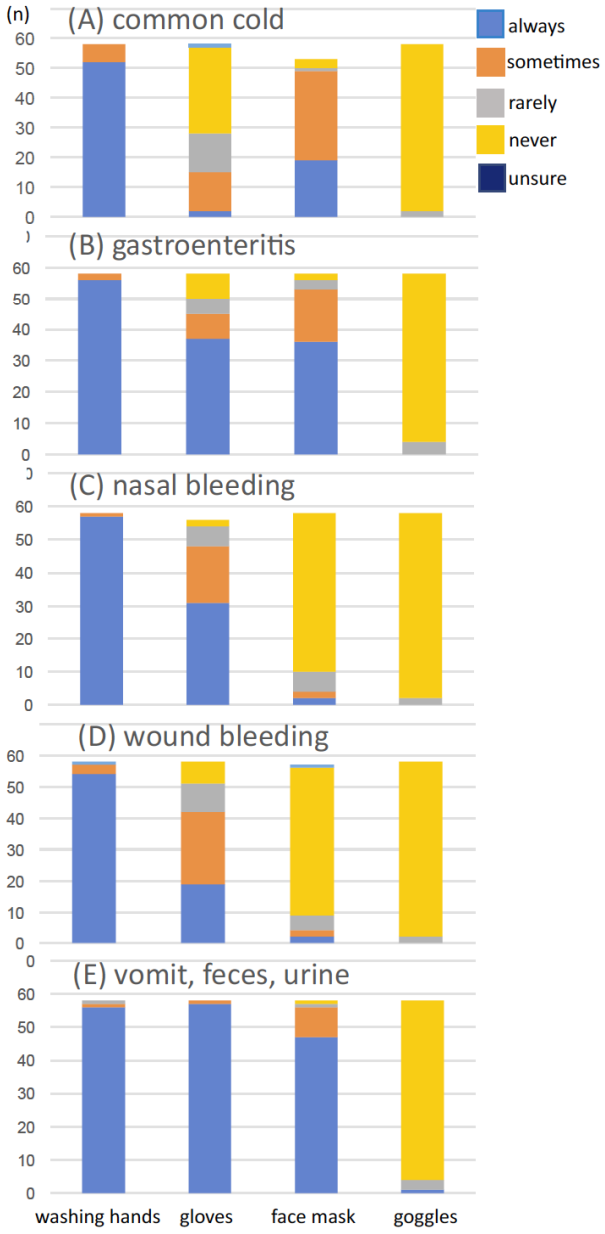

Figure 1: Usage of standard precautions at different situations in the school.
The results from the questionnaires regarding the usage of standard precautions are shown. The different situations in the school are as follows: attending students with a common cold (**A**), gastroenteritis (**B**), epistaxis (**C**), and wound bleeding (**D**) and handling with vomit, feces, or urine (**E**).

Awareness and Provision of Bloodborne Diseases

All except 1 respondent (98.4%) reported that they have sufficient knowledge of bloodborne diseases. Thirty-one (49.2%) had examinations for HBV and 21 (33.9%) for HCV. The most common reason why they had undergone the examinations was "a regular health checkup" (13/33, 39.4%, and 8/22, 36.4%, respectively) (Figure **3**). Only 11 respondents (18.3%) had received an HBV vaccination and the most common reason (multiple answers were allowed) was "necessity for the work" (5/12, 41.7%). Thirty-three respondents (55.0%) could get to know a student who was a carrier of bloodborne diseases in the school. If a carrier was in the school, 38 respondents (63.3%) would take special care of that student (Figure **4**).

None of the respondents had heard about school personnel who were infected with HBV or HCV related to occupational exposure.

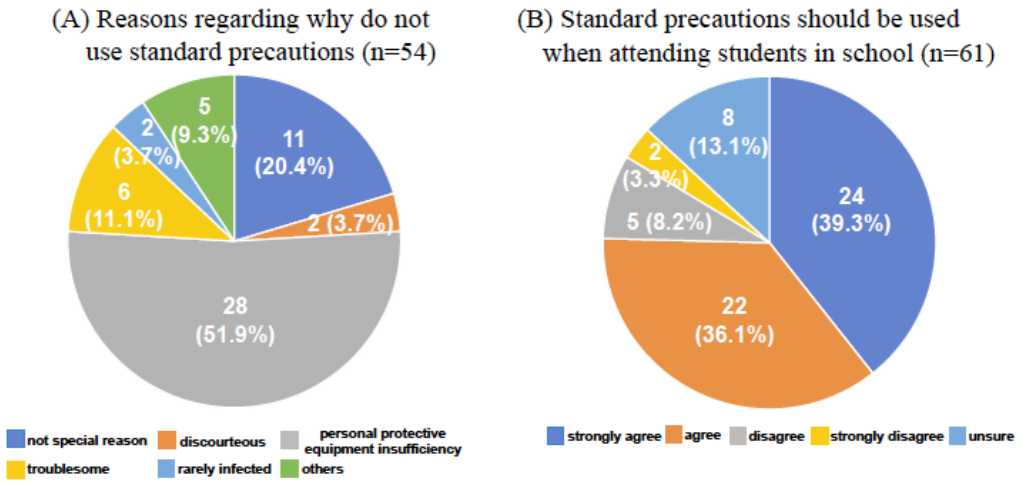

Figure 2: School nurse teachers' views of standard precautions in the school.
The results from the questionnaires regarding the views of standard precautions are shown. The questions are as follows: "If you do not use standard precautions in the school, why?" (**A**), and "When attending any of the students in the school, you should always use standard precautions." (**B**).

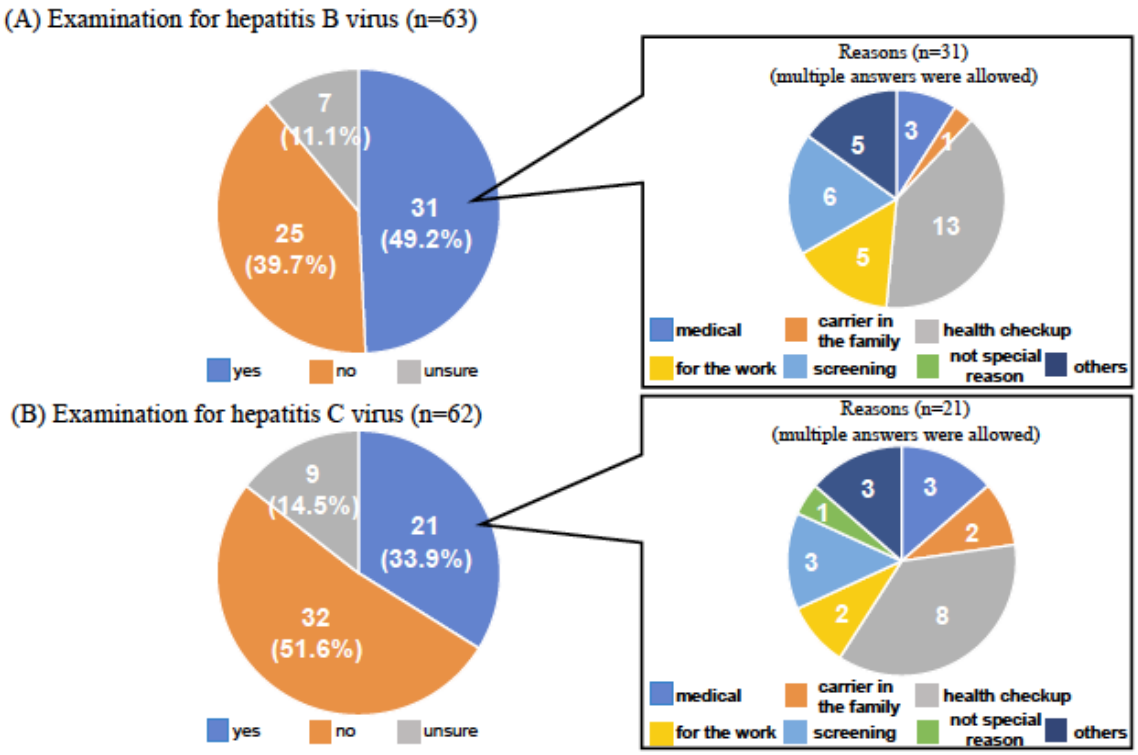

Figure 3: Examinations for hepatitis **B** and **C** viruses and reasons.
The results from the questionnaires regarding the examinations for hepatitis B (**A**) and C (**B**) viruses and reasons are shown.

DISCUSSION

School nurse teachers in Japan play an essential role in keeping students healthy, safe, and ready to learn and are the only healthcare provider in school settings. The present study indicated that almost all school nurse teachers in Japan probably have sufficient knowledge of IPC; however, their actual usage of IPC measures in school settings may be insufficient.

Vaccines are one of the most effective means to prevent infectious diseases [10]. Vaccine-preventable diseases include not only those caused by viral

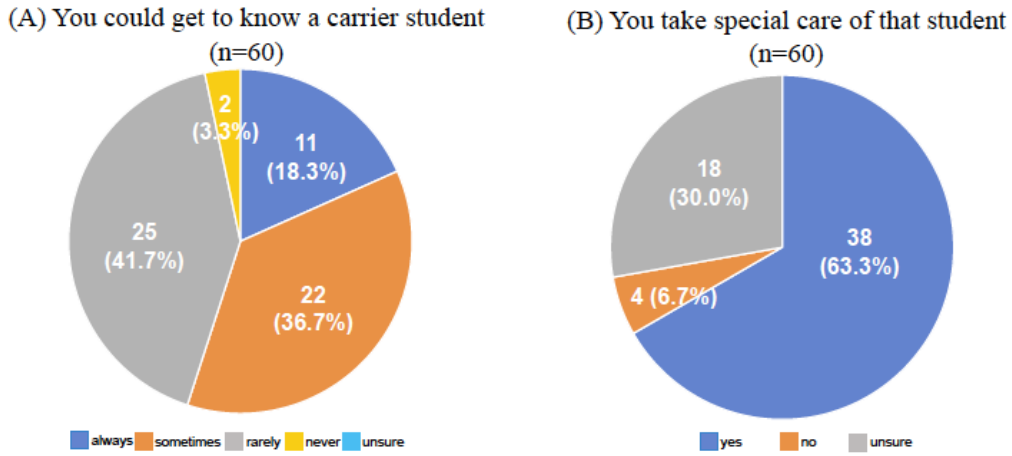

Figure 4: School nurse teachers' views of a carrier student of bloodborne diseases in the school.
The results from the questionnaires regarding the views of a carrier student of bloodborne diseases are shown. The questions are as follows: "You could get to know a student who is a carrier of bloodborne diseases in your school." (**A**), and "If a carrier is in your school, do you take special care of that student?" (**B**).

infections, such as measles, rubella, and mumps, but also those caused by bacterial infections, such as *Haemophilus influenzae* and pneumococcal infections. The vaccine schedule for children younger than elementary school age in Japan is as follows: Bacille Calmette-Guérin (BCG, single dose); *Haemophilus influenzae* type b (Hib, total of 4 doses); pneumococcus (total of 4 doses); hepatitis B (HB, total of 3 doses); diphtheria, pertussis, tetanus, and polio (DPT-IPV, total of 4 doses); measles and rubella (MR, total of 2 doses), and varicella-zoster (VZ, total of 2 doses); these are all administered as routine immunizations [11]. Vaccines against hepatitis A (HA), rota-, mumps, and influenza viruses are generally provided, but are available with an associated fee [11]. The Ministry of Health, Labor and Welfare in Japan reported recent trends in the above representative infectious diseases, as follows [12]: an outbreak of measles occurred from 2007 to 2008, mainly affecting people aged 10 to 20 years. An outbreak of rubella occurred from 2012 to 2013, affecting males aged 10 to 50 years and females in their twenties; and the number of patients with congenital rubella syndrome increased temporarily in certain areas. Both (measles and rubella) infections, as well as those of Hib, pneumococcus, pertussis, Japanese encephalitis, tuberculosis, HA, and HB, are currently well controlled in children. Meanwhile, annually, many children are infected with VZ, mumps, and influenza viruses, in addition to other common infectious agents including group A streptococcus, mycoplasma, adenovirus, and norovirus [12]. School nurse teachers in Japan continue to have the opportunity and duty to conduct IPC for many pathological agents in school.

The Ministry of Education, Culture, Sports, Science and Technology (MEXT) in Japan published manuals for IPC against tuberculosis, measles, and pandemic influenza independently. The MEXT along with the Japan Society of School Health also published an IPC manual regarding general infectious diseases in school settings and have put them on the website [13]. Furthermore, IPC measures against norovirus are emphasized in that manual regarding general infectious diseases in school settings [13]. Norovirus, a gastrointestinal virus, is a leading cause of acute gastroenteritis in all age groups, and is responsible for 685 million gastroenteritis cases and 200,000 deaths annually worldwide [14]. Although no clear evidence suggests that the virus is transmitted by the airborne route, the importance of this route has been suggested by several studies. Based on the findings of virus-containing aerosol droplets from vomit or toilet flushing, and the detection of dispersed norovirus in the air, the potential of airborne transmission of the norovirus is suggested [14]. Our study clearly showed that the school nurse teachers dealt with children with gastroenteritis or vomit and feces more strictly by using PPE than with children with a common cold or bleeding. This is partly because they consider norovirus to be one of the most feared infectious agents in school settings. Meanwhile, it is noteworthy that half of the respondents referred to the PPE insufficiency in the schools, despite the MEXT recommending standard precautions [13]. This is one of the important reasons for improving IPC implementation in the school environment as soon as possible.

The World Health Organization estimates that 257 million people were living with chronic HBV infection [15], and 71 million people have chronic HCV infection [16]. In Japan, carrier rates of both viruses were estimated to be 0.71% and 0.63% of the total population, respectively [17]. However, there are few reports concerning those of children in Japan; one study estimated the carrier rate of 0.02-0.05% with HBV and 0.01-0.02% with HCV [17]. Therefore, the total carrier rate of both diseases in Japanese children may be less than 0.1%. In our recent study [18], we investigated 168 Japanese female university students aged 20 to 21 years, who enrolled in school nurse teacher training courses at the Ibaraki University. Almost all the students probably were not affected or infected by HBV and HCV. The seronegative rates of these diseases were estimated to be lower than those of the Japanese population [17]; this could be due partly to a high level of education regarding the transmission of these infectious diseases in the students enrolled in the school nurse teacher training courses [19]. However, less than half of the school nurse teachers who participated in this study had examinations for HBV and HCV infections. Bloodborne viruses including HBV and HCV could be potentially transmissible from infected HCWs to patients. There is also a risk that injury to an HCW may result in exposure of the HCW's blood to a patient's open tissues [20]; the same risk is found in school settings. School nurse teachers should get to know more about themselves and whether or not they are infected with bloodborne diseases. Fortunately, this study indicated that there may be no school personnel who were infected HBV or HCV related to occupational exposure. Nevertheless, the school nurse teachers with negative HBV antibodies should have received an HBV vaccine, even though an HBV carrier child is exceptionally rare in school. Hence, school nurse teachers should strictly use PPE whenever attending students, especially with bleeding, in school.

DIRECTIONS FOR FUTURE RESEARCH

This study has several limitations. First, our dataset was relatively small. Second, the results were derived from school nurse teachers who worked in only one prefecture, not all over Japan. Therefore, we may not be able to extrapolate these results to a broader school nurse teacher population. Finally, the implementation of IPC among school nurse teachers, as well as other HCWs, has undergone a significant change after the pandemic outbreak of the novel coronavirus disease (COVID-19). In fact, the MEXT in Japan recently published an IPC manual for COVID-19 in schools (May 22, 2020) and proposed a new school lifestyle in the manual [21]. It highlights for the prevention of COVID-19 spreading in school to avoid "the three Cs": closed spaces with poor ventilation; crowded spaces with many students nearby; and closed-contact settings such as close-range conversations, and recommends such practical measures as ventilating frequently, making enough spaces with others, and wearing a mask when talking [21]. Therefore, the pandemic outbreak of COVID-19 could result in considerable changes in the concept of IPC. Further investigations in these areas are required.

CONCLUSIONS

Standard precautions for IPC are as important today as in healthcare and school settings [5]. As the school nurse system is not adopted in Japan, alternatively, one or 2 school nurse teachers are assigned to the schools. They support students' growth and development through health education and health services, similar to school nurses [8]. This study implys that school nurse teachers in Japan have sufficient knowledge of IPC; however, their actual usage of IPC measures in school settings remains insufficient. School nurse teachers should consistently use PPE whenever attending students. However, the implementation of IPC among school nurse teachers, as well as other HCWs, has undergone a significant change after the pandemic outbreak of COVID-19. The pandemic outbreak of COVID-19 could result in considerable changes in the concept of IPC. Further investigations in these areas are required.

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Received on 7-6-2020 Accepted on 12-7-2020 Published on 18-7-2020

DOI: https://doi.org/10.12974/2311-8687.2020.08.2