Impact of Knowledge and Positive Attitudes About Avian Influenza (H5N1 Virus Infection) on Infection Control and Influenza Vaccination Practices of Thai Healthcare Workers

To the Editor—Few data are available concerning healthcare workers' (HCWs') knowledge and attitudes regarding avian influenza (H5N1 virus infection) and what effect their knowledge and attitudes have on infection control practices for suspected or documented cases of infections spread by droplet or airborne transmission and on influenza vaccination practices in an area where H5N1 is endemic. We designed a cross-sectional survey that collected data on these factors to guide the development of public health policy for prevention of the transmission of influenza in healthcare settings during a pandemic.

The study was performed at Thammasat University Hospital, a 500-bed academic hospital, and Pratumthani Hospital, an acute care 300-bed government hospital, which are the only tertiary care centers in Pratumthani, Thailand. We surveyed HCWs in the departments of medicine, pediatrics, emergency medicine, family practice, and intensive care, because these HCWs are at highest risk for nosocomial influenza. In 2004, the Thai government started offering free influenza vaccination to HCWs at Pratumthani Hospital, but not at Thammasat University Hospital. During July and December 2006, we surveyed nurses, attending physicians, and resident physicians. We collected data on each HCW's demographic characteristics, occupation, and previous experience caring for patients who had or were suspected to have H5N1 infection; the HCW's knowledge about H5N1 infection and modes of transmission; and the HCW's attitudes toward H5N1 infection, infection control practices for dealing with patients with suspected or proven cases of infections spread by droplet or airborne transmission, and influenza vaccination practices. Definitions of H5N1 infection and disease transmission were derived from World Health Organization criteria.[1] The survey was pilot-tested then modified to assure clarity and coherence.

Three hundred twenty-two HCWs participated in the survey (215 [86%] of 250 HCWs at Thammasat University Hospital and 107 [86%] of 124 HCWs at Pratumthani Hospital). The demographic characteristics of participants are given in the Table. Of the 322 participating HCWs, 316 (98%) correctly defined H5N1 infection as a contagious infection caused by a virus that can affect all species of birds, and 282 (88%) knew that H5N1 virus can be transmitted by touching infected eggs or poultry and can be transmitted from patients to HCWs. All HCWs identified poultry and wild birds as common vectors, and 275 (85%) answered all questions correctly. Two hundred ninety-nine HCWs (93%) believed there would be an outbreak of H5N1 infection among humans in Thailand in the future, and 289 (90%) accepted the personal risk of caring for H5N1-infected patients. Although 139 HCWs (43%) believed that they had little control over their chance of contracting H5N1 infection and 120 (37%) were afraid of falling ill, 306 (95%) would not consider a job change even if they were required to care for infected patients. With regard to infection control practices for caring for patients with suspected or documented cases of infections spread by droplet or airborne transmission, 113 HCWs (35%) reported washing their hands before patient contact, 236 (73%) reported washing their hands after patient contact, and 153 (48%) practiced cough etiquette. The proportion of HCWs who used personal protective equipment varied from 24% to 65%, depending on the item. Only 106 HCWs (33%) wore all recommended personal protective equipment and practiced cough etiquette when evaluating patients with a suspected or documented case of infections spread by droplet or airborne transmission. There was no difference in knowledge, attitudes, or infection control practices by HCW specialty.

One hundred fifty HCWs (47%) reported receiving influenza vaccination in the previous year (91 [85%] of 107 at Pratumthani Hospital and 59 [27%] of 215 at Thammasat University Hospital; $P < .001$). The main reasons that HCWs gave for receiving vaccination were self-protection (reported by 126 HCWs [84%]); protection of patients (84 [56%]); the desire to avoid missing work (38 [25%]); the belief that it was better to be vaccinated than to contract influenza (32 [21%]); and the recommendation of their peers (23 [15%]). By multivariate analysis, 2 factors were associated with an HCW's reporting having been vaccinated: location at Pratumthani Hospital rather than Thammasat University Hospital (adjusted odds ratio [aOR], 1.5 [95% confidence interval {CI}, 1.05-65.9]) and prior experience caring for patients who had or were suspected of having H5N1 infection (aOR, 2.6 [95% CI, 1.2-71.1]). Among the 172 HCWs who reported not being vaccinated, the main reasons given were the unavailability of free vaccine (reported by 136 [79%]); fear of side effects (82 [48%]); and the belief that influenza is not a severe disease (64 [37%]). The main reason for nonvaccination among HCWs at Thammasat University Hospital was unavailability of free vaccine (reported by 136 [87%] at Thammasat University Hospital and 0 [0%] at Pratumthani Hospital; $P < .001$). The reasons among HCWs at Pratumthani Hospital were more diverse (fear of side effects was reported by 16 HCWs [15%], the belief that influenza is not a severe disease by 16 [15%], and the belief that vaccination is not effective by 16 [15%]). Attitudes related to vaccination did not differ by specialty.

The majority of HCWs surveyed in this area of H5N1 virus endemicity were knowledgeable about H5N1 infection. How-

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TABLE. Findings of the Survey of Healthcare Workers (HCWs) at 2 Hospitals in Thailand Regarding Avian Influenza (H5N1 Virus Infection)

Variable	Thammasat University Hospital	Pratumthani Hospital	P[a]
No. of HCW respondents	215	107	
Age in years, median (range)	32 (24-51)	32 (21-58)	.71
Female sex	131 (61)	62 (58)	.82
Occupation			<.001
Resident physician	37 (17)	8 (7)	
Attending physician	88 (41)	17 (16)	
Nurse	90 (42)	82 (76)	
No. of years in practice			.94
<5 years	72 (33)	40 (37)	
5-10 years	82 (38)	33 (31)	
>10 years	61 (29)	34 (32)	
Knowledge about H5N1 infection[b]			
Definition	213 (99)	103 (96)	.95
Poultry and wild birds are common vector	215 (100)	107 (100)	.99
Transmission by eating uncooked infected poultry	185 (86)	97 (91)	.76
Transmission by eating uncooked infected eggs	203 (94)	103 (96)	.85
Transmission by touching infected poultry	209 (97)	103 (96)	.92
Transmission by touching infected eggs	194 (90)	100 (93)	.91
Human-to-human transmission has been reported	192 (89)	90 (84)	.78
Attitudes toward H5N1 infection			
I believe that H5N1 infection is likely to reoccur in Thailand	210 (98)	89 (83)	.71
I accept the risk of H5N1 infection as part of my job	201 (93)	88 (82)	.76
I should not care for H5N1-infected patients	13 (6)	4 (4)	.89
I have no control over if I will be infected with H5N1	89 (41)	50 (47)	.85
I am afraid of falling ill with H5N1 infection	80 (37)	40 (37)	.99
I will consider resigning because of the risk of H5N1 infection	12 (6)	4 (4)	.46

NOTE. Data are no. (%) of respondents, unless otherwise indicated.

[a] Categorical variables were compared using χ^2 or Fisher exact test, as appropriate. Continuous variables were compared using the Wilcoxon rank sum test.

[b] Calculated as the number of healthcare workers who correctly answered each question.

ever, there was a gap between their knowledge and their actual infection control and influenza vaccination practices. Although direct exposure to infected poultry is the main route of H5N1 virus transmission to humans, human-to-human transmission has been increasingly reported.[2-4] Low rates of adherence to World Health Organization recommendations on how to avoid the spread of H5N1 virus in healthcare settings and through food preparation have also been reported.[5,6] Similar to a previous study,[7] more than half of our HCWs held a positive attitude in response to the impending outbreak of H5N1 infection. In addition, HCWs' increased acceptance of influenza vaccination was associated with the threat of an impending avian influenza epidemic.[8-10]

Our study was limited by the relatively small sample size and by possible recall bias. The fact that our survey did not undergo psychometric validity testing and its lack of gradations in response types may have led to oversimplified survey results. Despite these limitations, our study suggests the need to monitor infection control practices to help minimize influenza transmission in hospitals in areas where H5N1 virus is endemic. Improvement of influenza vaccination administration may be promoted by education and by providing free vaccinations for HCWs at high risk of infection. Additional studies to evaluate knowledge, attitudes, and infection control practices among HCWs in areas where H5N1 infection is endemic are needed.

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Disinfectants Containing Chlorine: An Occupational Hazard?

The Belgian national guidelines to prevent transmission of *Clostridium difficile* in hospitals state that it is justified to use a disinfectant containing 1,000 or 5,000 ppm free chlorine to disinfect the rooms of patients with *C. difficile*–associated disease (CDAD).[1] Concern has risen about the occupational safety of the cleaning employees using the disinfectant at this concentration. We conducted a small test to evaluate the concentration of chlorine in the air while the cleaning employees disinfected a patient's room according to our standard procedure (furniture, door, bathroom, and floor).

The chlorine-containing disinfectant in our hospital is made from 3 tablets of sodium dichloroisocyanurate dihydrate dissolved in 1 L of water to obtain a concentration of 4,500 ppm free chlorine. During the test, the door and windows were closed. Air samples were taken in the neighborhood of the cleaning employees (distance, approximately 1 m) during the decontamination procedure. The samples were analyzed according to method P&CAM 209 in the NIOSH Manual of Analytical Methods.[2]

During an 18-minute decontamination with a solution containing 4,500 ppm free chlorine, we sampled 18.3 L of air and found traces of chlorine that were not quantifiable. During a 15-minute decontamination with a solution containing 1,500 ppm free chlorine, we sampled 15.2 L of air and could not detect chlorine at all. On the basis of these results, we concluded that there is no occupational hazard for the cleaning employees while performing a decontamination procedure with a solution containing 4,500 ppm free chlorine made from sodium dichloroisocyanurate dihydrate tablets.

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