

Clinical and Nonclinical Health Care Workers Faced a Similar Risk of Acquiring 2009 Pandemic H1N1 Infection

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(See the editorial commentary by Drumright and Holmes, on pages 284–286.)

Reporting of confirmed pandemic influenza A virus (pH1N1) 2009 infection was mandatory among health care workers in Hong Kong. Among 1158 confirmed infections, there was no significant difference in incidence among clinical versus nonclinical staff (relative risk, 0.98; 95% confidence interval, 0.78–1.20). Reported community exposure to pH1N1 was common and was similar in both groups.

Since the emergence of the 2009 pandemic influenza A virus (pH1N1), its epidemiology and transmission characteristics have been studied in detail [1–3]. However, relatively limited data are available on the epidemiology of pH1N1 in health care settings, particularly regarding the risk of nosocomial acquisition among health care workers (HCWs). In an early report of 48 HCWs with confirmed pH1N1 infection, information on health care exposure was available for only 26 individuals [4].

In Hong Kong, the government-funded Hospital Authority (HA) manages 38 hospitals, representing over 90% of hospital beds in the territory, and oversees 74 outpatient departments, including 18 clinics designated for pH1N1 cases and established

especially for the pandemic. The HA implemented mandatory reporting for HCWs with confirmed pH1N1 infection after the first case of local transmission was identified, making it possible to collect detailed information on incidence and risk factors for confirmed pH1N1 among HCWs.

METHODS

Under the mandatory reporting conditions, all HCWs with influenza-like illness had to present themselves to staff clinics. Laboratory testing was free of charge, and specimens were tested for pH1N1 by reverse-transcription polymerase chain reaction and viral culture [5]. A confirmed case of pH1N1 was defined as present in a patient with a positive result on either test.

HCWs with confirmed pH1N1 infection were required to report through their working unit to the HA Major Incident Control Centre, which was responsible for providing daily reports of all confirmed cases to the chief infection control officer (CICO). The CICO office then contacted the infection control nurse (ICN) responsible for the hospital or clinic for follow-up and further investigation of any infected HCW. A standard questionnaire administered through personal interview by an ICN was used to obtain information on each confirmed case and to assess clinical presentation and the nature of exposure. Clinical staff were defined as HCWs involved in direct patient care as part of their regular routine, and nonclinical staff were defined as those not involved in patient care and with no opportunity for patient contact during their regular work routine. The CICO office tracked all cases until the questionnaire was returned, ensuring a 100% response rate.

Mandatory reporting of both clinical and nonclinical staff began on 17 June 2009 and continued until 31 August 2009. From 1 September 2009, reporting and investigation was only mandatory for clinical staff. Reporting of confirmed cases among clinical staff continued until 31 May 2010, when the pandemic alert level was downgraded by the Hong Kong government. Compliance with mandatory reporting was likely to be close to 100%, because all staff with influenza-like illness could easily be identified by their supervisors, and the 7 days leave for confirmed cases could only be obtained through this procedure.

RESULTS

A total of 1158 confirmed pH1N1 infections were reported among HA staff. Most cases were mild, and only 30 (2.6%) required hospital admission, with no mortality reported. During the period

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of mandatory reporting for all staff, there were 249 confirmed pH1N1 cases among 40511 clinical staff (0.62%) and 119 cases among 18759 nonclinical staff (0.63%; $P = .82$). The relative risk of acquiring the infection for clinical versus nonclinical staff was 0.98 (95% confidence interval [CI], 0.78–1.20). A total of 1039 (2.6%) of the clinical staff had confirmed pH1N1 infection during the entire study period. Most infected clinical HCWs were nurses (53.4%), health care assistants (27.1%), medical staff (12.3%), and allied health professionals (7.1%). Table 1 compares the characteristics of clinical and nonclinical staff with confirmed pH1N1 infection. There were no differences between clinical and nonclinical staff regarding age, sex, and presenting symptoms, which were most commonly fever and cough. We did not identify significant differences in the risk of infection for HCWs in outpatient departments, accident and emergency departments, and isolation wards (data not shown).

All confirmed case patients were asked to report whether they had been in contact with a confirmed infected case in the community during the 7 days preceding the onset of influenza-

like illness. Among clinical staff, 212 (20%) of 1039 case patients reported recent contact with a family member or friend with confirmed pH1N1 infection, which is similar to the 24 (20%) of 119 case patients from nonclinical staff. All nonclinical staff confirmed that they were not in contact with any patient during the previous week, whereas 78 (7.5%) of the clinical staff recalled having provided care to a patient with confirmed pH1N1 infection. Nine (0.9%) of the clinical staff reported unprotected exposure (ie, managing a patient with confirmed infection without adequate droplet precautions, typically because the patient had not yet received a diagnosis at that time). Importantly, reports of unprotected exposure to a colleague subsequently confirmed to have pH1N1 infection were much more common (10-fold more common) than exposure to infected patients (Table 1) and were reported with similar frequency by clinical (9.0%) and nonclinical (8.4%) staff ($P = .97$).

All clinical staff were asked to evaluate whether their infection could have resulted from care of a hospitalized patient. The contact history of the 26 staff who responded affirmatively

Table 1. Characteristics, Symptoms, and Exposure Risk Evaluated Among 1158 Clinical and Nonclinical Health Care Workers With Confirmed Pandemic Influenza A Virus (pH1N1) Infection, Hong Kong Hospital Authority, June 2009–May 2010

Variable	Clinical (n = 1039)	Nonclinical (n = 119)	P
Demographic data			
Male	253 (24.4)	36 (30.3)	.19
Female	786 (75.7)	83 (69.8)	
Mean age (y)	37.0	38.6	.45
Onset signs and symptoms			
Fever	883 (85.0)	97 (81.5)	.39
Running nose	513 (49.4)	47 (39.5)	.05
Sore throat	720 (69.3)	88 (74.0)	.35
Cough	864 (83.2)	101 (84.9)	.73
Headache	332 (32.0)	39 (32.8)	.94
Routine PPE when on duty			
Surgical mask	999 (96.2)	70 (58.8)	<.01
N95	1 (0.1)	0	.99
Face/eye shield	33 (3.2)	1 (0.8)	.25
Gloves/gown	3 (0.3)	1 (0.8)	.35
Contact history			
Confirmed case in community			
Family	177 (17.0)	16 (13.5)	.38
Friend	35 (3.4)	8 (6.7)	.07
Others, public transportation	2 (0.2) ^a	0	.99
No perceived community contact	825 (79.4)	95 (79.8)	.99
Unprotected exposure to confirmed case in patient care			
Unprotected exposure			
Colleague	93 (9.0)	10 (8.4)	.98
Patient	9 (0.87)	0	.61
Protected exposure	69 (6.6)	0	<.01
Staff infected perceived as due to patient care	26 (2.5)	0	.10

NOTE. Data are no. (%) of subjects unless otherwise indicated. PPE, personal protective equipment.

^a Influenza-like illness contact not confirmed as having pH1N1 infection.

confirmed that all of them had contact with an infected patient, but with no other documented exposure. Also, 9 of 26 reported unprotected exposure to patients, 4 of 26 were assigned to an isolation ward, and 10 of 26 were involved in performing high-risk procedures. In comparison, among the 1013 HCWs with confirmed pH1N1 infection that was not perceived as related to patient care, 0 of 1013 reported unprotected exposure, 7 of 1013 were assigned to an isolation ward, and 16 of 1013 were involved in performing high-risk procedures.

Infection control guidelines for the pandemic were issued very early, on 29 April 2009, and stipulated droplet precautions, as recommended by the World Health Organization [6, 7]. Almost all (96.2%) of the clinical staff reported using a surgical mask at all times (Table 1), whereas only a few reported routinely wearing gowns and gloves, which are not part of droplet precautions [6]. This suggests that most staff had a correct understanding of droplet precautions and indicates that the level of infection control practices is high in Hong Kong. Educational sessions conducted organization-wide were attended by >39000 staff.

DISCUSSION

To our knowledge, we present the largest set of data collected for HCWs with confirmed pH1N1 infection in the health care setting during the 2009 pandemic. Our most important finding is that the attack rate was very similar among clinical and non-clinical staff, showing that there is no increased risk associated with clinical care of infected pH1N1 patients if adequate infection control practices are in place. This finding is particularly important because one recent study reported a significantly higher risk of pH1N1 among clinical HCWs in Saudi Arabia when infection control personnel were overloaded and practices possibly suboptimal [8].

Monovalent pH1N1 vaccines were not available in Hong Kong during the phase of mandatory reporting for both groups, and so pH1N1 vaccination could not have affected our results. Furthermore, as shown in Table 1, the epidemiology of community contact was similar for clinical and nonclinical staff and suggests that the greatest risk for HCWs to acquire infection during the pandemic was from the community. A definite risk in the health care setting is unprotected exposure to an infected colleague, but this was also similar for both clinical and non-clinical staff, and such exposure will also occur in other working environments. This similarity in risk of infection between clinical and nonclinical staff in Hong Kong has been confirmed in a separate serologic survey performed among 586 HCWs, which found similar proportions of clinical (12%) and nonclinical (14%) staff with antibody titer $\geq 1:40$ against pH1N1 by viral neutralization following the first pandemic wave ($P = .79$) [9]. Other serologic surveys have reported a similar infectious risk

between HCWs and the community for both pH1N1 [10, 11] and seasonal influenza [12].

Potential study limitations include participation and recall bias associated with questionnaire surveys where there could be a tendency for staff to report better compliance with infection control practices. In addition, we recorded data on contact with pH1N1 patients, but we did not record data on duration of contact which may affect the risk of infection. Although a small proportion of staff did appear to be infected during the patient care process, exposures in the community and to infected colleagues appeared to be much more common. Although our analysis focuses on confirmed cases and may exclude asymptomatic or subclinical infections among HCWs, it is likely that confirmed cases are of greatest epidemiologic importance, given that HCWs with asymptomatic infection would not require sick leave, and might not present an infectious hazard to patients or colleagues [13].

Our findings have important implications for public health, for the investigation of both seasonal and new emerging influenza, and possibly for other respiratory viruses. With adequate infection control practices, HCWs in direct contact with patients and those who are not in direct contact appear to face a similar risk of pH1N1 infection. Although HCWs may not face a higher risk of pH1N1 infection associated with their occupation, HCW infection remains extremely important in infection control because of the potential for onward transmission to patients. In our study, reported exposure to a pH1N1-infected colleague was 10-fold more common than reported exposure to a pH1N1-infected patient. Consequently, in addition to infection control measures during patient care, respiratory hygiene should be promoted and improved, together with universal vaccination of both clinical and nonclinical staff.

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References

1. Lessler J, Reich NG, Cummings DA, et al. Outbreak of 2009 pandemic influenza A (H1N1) at a New York City school. *N Engl J Med* 2009; 361:2628–36.

2. Cauchemez S, Donnelly CA, Reed C, et al. Household transmission of 2009 pandemic influenza A (H1N1) virus in the United States. *N Engl J Med* **2009**; 361:2619–27.
3. Cowling BJ, Chan KH, Fang VJ, et al. Comparative epidemiology of pandemic and seasonal influenza A in households. *N Engl J Med* **2010**; 362:2175–84.
4. Centers for Disease Control and Prevention. Novel influenza (H1N1) virus infections among health-care personnel—United States, April–May 2009. *MMWR Morb Mortal Wkly Rep* **2009**; 58:641–45.
5. To KK, Chan KH, Li IW, et al. Viral load in patients infected with pandemic H1N1 2009 influenza A virus. *J Med Virol* **2010**; 82:1–7.
6. Siegel JD, Rhinehart E, Jackson M, et al. 2007 Guideline for isolation precautions: preventing transmission of infectious agents in healthcare settings. Atlanta, GA: Centers for Disease Control and Prevention, 2007.
7. World Health Organization. Infection prevention and control during health care for confirmed, probable, or suspected cases of pandemic (H1N1) 2009 virus infection and influenza-like illnesses. Geneva, Switzerland: World Health Organization, 2009.
8. Balkhy HH, Saed AE, Sallah M. Epidemiology of H1N1 (2009) Influenza among healthcare workers in a tertiary care center in Saudi Arabia: a 6-month surveillance study. *Infect Contr Hosp Epidemiol* **2010**; 31:1004–10.
9. Zhou Y, Ng DM, Seto WH, et al. Seroprevalence of antibody to pandemic influenza A (H1N1) 2009 among health care workers after the first wave in Hong Kong. *J Hosp Infect* **2011**. doi:10.1016/j.jhin.2011.02.017.
10. Shiley KT, Nadoski G, Mickus T, et al. Differences in the epidemiology and clinical outcomes of pandemic (H1N1) 2009 influenza, compared with seasonal influenza. *Infect Contr Hosp Epidemiol* **2010**; 31:676–82.
11. Chen MI, Lee VJ, Lim W, et al. 2009 influenza A(H1N1) seroconversion rates and risk factors among distinct adult cohorts in Singapore. *JAMA* **2010**; 303:1383–91.
12. Williams CJ, Schweiger B, Diner G, et al. Seasonal influenza risk in hospital healthcare workers is more strongly associated with household than occupational exposures: results from a prospective cohort study in Berlin, Germany, 2006/07. *BMC Infect Dis* **2010**; 10:8.
13. Patrozou E, Mermel LA. Does influenza transmission occur from asymptomatic infection or prior to symptom onset? *Public Health Rep* **2009**; 124:193–6.