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Novel Influenza A (H1N1) Virus Infections Among Health-Care Personnel --- United States, April--May 2009

Soon after identification of novel influenza A (H1N1) virus infections in the United States in mid-April 2009, CDC provided interim recommendations to reduce the risk for transmission in health-care settings. These included recommendations on use of personal protective equipment (PPE), management of health-care personnel (HCP) after unprotected exposures, and instruction of ill HCP not to report to work (*1*). To better understand the risk for acquiring infection with the virus among HCP and the impact of infection-control recommendations, CDC solicited reports of infected HCP from state health departments. As of May 13, CDC had received 48 reports of confirmed or probable infections with novel influenza A (H1N1) virus* (*2*); of these, 26 reports included detailed case reports with information regarding risk factors that might have led to infection. Of the 26 cases, 13 (50%) HCP were deemed to have acquired infection in a health-care setting, including one instance of probable HCP to HCP transmission and 12 instances of probable or possible patient to HCP transmission. Eleven HCP had probable or possible acquisition in the community, and two had no reported exposures in either health-care or community settings. Among 11 HCP with probable or possible patient to HCP acquisition and available information on PPE use, only three reported always using either a surgical mask or an N95 respirator. These findings suggest that transmission of novel influenza A (H1N1) virus to HCP is occurring in both health-care and community settings and that additional messages aimed at reinforcing current infection-control recommendations are needed.

After identifying the first two cases of novel influenza A (H1N1) infection in the United States on April 15, 2009, CDC requested that all state and local health departments implement enhanced surveillance for unsubtypable influenza A viruses (*3*). On May 4, CDC began distributing a data collection instrument to health departments to gather additional information on infected HCP. The instrument included questions on job type, facility type, contact with patients with novel influenza A (H1N1) infections or respiratory illness (i.e., pneumonia, upper respiratory tract infections, or influenza-like illness), and use of PPE (i.e., gloves, gowns, surgical masks, N95 respirators, or eye protection [goggles or face shield]). For this analysis, HCP were defined as employees, students, contractors, clinicians, or volunteers whose activities involved contact with patients in a health-care or laboratory setting. Only HCP with confirmed or probable novel influenza A (H1N1) infections were included in the analysis.

Reports on HCP cases were reviewed by infection-control staff members at CDC. Cases were categorized, using criteria developed for this investigation, as having potential acquisition in the community or in a health-care setting.† The criteria used to determine the most likely source of acquisition were based on exposures indicated on the data collection instrument during the 7 days preceding symptom onset. PPE use was used to assign a

level of certainty (probable or possible) to patient to HCP transmission, but PPE use was not used to distinguish between acquisition in community or health-care settings.

CDC received 48 reports of confirmed or probable novel influenza A (H1N1) infection among HCP from 18 states. Detailed information on health-care exposures was obtained for 26 cases (18 confirmed and eight probable) reported from 11 states (Table 1). Dates of illness onset ranged from April 23 to May 4. Job type was available for 25 HCP: five registered nurses (20%), four nursing assistants (16%), four physicians (16%), and 12 persons in 10 other occupations.§ Two (8%) of these infected HCP were hospitalized, one of whom reported having underlying medical conditions. Neither hospitalized HCP was admitted to an intensive-care unit; no HCP died. Among the 16 HCP for whom such information was available, eight had been vaccinated for seasonal influenza since September 2008.

Among the 26 infected HCP, 12 (46%) reported caring for a patient with either novel influenza A (H1N1) infection (six) or respiratory illness (six) (Table 2). Six HCP (23%) reported having a close contact or family member with either respiratory illness (three) or novel H1N1 infection (three); four (15%) reported recent travel to Mexico. By using the criteria for assessment of infection acquisition, 13 HCP (50%) were deemed to have been infected in a health-care setting, including five instances of probable patient to HCP transmission,¶ seven of possible patient to HCP transmission, and one of probable HCP to HCP transmission. Community transmission was deemed most likely for 11 HCP (42%); two HCP (8%) had no reported exposures in either health-care or community settings.

Of the 12 HCP with probable or possible patient to HCP acquisition, 11 reported information on their use of PPE when caring for the presumed source patient. Only three reported always using either a surgical mask (two) or an N95 respirator (one) (Table 2). Five reported always using gloves. None reported always using eye protection. None reported always using gloves, gown, and either surgical mask or N95 respirator.

Among the three HCP who reported always using either a surgical mask or N95 respirator, a physician with possible patient to HCP acquisition reported always using an N95 respirator when with the presumed source patient. However, the physician also reported never having had a fit test for the respirator, and information was not available on whether the physician used a gown or eye protection (Table 3). A nurse anesthetist with possible patient to HCP transmission reported always using gloves and a surgical mask with the presumed source patient, but sometimes using a gown, N95 respirator, and eye protection. In addition, a registered nurse with possible patient to HCP transmission (who was caring for a novel H1N1 patient on droplet precautions) reported always using a surgical mask and gloves with the presumed source patient but never using a gown, N95 respirator, or eye protection.

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Editorial Note:

Routine infection-control recommendations to decrease the risk for transmission of seasonal influenza to HCP include vaccination, isolation of infected patients in single rooms, and use of standard precautions and droplet precautions (*4*,*5*). For infections with the novel influenza A (H1N1) virus, because of the lack of a vaccine and little initial information regarding the severity and transmissibility of the virus, CDC's interim infection-control recommendations for the care of patients with such infections have included the use of fit-tested N95 respirators, eye protection, and contact precautions in addition to routine infection-control practices applied to seasonal

influenza (*1*). In addition, CDC has recommended that aerosol-generating procedures (e.g., bronchoscopy) should be performed in an airborne infection--isolation room with negative pressure air handling. In this analysis, among the 11 HCP infected because of probable or possible patient to HCP transmission for whom information was available, none adhered to these recommended practices completely.

Although no data are available on why recommended practices often were not followed in these situations, similar nonadherence with recommended PPE by HCP caring for patients with febrile respiratory infections has been documented previously for influenza and other respiratory infections (*6--8*). Barriers to adherence can include 1) a belief that these practices are not necessary, inconvenient, or disruptive; 2) lack of availability of PPE; 3) inadequate training in infection control; 4) failure to establish effective, systematic approaches to HCP safety; and 5) failure to recognize patients and activities that warrant specific infection-control practices. In addition, some of the suboptimal practices described in this report might have occurred before CDC's interim recommendations were first issued on April 25.

Most of the probable or possible patient to HCP transmissions in this report occurred in situations where the use of PPE was not in accordance with CDC recommendations. Among the three HCP who reported always using either a surgical mask or an N95 respirator while caring for a patient with either confirmed novel H1N1 infection or respiratory illness, one had not been fit-tested for the respirator, and none used all of the PPE recommended by CDC for infection control. Even so, these findings cannot definitively establish that patient to HCP transmission was related to nonuse of certain PPE, nor can the findings be used to determine the effectiveness of PPE in protecting HCP from infection with the novel influenza A (H1N1) virus.

Initial evidence suggests that HCP are not overrepresented among reported cases of persons infected with novel influenza A (H1N1) virus in the United States. Among confirmed and probable cases in adults aged 18--64 years and reported to CDC as of May 13, approximately 4% have occurred in HCP; approximately 9% of working adults in the United States are employed in health-care settings (*9,10*). However, this comparison is subject to several limitations, including that case reports are not geographically homogeneous, and substantial underreporting is likely. As data on additional novel influenza A (H1N1) cases are collected, the risk for infection among HCP might be better elucidated.

Whatever the risk for infection to HCP, much of that risk likely exists in the outpatient setting. As of May 31, only 653 (6%) of 10,053 patients reported with novel influenza A (H1N1) infection had been hospitalized. The findings in this report indicate that six of the 12 HCP with probable or possible patient to HCP acquisition reported working in outpatient settings during the week preceding symptom onset. Many interactions between HCP and infected patients likely occur in ambulatory-care settings and highlight the need for outpatient staff members to follow infection-control recommendations.

The findings in this report are subject to at least four limitations. First, the total number of infected HCP likely is underreported. Some HCP might not seek care for their symptoms; in addition, some states might not systematically collect data that allow them to identify HCP among persons with novel H1N1 infection. Second, detailed risk factor information was available for only 26 (54%) of the 48 reported cases, some information was missing, and data were not collected on a number of infection-control practices, including hand hygiene. Third, information collected on health-care and community exposures might have been subject to recall bias, and HCP might have had unrecognized exposures in either setting, which might have resulted in errors in identifying the source of acquisition. Finally, conclusions in this report were limited by the small number of HCP cases available for analysis.

These results highlight the need to maintain adherence to comprehensive infection-control strategies to prevent transmission of novel H1N1 in health-care settings. These strategies should include administrative controls (e.g., visitor policies and triage of potentially infectious patients), provision of infection-control resources, training in infection-control practices and correct use of PPE, identification of all ill HCP, and exclusion of ill HCP from work.

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* A confirmed case of novel influenza A (H1N1) virus infection was defined in a person with an influenza-like illness and laboratory-confirmed novel influenza A (H1N1) virus infection by real-time reverse transcription--polymerase chain reaction (rRT-PCR) or viral culture. A probable case was defined in a person with an influenza-like illness who was positive for influenza A, but negative for human H1 and H3 by influenza rRT-PCR.

† All exposures occurred ≤7 days before symptom onset. *Health-care settings:* Probable patient to HCP transmission was defined as exposure to a patient with known novel influenza A (H1N1) virus infection without using a surgical mask or N95 respirator. Possible patient to HCP transmission was defined as exposure to a patient with known novel H1N1 virus infection while using a surgical mask or N95 respirator or exposure to a patient with respiratory illness (i.e., pneumonia, upper respiratory tract infections, or influenza-like illness) regardless of the use of respiratory PPE. Probable HCP to HCP transmission was defined as contact with a coworker with confirmed or probable novel H1N1 virus infection or contact with a coworker with respiratory illness who traveled to Mexico. *Community settings:* Probable community transmission was defined as exposure to a person with confirmed or probable novel H1N1 virus infection outside of a health-care setting, or travel to Mexico, or having no contact with a health-care setting. Possible community transmission was defined as contact with a person with respiratory illness outside of a health-care setting with no other reported exposures.

§ Licensed practical nurse and medical assistant (two each); physician's assistant, nurse anesthetist, orthodontic clinical assistant, pharmacy technician, physical therapist, ward clerk, student, and receptionist (one each).

¶ One HCP had both 1) exposure to a patient with known novel influenza A (H1N1) infection while using only gloves for PPE (probable patient to HCP transmission) and 2) exposure to a community contact with respiratory illness (possible community transmission). For this HCP, the route of transmission was categorized as probable patient to HCP transmission.

TABLE 1. Number and percentage of health-care personnel (N = 26) with confirmed or probable novel influenza A (H1N1) infection,* by selected characteristics --- United States, April--May 2009

Characteristic	No.	(%)†
Case status		
Confirmed	18	(69)
Probable	8	(31)
Sex (n = 23)		
Male	4	(17)
Female	19	(83)
Age group (yrs) (n = 20)		
20--29	8	(40)
30--39	7	(35)

40--49	3	(15)
≥50	2	(10)
Race/Ethnicity (n = 22)		
White, non-Hispanic	12	(55)
Hispanic	5	(23)
Black, non-Hispanic	2	(9)
Asian/Pacific Islander	2	(9)
Other	1	(5)
Job type (n = 25)		
Registered nurse	5	(20)
Nursing assistant	4	(16)
Physician	4	(16)
Licensed practical nurse	2	(8)
Medical assistant	2	(8)
Physician's assistant	1	(4)
Nurse anesthetist	1	(4)
Orthodontic clincial assistant	1	(4)
Pharmacy technician	1	(4)

Physical therapist	1	(4)
Ward clerk	1	(4)
Student	1	(4)
Receptionist	1	(4)
Facility type§ (n = 25)		
Outpatient	10	(40)
Inpatient, acute care	8	(32)
Long-term care facility/Long-term acute-care facility	2	(8)
Emergency department	2	(8)
None	3	(12)

* A confirmed case of novel influenza A (H1N1) virus infection was defined in a person with an influenza-like illness and laboratory-confirmed novel influenza A (H1N1) virus infection by real-time reverse transcription--polymerase chain reaction (rRT-PCR) or viral culture. A probable case was defined in a person with an influenza-like illness who was positive for influenza A, but negative for human H1 and H3 by influenza rRT-PCR.

† Percentages in groupings might not add to 100% because of rounding.

§ Facility in which health-care personnel worked during the week preceding symptom onset.

TABLE 2. Reported exposures and personal protective equipment (PPE) use among health-care personnel (HCP) (N = 26) with confirmed or probable novel influenza A (H1N1) infection --- United States, April--May 2009

Characteristic	No.	(%)*
Reported exposures†		
Cared for a patient with H1N1 infection	6	(23)

Cared for a patient with respiratory illness (H1N1 status unknown)	6	(23)
Travel to Mexico	4	(15)
Close/family contact with H1N1 infection	3	(12)
Close/family contact with respiratory illness	3	(12)
No contact with a health-care setting	3	(12)
Coworker with respiratory illness and recent travel to Mexico	1	(4)
Postulated exposure source§		
Probable community transmission	10	(38)
Probable transmission from patient to HCP	5	(19)
Possible transmission from patient to HCP	7	(27)
Probable transmission from HCP to HCP	1	(4)
Possible community transmission	1	(4)
Unknown source	2	(8)
PPE use among HCP (n = 12) with probable or possible patient to HCP transmission		
Surgical mask (n = 10)		
Always	2	
Sometimes	3	
Never	5	

N95 respirator (n = 11)	
Always¶	1
Sometimes**	2
Never	8
N95 respirator or surgical mask (n = 11)	
Always	3
Sometimes	4
Never	4
Gloves (n = 11)	
Always	5
Sometimes	1
Never	5
Gown (n = 10)	
Always	0
Sometimes	3
Never	7
Eye protection (n = 10)	
Always	0

Sometimes	1
Never	9

* Percentages in groupings might not add to 100% because of rounding.

† During the week preceding symptom onset. Two HCP had more than one type of exposure, and two HCP had no reported exposures.

§ All exposures occurred ≤7 days before symptom onset. *Health-care settings:* Probable patient to HCP transmission was defined as exposure to a patient with known novel influenza A (H1N1) virus infection without using a surgical mask or N95 respirator. Possible patient to HCP transmission was defined as exposure to a patient with known novel H1N1 virus infection while using a surgical mask or N95 respirator or exposure to a patient with respiratory illness (i.e., pneumonia, upper respiratory tract infections, or influenza-like illness) regardless of the use of respiratory PPE. Probable HCP to HCP transmission was defined as contact with a coworker with confirmed or probable novel H1N1 virus infection or contact with a coworker with respiratory illness who traveled to Mexico. *Community settings:* Probable community transmission was defined as exposure to a person with confirmed or probable novel H1N1 virus infection outside of a health-care setting, or travel to Mexico, or having no contact with a health-care setting. Possible community transmission was defined as contact with a person with respiratory illness outside of a health-care setting with no other reported exposures.

¶ Not fit-tested

** Fit-tested.

TABLE 3. Use of personal protective equipment (PPE)* among health-care personnel (HCP) (n = 12) with probable or possible patient to HCP transmission of novel influenza A (H1N1) infection, by job type and facility type --- United States, April--May 2009

Job type	Transmission type†	Facility type	Gloves	Gown	Surgical mask	N95 respirator	Eye protection
Nursing assistant	Probable patient to HCP	Inpatient, acute care	Never	Never	Never	Never	Never
Medical assistant	Probable patient to HCP	Outpatient	Never	Never	Sometimes	Never	Never
Licensed practical nurse	Probable patient to HCP	Outpatient	Never	Never	Never	Never	Never
Physician's assistant	Probable patient to HCP	Outpatient	Always	Never	Never	Never	Never

Registered nurse	Probable patient to HCP	Outpatient	Never	Never	Sometimes	Never	Never
Nursing assistant	Possible patient to HCP	Inpatient, acute care	Always	Sometimes	Never	Sometimes	Never
Physician	Possible patient to HCP	Outpatient	Always	---§	---	Always	---
Licensed practical nurse	Possible patient to HCP	Inpatient, long-term care	Sometimes	Sometimes	Sometimes	Never	Never
Nurse anesthetist	Possible patient to HCP	Inpatient, acute care	Always	Sometimes	Always	Sometimes	Sometimes
Registered nurse	Possible patient to HCP	Inpatient, acute care	Always	Never	Always	Never	Never
Medical assistant	Possible patient to HCP	Outpatient	Never	Never	Never	Never	Never
Physician	Possible patient to HCP	Inpatient, acute care	---	---	---	---	---

* When with presumed source patient.

† All exposures occurred ≤7 days before symptom onset. Probable patient to HCP transmission was defined as exposure to a patient with known novel influenza A (H1N1) virus infection without using a surgical mask or N95 respirator. Possible patient to HCP transmission was defined as exposure to a patient with known novel H1N1 virus infection while using a surgical mask or N95 respirator or exposure to a patient with respiratory illness (i.e., pneumonia, upper respiratory tract infections, or influenza-like illness) regardless of the use of respiratory PPE.

§ Information not available.

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