



## Risk Factors of an Influenza A(H1N1)pdm09 Outbreak in a Nursing Institute, Noagaon, Bangladesh, 2015

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### Abstract

An H1N1 outbreak in the Noagaon Nursing Institute in Bangladesh allowed examination of risk factors for influenza transmission and a return-to-work policy. We conducted a retrospective cohort study of 119 nursing students residing in the nursing institute's dormitory. The attack rate of influenza was 51% (61/119) and 28% (5/18) of suspected influenza cases tested positive for influenza A(H1N1)pdm09. Eighty percent of the students returned to their training in the hospital and the classroom three days after the first onset of symptoms. Living in overcrowded dormitories (risk ratios (RR) 1.7, 95% confidence interval (CI) 1.2-2.4), contacting with students with influenza-like illness (RR 2.7, 95% CI 1.6-4.6) placed students at greater risk for receiving and for transmitting influenza. To prevent transmission, we recommended isolating students with influenza during the viral shedding period and annual influenza vaccination.

**Keywords:** H1N1, influenza, nursing student, Bangladesh

### Introduction

In 2007, a hospital-based influenza surveillance was established in twelve sentinel hospitals in Bangladesh. This surveillance system reports the burden and trends of influenza infection in Bangladesh. On 18 Jun 2009, through event-based surveillance system at the Institute of Epidemiology, Disease Control and Research (IEDCR), the first human case of influenza A(H1N1)pdm09 was detected in Bangladesh. In 2010, another surveillance system, the National Influenza Surveillance Platform, Bangladesh (NISB), was established to strengthen influenza surveillance activity in Bangladesh.<sup>1</sup> From January to December 2015, NISB identified 201 cases of influenza A and among them 70% (142) were laboratory confirmed H1N1 cases.<sup>2</sup>

In 2012 and in 2015, the outbreak investigation teams of IEDCR investigated five outbreaks of influenza-like illness (ILI) across the country.<sup>3</sup> Of the five events, two were ILI and three were suspected to be caused by influenza A(H1N1)pdm09. Overcrowding and contact with positive cases were risk factors of the spread of influenza virus. In 2012, the outbreak of H1N1

occurred among students in the Kurigram Nursing Institute in the west-northern part of Bangladesh. The study concluded that crowded living conditions facilitated transmission of influenza infection among the dormitory students.<sup>4</sup>

On 2 Jul 2015, the local health authority in Noagaon District reported an increase of ILI cases in the nursing students to IEDCR. A team from IEDCR investigated this outbreak with the following objectives: to identify the causative and risk factors associated with the outbreak, to provide evidence-based recommendations to stop viral transmission under this setting, and to prevent future influenza outbreaks.

### Methods

From 3 to 20 Jul 2015, the outbreak team conducted an initial field investigation in the Noagaon Nursing Institute. There were 126 students enrolled in the nursing institute. All students were female and 119 lived in dormitory. There were six teachers, three females, and one male supervisor. The school has a three-year curriculum with the first year in classroom and the second and third year in classroom and hospital.

The institute has a two-story dormitory with 27 rooms for the students and one room for the teachers. We restricted our analysis to 119 students who lived in the dormitory.

We collected information on the number of students affected, the cases' symptoms, the status of hospitalized students, and the steps taken by local health authorities. To verify the diagnosis, we reviewed medical records in Noagaon Hospital where the affected students sought treatment. We also reviewed the medical records of inpatients and outpatients in the same hospital during 20 to 25 Jun 2015 to identify other ILI cases. To identify potential risk factors, we interviewed all the students, the supervisor, the teachers, and other staffs using a semi-structured questionnaire.

### Study Design

We conducted a retrospective cohort study to identify the cause and possible risk factors for this outbreak. The definition for a suspected influenza case was a person in the Noagaon Nursing Institute suffering from fever with or without cough, headache, runny nose and sneeze from 20 Jun 2015 to the date of their interview.

### Laboratory Testing

Nasal and throat swabs were collected from study subjects using viral transport media and the samples were transported to the National Influenza Center at IEDCR in cold boxes. Nasal and throat swabs were first tested for influenza A and B viruses by reverse transcription polymerase chain reaction (RT-PCR) (ABI 7500 Fast Dx, Thermo Fisher, Waltham, MA). All

influenza A positive samples were then tested for other influenza viruses (e.g., H1N1pdm09).

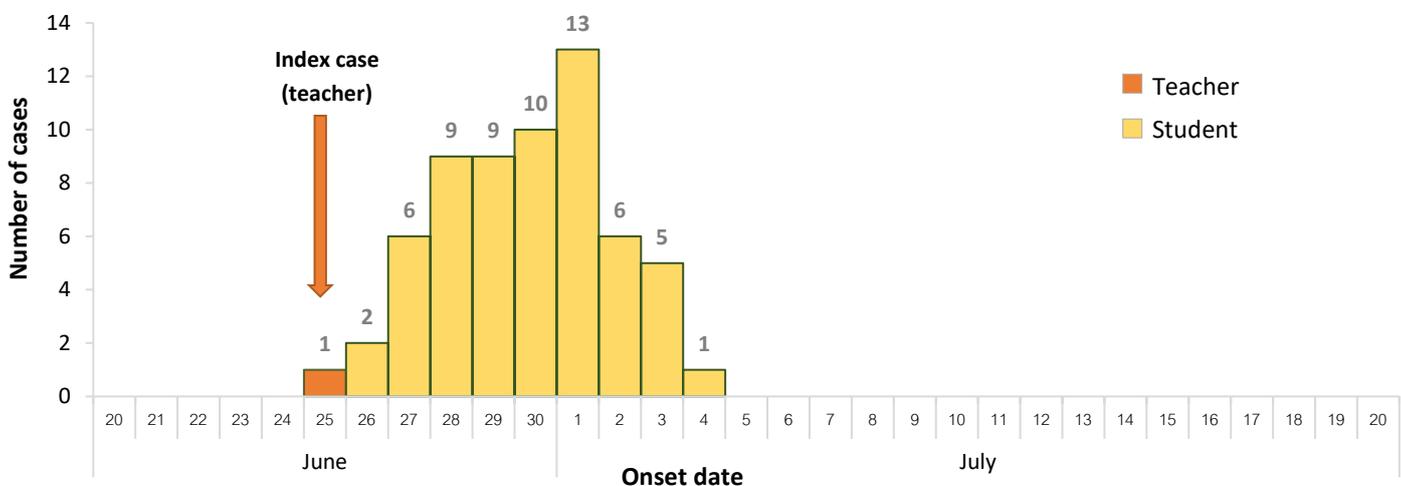
### Statistical Analysis

Crowding in the dormitory was calculated by the area per person with more crowding having an area of approximately 1.6 m<sup>2</sup>/person and less crowding having an area of approximately 2 m<sup>2</sup>/person. We calculated the risk ratio (RR) for contacting influenza with overcrowding, contact history, and years of education. To determine whether the students returned to the regular academic or practical sessions during the infectious period, we calculated the number of days of absenteeism by subtracting between the date of isolation to the date they returned to their training hospital. We entered the data into Microsoft Excel (Office Professional Plus 2013) and used STATA (Version 13, College Station, TX) to calculate attack rates, RR and 95% confidence intervals (CI).

### Results

The outbreak team traveled to Noagaon on 3 Jul 2015 to investigate and control the outbreak and returned to Dhaka on 20 Jul 2015. All 119 students in the dormitory participated in this study. Seven students, all teachers and the supervisor were not included in the study because they resided outside the dormitory.

Among the 119 students in the dormitory, 61 met the suspected case definition. We collected swab samples from 18 students and 5 were positive for influenza A by RT-PCR. Further testing showed that all of the Influenza A cases were found positive for influenza A(H1N1)pdm09.



**Figure 1. Epidemic curve of suspected influenza cases at Noagaon Nursing Institute, Bangladesh, 2015 (n=62, including the index case)**

The onset date of the students' illness ranged from 26 Jun and 4 Jul 2015 with the highest number of cases on 1 July (Figure 1). The epidemic curve showed a single peak followed by a gradual decline of the

suspected influenza cases. The shape of the curve followed a pattern of point source outbreak. The index case for this outbreak was "teacher X" as indicated in Figure 1. Teacher X developed ILI symptoms on 25 June.

She attended scheduled classes and official meetings while being ill. On 28 June, teacher Y of the institute became ill and remained in the teacher's room. Another "teacher Z", who is the sibling of teacher Y, provided care to teacher Y. Teacher Z did not wear a mask or other protective equipment during that time. Teacher Z developed symptoms on 30 June. All teachers reported neither history of exposure to poultry nor travel history during the last seven days before their illness. All three teachers taught students in the classroom and did not live on the school premises.

The attack rate among the students was 51.3% (61/119). The mean age and standard deviation of the affected students was 19.3±1.2 years (Table 1). Students affected most were in the first year of schooling. The risk of developing influenza was higher

in the crowded rooms (1.6 m<sup>2</sup>/person) compared with the less crowded rooms (2.0 m<sup>2</sup>/person), RR 1.7, 95% CI 1.2-2.4. Moreover, the risk among those who had a history of contact with positive cases was 2.7 (95% CI, 1.6-4.6) times as large as the risk in students with no contact history. The first-year students faced higher risk of developing the disease compared with the students in the second and third years (RR 1.7, 95% CI 1.2-2.4) (Table 2). The mean absence period of students equaling three days (Table 1) and about 80% (33/41) of students returned to their regular classroom work and attended practical sessions at the hospital, three days after the symptom onset. However, the surveillance for ILI in the hospital showed no new cases after the nursing students returned to their training in the hospital.

**Table 1. Characteristics and attack rates during an influenza A(H1N1)pdm09 outbreak in students at Noagaon Nursing Institute, Bangladesh, June to July 2015 (n=119)**

<b>Total number of suspected cases</b>	<b>61</b>
<b>Age of the student cases in years (Mean±SD)</b>	<b>19.3±1.2</b>
<b>Clinical features (n=61, (%))</b>	
Fever	61 (100.0)
Cough	39 (63.9)
Headache	43 (70.5)
Body ache	35 (57.4)
Runny nose	26 (42.6)
Vomiting	15 (24.6)
Sneeze	13 (21.3)
Sore throat	12 (19.7)
<b>Attack rate by student years</b>	
First year (n=45)	31 (68.9)
Second year (n=45)	18 (40.0)
Third year (n=29)	12 (41.4)
<b>Attack rate by room occupancy</b>	
Five persons per room (n=55)	36 (65.5)
Four persons per room (n=64)	25 (39.1)
<b>Days of absenteeism of the students (n=41) (Mean±SD)</b>	<b>3.0±0.6</b>

**Table 2. Risk ratio among the affected students, Noagaon Nursing Institute, Bangladesh, June to July 2015 (n=119)**

Exposure	Suspected cases	Not suspected cases	RR
	n (%)	n (%)	(95% CI)
<b>Crowding status</b>			
Relatively more crowding (1.6 m <sup>2</sup> /person)	38 (64.4)	21 (35.6)	1.68 (1.16-2.44)
Relatively less crowding (2.0 m <sup>2</sup> /person)	23 (38.3)	37 (61.7)	Reference
<b>Contact with infected patients</b>			
History of contact with infected patients	50 (66.7)	25 (33.3)	2.67 (1.56-4.56)
No contact history with infected patients	11 (25.0)	33 (75.0)	Reference
<b>Years of education</b>			
First year	31 (68.9)	14 (31.1)	1.70 (1.21-2.38)
Second and third years combined	30 (40.5)	44 (59.5)	Reference

## Discussion

Clinical evidence and epidemiological and laboratory results verify that an outbreak of influenza A(H1N1)pdm09 occurred in the Noagaon Nursing Institute. In Bangladesh, the influenza season lasts from April to September with a peak in July and August and this outbreak occurred during the peak time of influenza season.<sup>5</sup> Bangladesh recorded 1,408 cases of influenza A(H1N1)pdm09 and eight deaths from 2009-2010.<sup>7,8</sup>

Overcrowded living conditions and contact history with a case were associated with developing influenza. The students of Noagaon Nursing Institute lived in overcrowded rooms. The 2012 Kurigram outbreak reported a significantly higher risk of developing influenza among the students with five roommates or more.<sup>6</sup> In this outbreak, the higher risk of developing influenza occurred in the crowded rooms than the less crowded rooms and among those with history of contact with the cases. The Bangladesh Government increased the number of seats at the nursing institutes from 1,590 to 2,580 but the classroom size and student accommodations did not change in tandem; this resulted in more overcrowding.<sup>9</sup>

The outbreak in Kurigram and Noagaon Nursing Institutes had a much higher attack rate compared with the World Health Organization global attack rate.<sup>9</sup> In 2012 an outbreak of influenza A(H1N1)pdm09 was detected among the students of Kurigram Nursing Institute. The attack rate was 42% among the students.<sup>5</sup> The 2015 outbreak among students in Noagaon Nursing Institute was similar to the 2012 outbreak in Kurigram. Both events demonstrated similar risk factors and both showed a high attack rate. The high attack rate also occurred in a residential school in Panchgani, Maharashtra, India, with an attack rate of more than 70%.<sup>8</sup> According to World Health Organization, the estimated annual global attack rate for influenza is 5-10% for adults.<sup>9</sup>

The index case for this outbreak was “teacher X” who was suspected of spreading the disease to the other teachers and students. Teacher Y and Z had a close relationship with each other, so the virus was spreading among all three teachers. By tracing back to the index patient’s infection source, we found that the most probable source was the exposure to a tuberculosis patient four days before the index patient’s symptom onset. Unfortunately, this tuberculosis patient lived far away and we were not able to reach the person by phone. The first-year students had more theoretical classes and spent more time in the classroom and had more contact with teachers compared with students in other years.

There were five students with laboratory tests positive for H1N1pdm09 and thirteen with negative results. The influenza virus can be detected from throat and nasopharyngeal swabs obtained within three days of onset of illness. In this outbreak, the samples were collected from the students during the recovery stage because we were notified five days after the symptom onset of the index case which explained the low proportion of virus detection.

An influenza case can be infectious from one day before the onset of symptoms to five days after the illness onset.<sup>10</sup> From a study of Praekunatham, median duration from onset of symptoms to the last day of viral shedding detected was five days (range 3-9 days).<sup>11</sup> We found that the students with influenza infection returned to the training hospital while they were still able to shed the virus. Fortunately, no new cases were reported in the hospital after the students returned to the institute. Most of the affected students were in the first year and did not go to the hospital. This can be a reason why no influenza cases occurred in the hospital after students returned to the institute. If the second- and third-year students were affected more than the first-year students, they might serve as the source of influenza virus transmission to the high-risk hospitalized patients, such as the elderly or children and infants.

## Public Health Actions and Recommendations

All of the training institutes and the affiliated hospitals should have an annual influenza vaccination plan for students and healthcare workers to protect themselves and prevent high-risk groups from contracting the disease and spreading the viruses. The accommodation arrangement in the dormitory of the institute should provide enough space to minimize person-to-person viral transmission. The institute should require workers and nurses not to go for working and to remain in the dorms up to seven days after the onset of ILI.<sup>10</sup> The training sessions with regular refreshing should be given to all hospital staff and students at the institute to emphasize the importance of prevention and control measures and to maintain good personal hygiene.

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## Biographical Sketch

Dr. Samsad Rabbani Khan, currently working as Senior Scientific Officer at Institute of Epidemiology, Disease Control and Research (IEDCR). Research interest in field epidemiology.

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### Suggested Citation

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