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Inside

Pandemic (H1N1) 2009 in Bangladesh

During 18th June–23 September 2009, the Institute of Epidemiology, Disease Control and Research (IEDCR) and International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) identified 604 cases of pandemic (H1N1) 2009. The median time for case-patients to present for medical attention was 7 days from the onset of symptoms. Eighty-six percent of patients were ambulatory and had mild disease and 15 (2%) met the case definition for severe acute respiratory infection. Two case-patients without pre-existing conditions who received oseltamivir more than 2 weeks after symptom onset died. A third person who tested positive for pandemic (H1N1) 2009 and had an unspecified cardiac disorder died (case fatality proportion = 0.5%). Bangladeshis who have respiratory distress or risk factors for severe disease should present to a hospital within 48 hours of symptom onset for presumptive treatment with oseltamivir.

During March 2009, Mexico experienced outbreaks of respiratory illness and increased reports of patients with influenza-like illness (ILI). On April 23, laboratories in Canada and the United States confirmed that samples from Mexican patients tested positive for pandemic (H1N1)

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2009 virus (1). The virus spread swiftly, presumably through air travellers unknowingly infected with pandemic (H1N1) 2009. On June 11, 2009 the World Health Organization (WHO) declared a pandemic (2). Since then, pandemic (H1N1) 2009 has spread throughout the world with more than 318,925 laboratory confirmed cases and 3,917 deaths with a case fatality ratio of 1.2% as of September 20, 2009. In the WHO designated south east region of the world, surveillance has identified 30,293 cases and 340 deaths (case-fatality proportion=1.1)(3). In India, among recognized cases, the case fatality proportion is 2.6% (4).

Following the pandemic declaration, the Ministry of Health and Family Welfare of Bangladesh enhanced surveillance for pandemic (H1N1) 2009 infection to complement existing hospital based sentinel surveillance and community based influenza surveillance. IEDCR started screening travellers at all major ports of entry starting on 29 April 2009. IEDCR and ICDDR,B identified cases of pandemic (H1N1) 2009 through air and land port screening of passengers, event based surveillance, self-reporting of cases, sentinel hospital-based surveillance in 12 hospitals (6 government and 6 private hospitals), community based surveillance at Kamalapur and Mirpur, Dhaka, nosocomial surveillance, and surveillance at the ICDDR,B hospital. Health personnel at ports of entry collected a throat swab and nasal swab from passengers who self-reported having fever >38˚C and cough, sore throat, or shortness of breath. At sentinel hospitals, physicians collected throat and nasal swabs from ambulatory patients with ILI 2 days during each month and from all admitted patients who met the case

Box 1: Case definitions and treatment recommendations

Severe acute respiratory illness (SARI):

Hospitalized patient with

– History of fever within 21 days and

– Cough or sore throat

Requires presumptive treatment with oseltamivir within 48 hours of symptom onset

Severe pneumonia:

Cough or difficult breathing and

– Chest indrawing or

– Stridor in calm child or

– History of convulsions or

– Not able to drink or

– Lethargic or unconscious or

– Vomits everything

Requires presumptive treatment with oseltamivir within 48 hours of symptom onset

Influenza like illness (ILI):

Any patient presents with

– Fever with

– Cough or sore throat

Requires presumptive treatment with oseltamivir within 48 hours of symptom onset if patient is aged <5 years, >65 years, or has diabetes, chronic heart or lung disease, asthma, chronic liver disease, neurologic or neuromuscular, haematologies, metabolic disorders, immune suppression, cancer, obesity, or pregnancy

definition of severe acute respiratory infection (SARI) (Box 1). At Kamalapur and Mirpur, physicians obtained nasal washes from children identified during biweekly active surveillance who met the case definition for acute respiratory infections. All samples were transported in viral transport media maintaining the cold chain during transport to laboratories at IEDCR and ICDDR,B and then tested by real time polymerase chain reaction using 4 sets of primers, including influenza A, universal swine, pandemic (H1N1) 2009, and a control for human genetic material following Centers for Disease Control and Prevention, Atlanta, USA (CDC) protocols (5).

A joint team comprised of IEDCR, ICDDR,B and WHO-Bangladesh followed the first 100 identified case-patients with pandemic (H1N1) 2009 and their household contacts for ten days after cases were identified. If any close contacts developed ILI, then an IEDCR/ICDDR,B team visited the contact's house and collected respiratory samples for testing. Health authorities treated individuals who tested positive for pandemic (H1N1) 2009 with oseltamivir 75mg twice daily for 5 days and asked them to voluntarily stay at home in isolation for ten days from the day of diagnosis.

As of September 23, IEDCR and ICDDR,B identified 604 cases of pandemic (H1N1) 2009 (Figure 1). Twenty six case-patients (4%) were identified from event based surveillance at ports and at hospitals. Sixty percent were male. The median age of patients who tested positive for pandemic (H1N1) 2009 was 14 years (range: 0.1-72 years) (Figure 2). The first pandemic (H1N1) 2009 case-patient was identified at the Travellers Clinic at ICDDR,B. An additional thirty-three (5%) of all 604 identified cases occurred among travellers. Of the 46 case-patients with known occupations, 33% were preschool children, 28% were students and 17% were health care professionals. At the time of publication identification of cases throughout the country was continuing.

Figure 1: Date of onset of illness of pandemic (H1N1) 2009 confirmed case-patients identified by surveillance platform during June-September, 2009 in Bangladesh

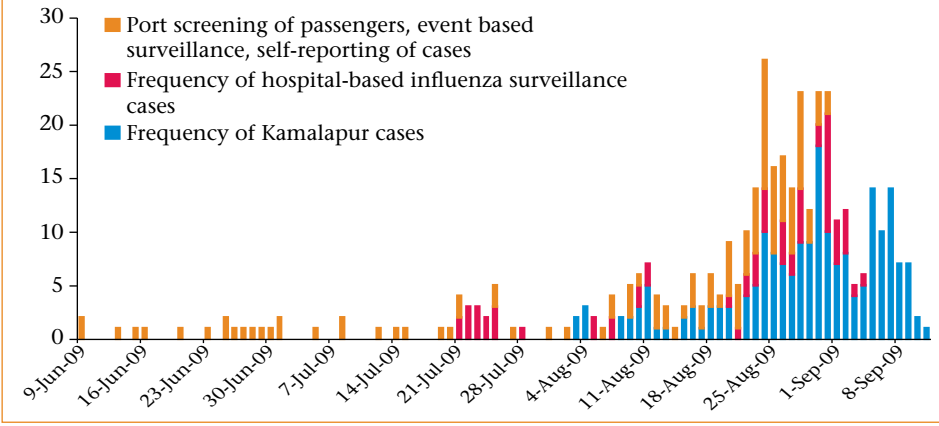


Figure 2: Age of pandemic (H1N1) 2009 confirmed case-patients during June-September, 2009 in Bangladesh

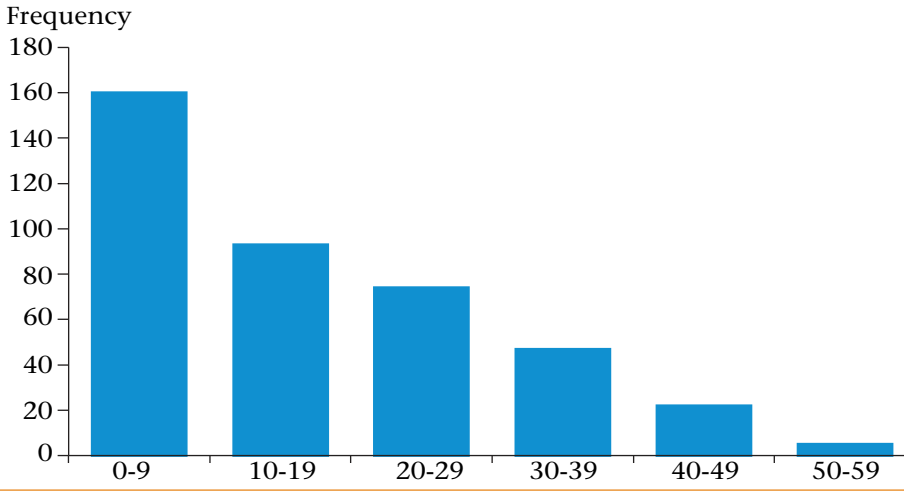
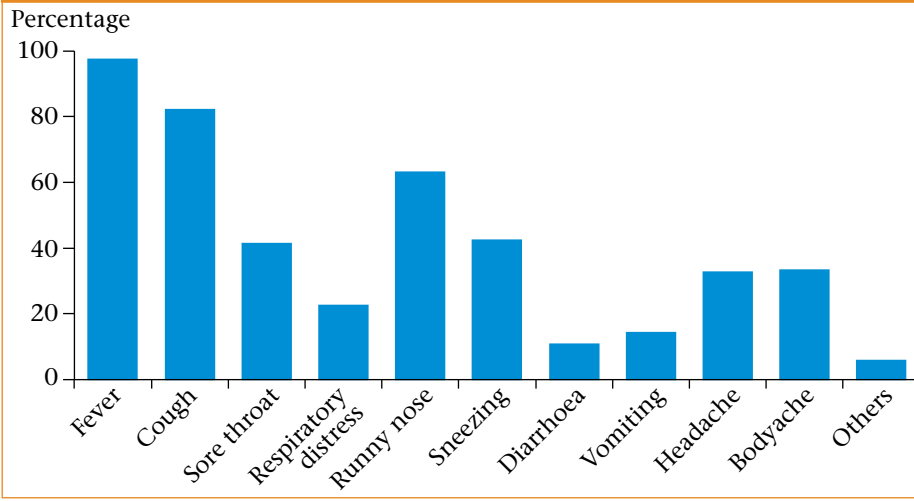


Figure 3: Symptoms of pandemic (H1N1) 2009 confirmed case-patients during June-September, 2009 in Bangladesh



Pandemic (H1N1) 2009 case-patients presented to medical attention a median of 7 days after onset of symptoms. Among the 134 for whom clinical data are available, 6 (4%) had chronic obstructive pulmonary disease, 3 (2%) had diabetes, and 1 (1%) had chronic heart disease (excluding hypertension). One woman who tested positive for pandemic (H1N1) 2009 was pregnant.

Pandemic (H1N1) 2009 cases frequently reported subjective fever (95%), dry cough (85%), sore throat (46%), difficulty breathing (22%), vomiting (17%), and diarrhoea (13%) (Figure 3). Four hundred and ninety-seven (86%) patients were ambulatory and had mild disease. Of these 130 with known symptoms, 116 (89%) met the ILI case definition. Eighty-three (14%) case-patients were hospitalized. Fifteen (75%) of the 20 hospitalized patients with symptoms met the case definition of SARI. Of the 76 patients who had chest radiographs, 60 (29) had alveolar infiltrates, and 8 (4%) had interstitial infiltrates. Typically, case-patients with known treatment history received oseltamivir after they tested positive for pandemic (H1N1) 2009 a median of 7 days after symptom onset. Two deaths occurred among those who tested positive for pandemic (H1N1) 2009 in individuals without diagnosed pre-existing conditions who presented and received treatment for oseltamivir more than 2 weeks after symptom onset. A third person who tested positive for pandemic (H1N1) 2009 who had an unspecified cardiac disorder died. Vignettes of two cases are presented below:

Case 1:

A 20 year old male from Chittagong developed high fever and cough on 7 August 2009. He was taken to the outpatient department of the sentinel surveillance hospital at Chittagong and was randomly sampled for specimen collection. The sample tested positive for pandemic (H1N1) 2009 virus. The investigators contacted him by telephone and found that all 8 family members of that household had influenza-like illness. Household members reported that an ill relative recently visited from Dhaka. When the investigation team went to their home, 3 members were sick and during follow-up, all tested positive for pandemic (H1N1) 2009. Presumptive treatment with oseltamivir 75mg twice daily for 5 days was given to all the family members who had influenza-like illness and all of them recovered without complications.

Case 2:

On the third day after developing severe pneumonia, a 3 month old malnourished female was admitted to a surveillance hospital on 5 August, 2009. She received ceftriaxone for severe pneumonia and a surveillance physician collected a routine nasal and throat swab for influenza testing. On 15 August 2009 her sample tested positive for pandemic (H1N1) 2009. Since oseltamivir was not initially recommended for children aged less than 1, she was not treated with oseltamivir on admission. Her condition deteriorated. On 19 August the investigation team visited the hospital and found her in critical condition. The next day, on the 16th day of her illness, the child was given oseltamivir, but her condition did not improve. On 2 September 2009, she died.

IEDCR and ICDDR,B followed the first case-patients by telephone and identified 23 contacts who lived in the same dwelling as case patients. Out of 12 contacts followed-up, 2 developed ILI within 10 days of the case-patient (secondary attack rate was 17%). In addition, Kamalapur has identified a total of 280 ambulatory patients tested for pandemic (H1N1) 2009 out of a population of 30,000 (prevalence 9 cases per 1,000 persons). Surveillance of Epidemiology of Influenza Study has also identified 12 ambulatory case-patients from their catchment area. Out of all 604 pandemic (H1N1) 2009 case-patients identified, 3 have died (case fatality proportion = 0.5%).

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Comments

Bangladesh maintains an extensive surveillance network to track influenza activity throughout the year. This surveillance network identified the introduction of pandemic (H1N1) 2009 in port cities and tracked its spread throughout the country. These surveillance findings are consistent with analyses of timing and geographical patterns of the spread of seasonal influenza in Bangladesh (Zaman – unpublished data).

The vast majority of people in Bangladesh who become infected with pandemic (H1N1) 2009, including those who die, will never be tested for the virus and will never become confirmed cases. The limited testing available for pandemic (H1N1) 2009 is to support public health surveillance. Assuming that the prevalence of pandemic (H1N1) 2009 in Kamalapur is representative of Dhaka and that Surveillance of Epidemiology of Influenza Study is representative of rural Bangladesh, surveillance findings suggest that as of 23 September 2009, there have been approximately 135,000 people ill with pandemic (H1N1) 2009 in urban Dhaka and 321,000 in rural Bangladesh.

Based on the pattern of transmission observed in the previous two years for seasonal influenza, pandemic (H1N1) 2009 is likely to continue to spread throughout Bangladesh during the next several weeks and resurface during the 2010 influenza season from April-October. Important steps to prevent influenza transmission include: frequent hand washing with soap; avoiding touching eyes, nose and mouth; covering coughs and sneezes with elbow and not hands; and avoiding close (<3 feet) contact with people with respiratory symptoms. Individuals who become ill should stay home and avoid coming within 3 feet of others. Those who develop influenza-like illness (i.e. fever, cough or sore throat) including children under 5, the elderly over 65, women who are pregnant and people with risk factors for diabetes, chronic heart or lung disease, asthma, chronic liver disease, neurologic or neuromuscular,

haematologic, metabolic disorders, immune suppression, cancer, and/or obesity, should seek treatment with oseltamivir. Those who develop fever, cough/sore throat and difficulty breathing should seek hospital care within 48 hours of symptoms onset.

Bangladeshis who have respiratory distress or risk factors for severe disease should present to the hospital for early evaluation and presumptive oseltamivir treatment (Box 1). Delays in receiving oseltamivir are associated with prolonged hospitalization and death (Rodriguez-Noriega, unpublished data). Testing of patients with pandemic (H1N1) 2009 is not required outside of routine surveillance activities and must not delay treatment with oseltamivir. While our current case-fatality proportion is low in comparison to that of Mexico early in the pandemic, our two decedents received oseltamivir more than 96 hours after symptom onset.

At the National Institute of Respiratory Diseases in Mexico City, 12 (67%) out of 18 patients required mechanical ventilation and 7 (39%) patients died (6,7). The discrepancy between our case series and data from Mexico may be explained by when the populations were affected by the epidemic. The National Institute of Respiratory Diseases data were collected during March 24-April 24, 2009, when it was still unclear that a proportion of cases with severe acute respiratory infections had pandemic (H1N1) 2009. In contrast, Bangladesh had ample warning and preparedness before the introduction of pandemic (H1N1) 2009. On average, case-patients in Bangladesh started oseltamivir within 7 days of symptom onset whereas patients reported in the Mexico City case series presented with more severe disease an average of 8 days after illness onset and received oseltamivir later. To keep our case-fatality proportion low, Bangladesh must now focus on decreasing delays in treatment and ensuring that people at high risk of complications, including SARI patients and those with ILI, receive oseltamivir within 48 hours of symptom onset.

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Clusters of severe acute respiratory infections caused by influenza A/H3 in Bangladesh – 2009

Since April 2007, ICDDR,B and IEDCR have conducted sentinel surveillance at 12 hospitals located throughout Bangladesh to identify novel and seasonal influenza viruses. In May 2009, we amended the surveillance protocol to increase the sensitivity for detecting hospitalized influenza cases and clusters of severe acute respiratory illness. During May-June 2009, the surveillance physicians collected 523 samples and 183 (35%) of them had influenza. Among 283 hospitalized cases, 99 (35%) tested positive for influenza A/H3. We also identified 6 clusters of severe respiratory illness. Among 12 patients included in those clusters, 5 (42%) had influenza A/H3 infection.

Seasonal influenza viruses infect 5-15% of the global population per year, resulting in 250,000-500,000 deaths (1). There are three types of influenza viruses – A, B and C. Type A viruses frequently change their genome and subsequently cause seasonal epidemics and pandemics (1,2). Influenza A virus has two surface glycoproteins – haemagglutinin and neuraminidase. All 16 haemagglutinin and 9 neuraminidase subtypes of influenza A viruses are found in birds. Only three haemagglutinin subtypes (H1, H2 and H3) and two neuraminidase subtypes (N1, N2) have established stable lineages in humans. H1N1 and H3N2 are the human seasonal influenza A subtypes that are currently in global circulation (1,2). Periodically influenza viruses

undergo major genetic changes that cause a pandemic. Currently the world is experiencing a pandemic with a triple reassortant influenza A (H1N1) virus (3).

Among human influenza viruses, influenza A/(H3N2) causes the largest number of hospitalization and deaths (4, 5). A group of scientists estimated that H3N2 epidemics during 1972-1992 caused 23,000-45,000 deaths per season in the United States, while the H1N1 and influenza B epidemics typically caused up to 23,000 deaths (4). The group also reported that during 1970-1995, hospitalization for acute respiratory infection was estimated at 142,000 per season, in comparison to 74,000 during H1N1 seasons (5). Systemic or lower respiratory illness are also more common with H3N2 infections than with H1N1 infections (6,7). There are much less data available on influenza burden in low income countries. In April 2007, the Institute of Epidemiology Disease Control and Research (IEDCR) of the Government of Bangladesh and ICDDR,B established an influenza surveillance network in 12 hospitals across the country to identify individuals and clusters of people with severe influenza infection (Figure 1). The objectives of this surveillance were to characterize the diversity of circulating influenza strains and to identify the emergence or introduction of novel strains with pandemic potential. Surveillance physicians collect throat and nasal swab specimens in viral transport media and the field assistants transport them to ICDDR,B virology laboratory to test influenza by real time reverse transcriptase polymerase chain reaction (rRT-PCR). During the first two years of the surveillance, most (96%) of the specimens collected were from patients visiting the hospitals' outpatient departments with influenza-like illness (ILI) (Box 1). During that period we conducted surveillance in the inpatient and outpatient departments of each hospital in two consecutive days each month.

Figure 1: Map of Bangladesh showing hospitals participating in the hospital-based influenza surveillance

To better understand severe influenza virus infection in Bangladesh, in May 2009, we changed the surveillance

procedures to obtain more timely samples from hospitalized case-patients. We changed the case definition of hospitalized cases and placed liquid nitrogen containers in each hospital so that we can collect and store inpatient samples throughout the month. The surveillance physicians screened patients aged more than 5 years with the case definition of severe acute respiratory illness (SARI) and they used the case definition of severe pneumonia for children aged less than 5 years (Box 1). Each month in each hospital, surveillance physicians collected samples from all adult SARI, 5 severe pneumonia and 10 ILI case-patients. They also collected demographic and clinical information in personal digital assistant (PDA) devices.

Physicians tallied the case-patients who met the case definitions to identify clusters of severe respiratory illness (Box 1). After identifying clusters the surveillance physicians immediately notified IEDCR/ICDDR,B investigators who travelled to the community to enquire about potential epidemiological links, contact history, family history, travel history, community outbreaks and poultry or animal deaths. Investigators also obtained swabs from symptomatic contacts. All samples were transported and tested within 24 hours in the ICDDR,B laboratory for a panel of respiratory pathogens including: respiratory syncytial virus, parainfluenza, metapneumo virus, adenovirus, *Chlamydia pneumoniae, Streptococcus pneumoniae, Mycoplasma pneumoniae, Legionella pneumophila* and *Legionella longbeachae*. In this article we review the findings from the surveillance system and the cluster investigations during the early 2009 influenza season.

Box 1: Surveillance case definitions

Severe acute respiratory illness (SARI):

Hospitalized patient with

– History of fever within 21 days and
– Cough or sore throat

Severe pneumonia:

Cough or difficult breathing and

– Chest indrawing or
– Stridor in calm child or
– History of convulsions or
– Not able to drink or
– Lethargic or unconscious or
– Vomits everything

Influenza like illness (ILI):

Any patient presents with

– Fever with
– Cough or sore throat

Cluster:

Two or more severe acute respiratory illness or severe pneumonia case-patients:

– Who live within a 30 minutes' walk or within 3 kilometer radius and
– Developed symptoms within 7 days of each other

During May-June 2009, we collected 523 samples and 183 (35%) of them had laboratory confirmed influenza (Table 1). In 2009, the influenza season started in April and in May there was increased activity dominated by influenza A/H3

virus (See surveillance update on page 21). In this article we focused on 283 hospitalized adult and pediatric case-patients; ninety-nine (35%) tested positive for influenza. The median age of the hospitalized influenza case-patients was 25 years. Among 176 male case-patients 53 (30%) and among 107 female case patients 46 (43%) were influenza positive (p-value <0.05). Hospitalized A/H3 cases were observed in all surveillance sites with the proportion of laboratory confirmed cases A/H3 ranging from 8% of collected samples at Sylhet hospital to 55% at Chittagong hospital. Among all cases, 213 (75%) were rural residents. Hospitalized influenza cases were significantly more frequently identified in Kishoregonj which represented 25 (25%) of 99 positive cases (p-value <0.001).

Table 1: Proportion of laboratory confirmed influenza identified by IEDCR/ ICDDR,B hospital-based influenza surveillance during May-June 2009 in Bangladesh

	Samples collected N	Influenza A/H1 n (%)	Influenza A/H3 n (%)	Influenza A/H5 n (%)	Influenza B n (%)
SARI	186	0 (0)	72 (39)	0 (0)	0 (0)
Severe pneumonia	97	0 (0)	27 (28)	0 (0)	0 (0)
ILI	240	0 (0)	83 (35)	0 (0)	1 (<1)
Total	523	0 (0)	182 (35)	0 (0)	1 (<1)

Fever was part of the case definition, and was therefore present in all 62 SARI cases with influenza. Other frequent symptoms were cough (100%), and difficulty breathing (61%). All 22 influenza positive severe pneumonia patients had fever and cough. Other frequent symptoms in this group were chest indrawing (96%), difficulty breathing (91%) and runny nose (59%). None of the hospitalized cases died during their hospitalization.

During May-June we identified 6 clusters of severe respiratory illness. In these clusters there were 12 individuals with SARI or severe pneumonia, and 5 (42%) who tested positive for influenza A/H3 infection. Two cases had parainfluenza-3 virus infection and 5 were negative for our panel of respiratory pathogens (Table 2). All of them had fever, cough and respiratory distress. All 4 patients in the clusters had fast breathing and chest indrawing. Among the 5 influenza A/H3 cases included in the clusters, 4 were aged <5 or >65 years and the remaining case had previously diagnosed chronic lung disease (bronchial asthma). All 12 case-patients in the clusters fully or partially recovered after a mean (±SE) of 8 (±0.6) days of hospital stay. All of them were treated with antibiotics and supplemental O_2 inhalation, but oseltamivir or other antivirals were not used in any of these cases. Cluster patients who tested positive for influenza A/H3 reported concurrent upper respiratory tract infections in their community.

Table 2: Demographic characteristics and laboratory findings of the patients in clusters identified from IEDCR/ICDDR,B hospital-based influenza surveillance during May-June 2009, Bangladesh

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
Date	May 05	May 25	June 05	June 06	June 15	June 26
District	Kishoreganj	Kishoreganj	Khulna	Rajshahi	Kishoreganj	Sylhet
Relations	Relatives	Unrelated	Unrelated	Brothers	Unrelated	Brothers
Case 1						
Age	22 years	72 years	18 years	8 months	67 years	5 months
Sex	Female	Female	Female	Male	Male	Male
Risk factor	Asthma	Elderly	Poultry death	Raise poultry	Elderly	None
Lab result	Flu A/H3	Unknown	Unknown	Flu A/H3	Unknown	Paraflu-3
Case 2						
Age	90 years	30 years	14 years	8 months	65 years	5 months
Sex	Male	Male	Male	Male	Female	Male
Risk factor	Elderly	None	None	Raise poultry	Elderly	None
Lab result	Flu A/H3	Unkown	Unknown	Flu A/H3	Flu A/H3	Paraflu-3

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Supported by: Centers for Disease Control and Prevention (CDC), USA

Comments

Seasonal influenza A/H3 caused considerable hospitalization and clusters of severe acute respiratory infection in the early part of influenza season in Bangladesh during May-June 2009. This is compatible with published articles reporting higher virulence of influenza A/H3 compared to other seasonal influenza viruses (6,7). A quarter of the cases were identified in Kishoregonj, suggesting a large community outbreak of influenza A/H3 in that region. In the previous influenza seasons in Bangladesh, we observed simultaneous circulation of seasonal influenza A/H1, A/H3 and B (See surveillance update in page 22). This year, the early part of the season was almost entirely dominated by influenza A/H3, with only one influenza B case identified. From July 2009, our surveillance system has identified the pandemic strain of influenza A/H1 (see article on page 1).

Identification and investigations of clusters of hospitalized severe acute respiratory illness cases provided important insight on community outbreaks of influenza. All of the cases of influenza A/H3 clusters were either infants, people over 65 years old, or those who had chronic lung disease. This supports the published data that seasonal influenza virus causes severe illness and deaths more frequently in extreme age groups and in people with chronic

heart or lung disease (1,4,5). Some of the cluster specimens were negative for all pathogens tested. These samples are undergoing further evaluation.

Influenza can be prevented and controlled by non-pharmaceutical (e.g. respiratory hygiene, hand hygiene and social distancing) and pharmaceutical interventions such as vaccination and medications (8). Maintaining respiratory hygiene by covering mouth and nose during coughing and sneezing and frequent handwashing can significantly reduce the transmission of respiratory pathogens (9,10). Our surveillance suggests that there are frequent clusters of hospitalized acute respiratory illness in Bangladesh. Identifying and reporting these clusters can be very effective in early identification of large community outbreaks. The co-circulation of influenza A/H3, H5, and pandemic (H1N1) 2009 viruses places Bangladesh at risk of reassortant virus. Clinicians throughout the country should be vigilant in identifying hospitalized clusters of severe acute respiratory diseases and report them immediately to IEDCR.

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Outbreak of hepatitis E in a low income urban community in Bangladesh

On 1 January 2009 a cluster of 10 deaths in women of reproductive age with jaundice was identified in an urban slum, adjacent to Dhaka city. We investigated the outbreak to determine the burden, aetiology, perception and causal explanation of jaundice, and to generate hypotheses about risk factors. The population density is approximately 100,000 per square kilometer. Water samples from the two municipal pumps were clean; however, water coming from the households' taps was highly contaminated with faecal coliforms. The attack rate of jaundice with onset between August to December 2008 was 3% (4,188/128, 899). We identified 20 deaths associated with jaundice. Seventy-seven percent (56/73) serum samples from persons with jaundice were IgM antibody positive to hepatitis E virus. This large outbreak was apparently due to water contamination through an ineffectively maintained water distribution system. Practical, affordable and effective approaches to improve drinking water quality in these rapidly growing communities are needed.

Hepatitis E virus (HEV), a single-stranded RNA virus, causes regular outbreaks in South Asia through faecal contamination of drinking water (1-4). Pregnancy with HEV infection results in severe illness with poor outcomes for maternal and fetal health (5,6).

On 1st January 2009, a colleague at ICDDR,B who was conducting surveillance as part of the Manoshi maternal and child health project (7) reported a cluster of 10 deaths in women of reproductive age due to jaundice since August, 2008. Four of the 10 women were reportedly pregnant at the time of death. We suspected that the cause of these deaths was due to HEV given that outcome of HEV infection during pregnancy is commonly fatal (5). ICDDR,B and the Institute for Epidemiology, Disease Control and Research (IEDCR) jointly investigated the outbreak to determine the burden and aetiology of infection and to identify the possible risk factors of the outbreak.

The survey was conducted in two communities, East Arichpur and West Arichpur, in the urban slum of Tongi, 15 km north of Dhaka from January 12 to April 15. A case of jaundice was defined as a person reporting yellowing of eyes or skin with onset from August 2008 until the date of the interview. From January 12 to February 23, 10 field research assistants surveyed every household in East Arichpur and every 5th household in West Arichpur to list the number of people in each household, jaundice cases and outcomes (death, recovered and currently ill). Between March 5-April 15, the team again visited every household in East Arichpur to assess the status of the outbreak from January to date of interview. In addition, the team surveyed every 5th household and listed the number of reported pregnancies, women

who experienced jaundice during pregnancy, and their pregnancy outcomes (live birth, miscarriage/still birth, neonatal death) since August 2008.

The area of East Arichpur is 0.5 square kilometer. The team visited 12,938 households where 50,941 people live. The area of West Arichpur is about 0.75 square kilometer with approximately 16,326 households and 77,975 inhabitants. The population of both East and West Arichpur was >100,000 per square kilometer. This low income population worked mainly in the garment industry, but some were rickshaw pullers and day labourers. The most common living arrangements were 10-15 households living in a compound. The whole compound shared a common oven, water source and toilet. The Manoshi maternal and child health project reported that approximately 40% of slum residents migrate in or out of the slum each year.

A total of 18% (2,273/12,938) of households were affected with jaundice in East Arichpur and 11% (1,920/16,326) in West Arichpur between August and December, 2008. The individual attack rate of jaundice was 5% (2,513/50,941) in East Arichpur and 2% (1,675/77,985) in West Arichpur. Jaundice was most common among persons 16-40 years of age (Table 1). In addition to the 10 deaths first identified in women in East Arichpur by the Manoshi project, the team identified 10 additional deaths during the survey in both sites; five adult males, 10 adult females (four that were known to be pregnant), three neonates and two stillborn babies born at term to women with jaundice. The overall case fatality rate was 0.3% (N=20) in both areas.

Table 1 : Demographic characteristic of jaundice cases and attack rate in East Arichpur and West Arichpur

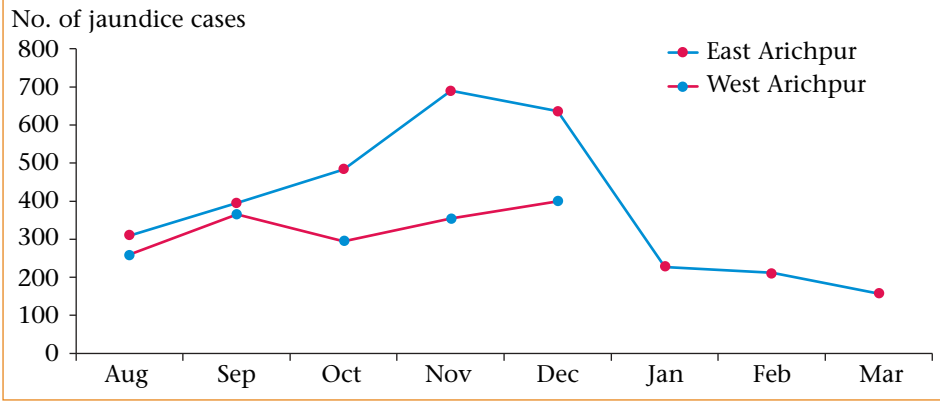
Demographic characteristics	East Arichpur (N=2523) n (%)	West Arichpur (N=1675)* n (%)	Both areas (N=4198) n (%)	Estimated attack rate in East Arichpur† n/N (%)
Age in years				
Mean (SD)	25 (14)	25 (14)	25 (14)	
Median (range)	22 (0-98)	24 (0-72)	23 (0-98)	
Age group				
0-5 years	150 (06)	155 (09)	305 (6)	150/5,960 (2.5)
6-15 years	412 (16)	245 (15)	657 (16)	412/9,590 (4.3)
16-40 years	1,641 (65)	1,070 (64)	2,611 (65)	1,641/29,415 (5.6)
>40 years	310 (12)	205 (12)	515 (12)	310/7,455 (4.2)
Sex				
Male	1,275 (51)	945 (56)	2,220 (51)	1,275/27,350 (4.7)
Female	1,238 (49)	730 (44)	1,968 (49)	1,238/25,070 (4.9)

*Every fifth household was visited in West Arichpur. The real number were multiplied by 5 to estimate total number of cases

†Every fifth household was visited in East Arichpur to record age group. The real number was multiplied by 5 to estimate total number by age group and sex. The number of jaundice cases were from August-December and the population denominator in different age group and sex were from the March survey

Monthly incidence of jaundice increased from August through November 2008 and then decreased at a lower level through March 2009 (Figure 1). One percent (603) of the population had jaundice between January and March in East Arichpur. Twenty-three percent people who had jaundice returned home for treatment or recovery.

Figure 1: Monthly incidence of jaundice: August 2008-March 2009



The cross-sectional survey among women in every 5th household in East Arichpur found 270 incidents of pregnancy between August 2008 and March 2009, among which 21 (8%) women reported having jaundice during pregnancy. Of these 21 pregnancies, 8 (38%) women were still pregnant at the time of the survey, 4 (19%) ended in miscarriage or still birth, and 9 (43%) resulted in live births. Of the 9 live births, 1 (11%) resulted in a neonatal death. Out of the 248 pregnancies without jaundice, there were 23 (9%) miscarriages or stillbirths, and 100 (40%) live births, 3 of which resulted in neonatal deaths (3%). Pregnancies associated with jaundice were at increased risk for miscarriage and neonatal death compared to pregnancies without jaundice (RR 2.2; 95% CI 1.1-4.3) (Table 2).

Table 2: Outcome of pregnancy with jaundice and without jaundice in East Arichpur from August 2008-March 2009

Outcome	Pregnancy with jaundice (N=21) n (%)	Pregnancy without jaundice (N=248) n (%)	Total (N=269) n (%)
Still pregnant at follow up	8 (38)	126 (51)	134 (50)
Miscarriage	4 (19)	23 (9)	27 (10)
Live birth	9 (43)	99 (40)	108 (40)
Neonatal death	1/9 (11)	3/99 (3)	4/108 (04)

We collected epidemiological and clinical information from all identified deaths and from jaundice cases in the same compound, along with their serum specimens to test for IgM antibodies to HEV and hepatitis A viruses (HAV). A total of 92 people agreed to participate in our survey: 75 survived cases and respondents of 17 deaths (16 from East Arichpur; 1 from West Arichpur). The most common clinical presentations were either yellow eyes (97%) or yellow skin (79%) or both (77%). Other commonly reported symptoms were fever (90%), anorexia (87%), weakness (82%), nausea (78%), vomiting (50%), abdominal pain (49%), headache (30%) and diarrhoea (25%). Fifty two (62%) were female and 43 were in reproductive age. Among females of reproductive age, 8 (14%) were pregnant with jaundice. Of them, 4 (50%) died. In the reproductive age of 15-45 years, pregnant women with jaundice are 5 times more likely to die than non-pregnant women with jaundice. (OR 4.8; 95% CI 0.73-34.2, P = 0.47).

Out of 75 survived cases, 73 serum specimens were tested for IgM antibodies to HEV and HAV. Two refused to give blood. Fifty six out of 73 cases (77%) had IgM antibodies against HEV and 7 (10%) had IgM antibodies against HAV (Table 3).

Table 3: Serological results for HAV and HEV (N=73)

	Anti HAV IgM		
	Positive	Negative	Total
Anti-HEV IgM			
Positive	4	52	56
Negative	3	14	17
Total	7	66	73

The outbreak investigation team observed and explored water distribution systems in the area and tested municipal pump water and tap water in houses of the deceased to assess contamination by faecal coliforms. The investigation team identified several pathways for contamination of water.

Water samples from two municipality distribution pumps, an underground shallow tube well, and seven taps in the deceased households were tested. The water from city distribution pumps and the underground pump were clean: the water did not have any faecal coliform. However, the tap-water samples collected from households were highly contaminated with faecal coliforms (median = 38; range = 12-12,000) (Table 4).

An anthropologist, experienced in outbreak investigations, explored community perceptions regarding jaundice, causal explanation of jaundice, and hygienic practices and care seeking behaviour during jaundice. Most residents did not consider jaundice to be a serious disease. They typically go to the *kabiraj* (traditional healer) for jaundice treatment as they believe doctors do not provide any treatment for jaundice other than rest. The community perception for jaundice is that faecal matter mixed with water and float over the submerged roads and drains and causes a foul smell in the

air that likely causes jaundice. They do not perceive that impure drinking water causes jaundice.

Table 4: Water supply bacteriological test results

Water samples	Total coliform*	Faecal coliform*	Total bacterial count†
City distribution pumps			
Pump water 1 (N=1)	0	0	180
Pump water 2 (N=1)	0	0	330
Shallow tubewell (N=1)	0	0	20
Pipeline water supply (N=7) Median (range)	71 (16-13,000)	38 (12-12,000)	7200 (2,080-12,600)

*Acceptable level is zero according to WHO guidelines for drinking water.
†Acceptable level of total bacterial count is <500/ml according to Environmental Protection Agency (EPA), USA

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Supported by: Centres for Disease Control and Prevention (CDC), USA

Comments

This was a large outbreak of hepatitis E with a large public health burden. In the survey area, 14% of households had at least one jaundice case. The individual attack rate of jaundice was 3%, which is higher than most other reported outbreaks of South Asia (3). The higher death rate in pregnancy and poor fetal and neonatal outcome in the outbreak area are consistent with other investigations of HEV infection in pregnancy (6,8). Increased disease severity and poor health outcome during pregnancy are likely due to decreased immunity, poor nutritional condition, high virus load and virulent genotypes or subtypes of HEV (8-10).

The disease was likely transmitted through leakage in the water distribution system. Several factors likely contributed to leakage in the water pipelines and to contamination of water in distribution lines. The area is low lying and prone to flooding. The water pipelines pass adjacent to sewerage lines which are both submerged during heavy rain. The pipelines pass through contaminated surface water and in some areas pass directly through open sewers. There are reports from the pump engineers that there have been leaks in the main lines, which may have contributed to water contamination. In addition, many residents make their own connections to main water lines where leaks into the system may occur. The slum's water supply is intermittent, resulting in negative pressure on the line that may draw sewage

in through breaches in the pipes. The contamination was evident by the absence of coliform organisms in water of the main municipal distribution pumps, but the supplied drinking water at the household level was highly contaminated with faecal coliform (median = 38; range = 12-12,000).

The problem of severely compromised water distribution systems is a common problem in urban Bangladesh. The water quality, distribution and maintenance systems are inadequate to meet community water demand.

Preventing transmission of hepatitis E and other waterborne pathogens including cholera, typhoid, and hepatitis A, requires improving the microbiological water quality of low income urban residents. The best methods are to improve water and sanitary infrastructure that separate sewage from drinking water. But this will unlikely happen in the short term due to high costs. Boiling all drinking water would be effective, but with an average of 12 households sharing a single stove, and each household receiving only 90 minutes per day of oven time to prepare meals, there is insufficient time to boil all drinking water for the household.

Water treatment with chlorine at the point of use is another possibility for decontamination of water. However, in a large outbreak of hepatitis E at a Sudanese refugee camp, drinking surface water that was regularly chlorinated (0.3-0.6 mg/L) was a risk factor for developing hepatitis E compared to persons who collected their water from a deep well. This was likely due to adding too low a dose of chlorine too infrequently to inactivate HEV (11).

Low cost, practical, affordable and acceptable approaches to improve drinking water quality in these growing communities are needed.

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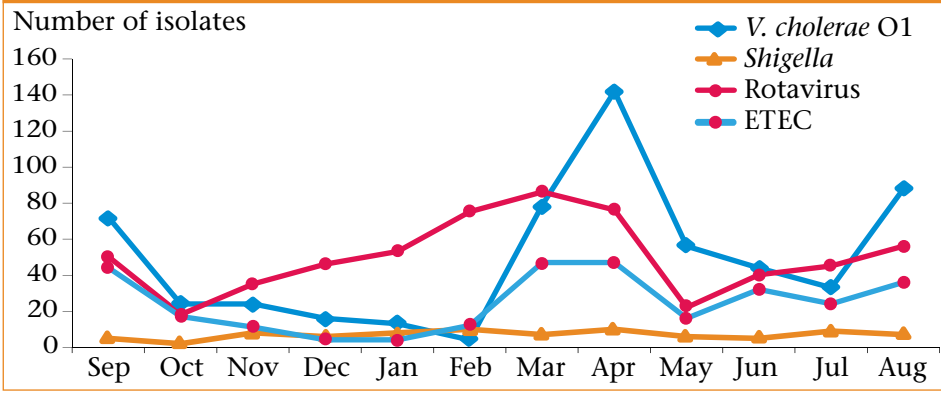
Surveillance Updates

With each issue of the HSB, updates of surveillance data described in earlier issues are provided. These updated tables and figures represent the most recent observation period available at the time of publication. We hope these updates will be helpful to health professionals who are interested in current patterns of disease and drug resistance.

Proportion of diarrhoeal pathogens susceptible to antimicrobial drugs: September 2008- August 2009

Antimicrobial agents	*Shigella* (n=86)	*V. Cholerae* O1 (n=595)
Nalidixic acid	24.4	Not tested
Mecillinam	62.8	Not tested
Ampicillin	45.3	Not tested
TMP-SMX	34.9	1.2
Ciprofloxacin	76.7	99.8
Tetracycline	Not tested	15.5
Erythromycin	Not tested	0.0
Furazolidine	Not tested	0.0

Monthly isolation of* V. cholerae *O1,* Shigella*, Rotavirus and ETEC September 2008-August 2009



Antimicrobial resistance patterns of 35 M. tuberculosis *isolates: May 2008-April 2009*

Drugs	Resistance type		Total (n=35)
	Primary (n=34)	Acquired* (n=1)	
Streptomycin	8 (23.5)	0 (0.0)	8 (22.9)
Isoniazid (INH)	2 (5.9)	0 (0.0)	2 (5.7)
Ethambutal	1 (2.9)	0 (0.0)	1 (2.9)
Rifampicin	0 (0.0)	0 (0.0)	0 (0.0)
MDR (INH+Rifampicin)	0 (0.0)	0 (0.0)	0 (0.0)
Any drugs	8 (23.5)	0 (0.0)	8 (22.9)

() column percentage *Antituberculous drugs received for 1 month or more

Antimicrobial susceptibility pattern of S. pneumoniae *among children <5 years during July-September 2009*

Antimicrobial agents	Total tested (n)	Susceptible n (%)	Reduced susceptibility n (%)	Resistant n (%)
Ampicilin	1	1 (100.0)	0 (0.0)	0 (0.0)
Cotrimoxazole	1	0 (0.0)	0 (0.0)	1 (100.0)
Chloramphenicol	0	0 (0.0)	0 (0.0)	0 (0.0)
Ceftriaxone	1	1 (100.0)	0 (0.0)	0 (0.0)
Ciprofloxacin	1	1 (100.0)	0 (0.0)	0 (0.0)
Gentamicin	1	0 (0.0)	0 (0.0)	1 (100.0)
Oxacillin	1	1 (100.0)	0 (0.0)	0 (0.0)

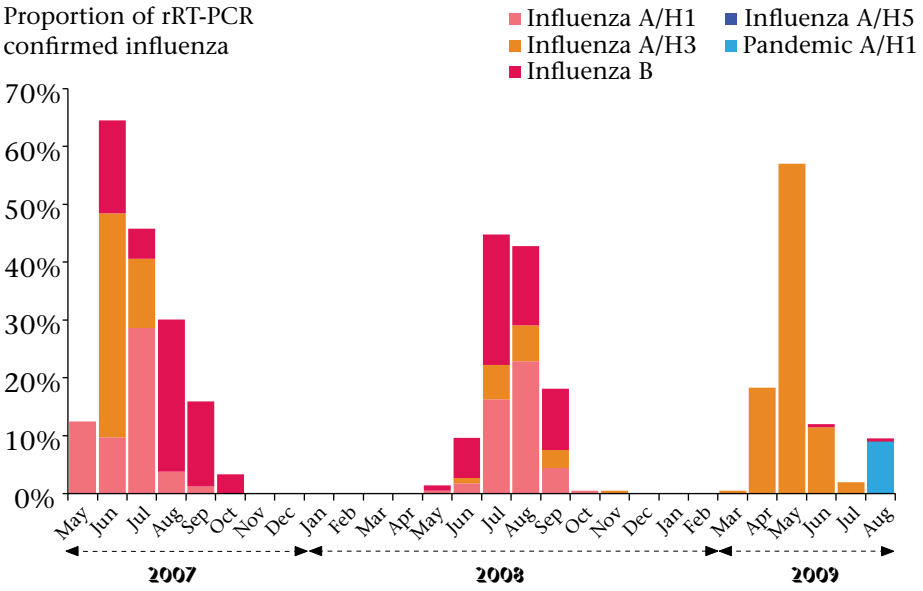
Source: ICDDR,B's urban surveillance in Kamalapur (Dhaka).

Antimicrobial susceptibility pattern of S. typhi *among children <5 years during July-September 2009*

Antimicrobial agents	Total tested (n)	Susceptible n (%)	Reduced susceptibility n (%)	Resistant n (%)
Ampicilin	26	12 (46.0)	0 (0.0)	14 (54.0)
Cotrimoxazole	26	12 (46.0)	0 (0.0)	14 (54.0)
Chloramphenicol	26	12 (46.0)	0 (0.0)	14 (54.0)
Ceftriaxone	26	26 (100.0)	0 (0.0)	0 (0.0)
Ciprofloxacin	26	0 (0.0)	24 (96.0)	1 (4.0)
Nalidixic Acid	26	1 (4.0)	0 (0.0)	25 (96.0)

Source: ICDDR,B's urban surveillance in Kamalapur (Dhaka).

Proportion of laboratory confirmed influenza among hospitalized severe acute respiratory illness (SARI) and outpatient influenza like illness (ILI) cases during May 2007 and August 2009



Source: Patients participating in hospital-based influenza surveillance in Dhaka National Medical College Hospital, Community-based Medical College Hospital (Mymensingh), Jahurul Islam Medical College Hospital (Kishoregonj), Rajshahi Medical College Hospital, Shaheed Ziaur Rahman Medical College Hospital (Bogra), LAMB Hospital (Dinajpur), Bangabandhu Memorial Hospital (Chittagong), Comilla Medical College Hospital, Khulna Medical College Hospital, Jessore General Hospital, Jalalabad Ragib-Rabeya Medical College Hospital (Sylhet) and Sher-e-Bangla Medical College Hospital (Barisal)

A confirmed pandemic (H1N1) 2009 patient under treatment at the influenza ward of National Institute of Diseases of the Chest and Hospital (NIDCH) at Mohakhali, Dhaka.

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ICDDR,B
GPO Box 128, Dhaka 1000, Bangladesh
www.icddrb.org/hsb