HSB
Health and Science Bulletin
VOLUME 10 • NUMBER 4 • DECEMBER 2012
ISSN 1729-343X

Inside

An outbreak of Chikungunya in Dohar Upazila, Bangladesh, 2011

In late October 2011, the Upazila Health and Family Planning Officer of Dohar sub-district of Dhaka District reported an outbreak of fever in four villages in Dohar. From November 2 to 21, 2011, a collaborative team from the Institute of Epidemiology, Disease Control and Research (IEDCR) and icddr,b investigated the outbreak in Char Kushai village to confirm the etiology and describe the epidemiology of the outbreak. Field research officers enlisted all inhabitants of the village and identified suspected case-patients by asking about symptoms of fever and joint pain in the past four months. Among the 3,840 inhabitants of the village, 275 met the suspect case definition and 250 (91%) of them agreed to provide a blood sample for laboratory testing. Of those 250 blood samples, 204 (82%) had IgM antibodies to Chikungunya virus. The attack rate of Chikungunya in the village was 7%, and 82% of suspect cases were ≥18 years of age. We collected larvae from artificial water containers in a random sample of households and sent them to IEDCR's entomology

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laboratory where they were hatched and the species identified. Eighty-nine percent of the hatched mosquitoes were *Aedes albopictus,* which is a known vector for Chikungunya virus. The 7% attack rate and predominance of adult cases suggest that there was little previous immunity in this community. This investigation emphasizes the emerging nature of Chikungunya in Bangladesh and the need for improved surveillance to identify outbreaks to better understand disease burden and transmission mechanisms to implement public health interventions.

Chikungunya virus is a zoonotic arthropod-borne virus (*Alphavirus* genus, Togaviridae family) first isolated in Tanzania in 1952 (1). It is endemic in Africa, India and Southeast Asia (2). The vectors are mosquitoes of the genus *Aedes*, the most common being *Aedes aegypti*, which is also a vector for dengue transmission (3). However, an outbreak during 2005-2006 in La Reunion (an island in the Indian Ocean) was associated with the vector *A. albopictus,* which allowed efficient replication and dissemination of Chikungunya virus beyond previously endemic areas (4). *A. albopictus* is resilient, thriving in both rural and urban environments (5) and since 2005, Chikungunya has become a major public health problem in Southeast Asia, with large numbers of cases reported in Singapore, Malaysia, and Thailand (6).

An outbreak of fever and severe joint pain was reported in Dohar sub-district by the Dohar Upazila Health and Family Planning Officer (UHFPO) in late October 2011. Limited antibody testing suggested that the illnesses were not caused by dengue. Following discussions with the UHFPO, the outbreak investigation team identified the village of Char Kushai for epidemiological investigation because 70% of the persons who sought medical care at the Upazila Health Complex for these symptoms resided there. The outbreak investigation team comprised medical epidemiologists, entomologists, field research officers and laboratory technicians from the Institute of Epidemiology, Disease Control and Research (IEDCR), of the Bangladesh Ministry of Health and Family Welfare, and icddr,b. The objectives of the investigation were to identify the etiology of the outbreak and describe the clinical presentation of cases.

Field research officers conducted house-to-house surveys to identify and enlist suspected cases, defined as any inhabitants of Char Kushai who reported fever followed by joint pain in the extremities from June to November, 2012. The field team administered a pre-structured questionnaire that collected socio-demographic, clinical and travel information (7) and collected blood specimens from suspected cases. Blood was tested in the IEDCR laboratory for IgM antibodies to Chikungunya virus. Approximately 25% of people with Chikungunya infection lose IgM antibodies by two months post-illness onset (8). Therefore, for the purposes of this report, we

have used suspected cases to calculate attack rates and to describe clinical symptoms rather than confirmed cases because we were unable to reliably evaluate infection among suspect cases given the time-lag between their illness onset and lab investigations.

For the entomological investigation, the village was divided into nine segments of approximately equal areas. As *Aedes* mosquitoes breed mainly in water that collects in artificial containers in the environment of human settlements (9), the entomological investigation team searched seven randomly selected houses from each segment for artificial water containers following World Health Organization's guidelines (10). The team collected larvae from these containers and transported them to the IEDCR entomology laboratory and the mosquito species was determined after they hatched. The Breteau index (the number of containers positive for mosquito larvae per 100 houses) was determined for the entire village and for each of the segments in the village to estimate the mosquito population density in the area (11). We assessed the correlation between the Breteau index and the attack rate.

We surveyed 3,840 residents in 897 households and 275 (7%) persons met the suspected case definition. Of these, 250 persons agreed to provide blood sample for laboratory testing: 204 (82%) had IgM antibodies against Chikungunya virus. Seventy-percent (627/897) of households had at least one suspected case. The mean age of the suspected cases was 37 years (range: 2-82 years, sd=18 years) and 82% (226/275) of the suspected cases were ≥18 years old. The majority (62%) of cases were adult women. The outbreak lasted for approximately 5 months and peaked in early November 2011 (Figure 1). All confirmed cases complained of the abnormally increased presence of mosquitoes in their areas since the middle of the year.

Nearly half of the suspected cases reported experiencing intense itching. Other common symptoms included joint swelling and headache (Table 1). The median number of joints affected as reported by suspected cases was seven (range: 1-16) and the joint most commonly reported to be affected was the knee (35%). Joint pain was accompanied by swelling in 36% of cases which subsided with the remission of joint pain. One hundred seventy-nine (65%) cases reported having joint pain that persisted for more than one month. Almost three-quarters (72%) reported having a rash, and most rashes were macular (71%) and involved the face (62%) and upper extremities (62%).

Eighty-nine percent of larvae that were collected and hatched yielded *A. albopictus* mosquitoes and the remaining yielded *Culex quinquefaciatus*. No *A. aegypti* mosquitoes hatched from the larvae.

We found a high Breteau index (34%) in the outbreak village (Figure 2). Earthen pots were the most commonly identified artificial water containers and 94% of pots had mosquito larvae in them. We found a significant

correlation between attack rates and Breteau index (r=0.74, p<0.02) in the nine segments of the village (Figure 2).

Table 1: Clinical symptoms of suspected Chikungunya cases in Char Kushai, *Dohar, Bangladesh, 2011*

Symptoms	Number	%
Fever	275	100
Joint pain	275	100
Rash	199	72
Joint pain lasting >1 month	179	65
Itching	125	46
Joint Swelling	74	27
Headache	38	14
Weakness	21	8
Sore throat	12	4
Swollen glands	12	4
Malaise	11	4
Cough	9	3
Vomiting	12	4
Abdominal Pain	4	2

Figure 1: Chikungunya suspected cases by week of onset in Dohar, Bangladesh, 2011 (N=275)

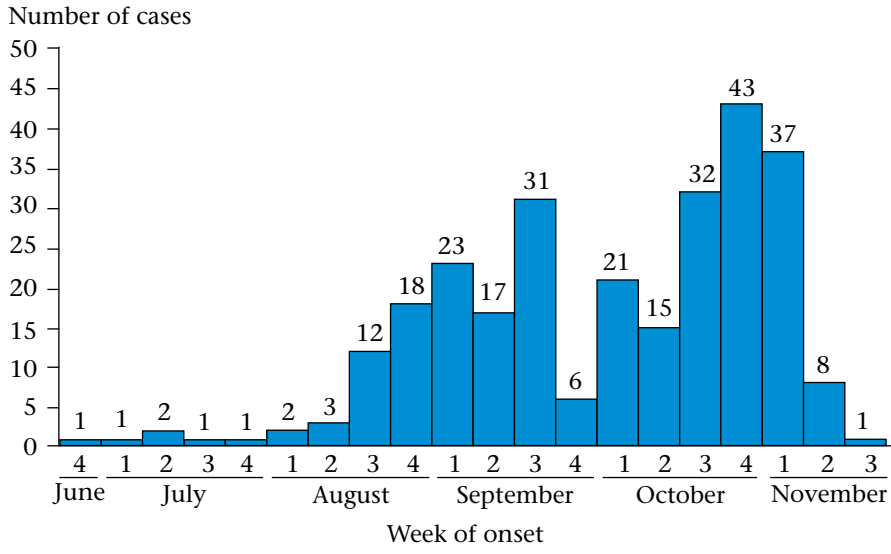
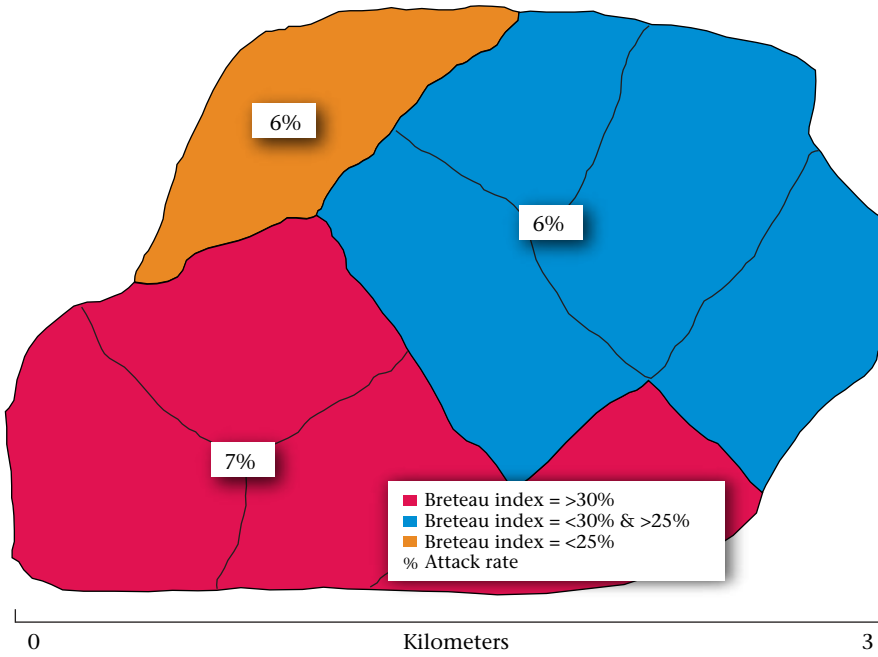


Figure 2: Attack rates of suspected Chikungunya illness and Breteau index in nine segments of Char Kushai *village in 2011*



Reported by: Centre for Communicable Diseases, icddr,b; Institute of Epidemiology, Disease Control and Research, Ministry of Health and Family Welfare, Government of Bangladesh

Supported by: Government of Bangladesh, World Health Organization and Centers for Disease Control and Prevention, Atlanta, USA

Comments

Laboratory findings confirmed that Chikungunya virus caused this outbreak and the clinical features were consistent with previously described outbreaks (12,13). This investigation provides further evidence that Chikungunya virus has become an emerging public health problem in Bangladesh (7). Though no recent community seroprevalence studies of Chikungunya have been conducted in Bangladesh or nearby countries, a 1995 cross-sectional survey carried out in Kolkata, which is approximately 250 km from Dhaka, indicated that the level of previous exposure to Chikungunya infection in that city was low (14). In 2006, one hundred and seventy-five serum samples from febrile patients in Dhaka were tested and none had antibodies against Chikungunya virus (15). In 2008, the first recognized outbreak of Chikungunya in Bangladesh occurred in the northwest area of the country, but transmission appeared to be geographically limited (7).

Chikungunya infection confers life-long immunity, so the fact that most cases identified in Dohar occurred among adults suggests that Chikungunya infection is new to this area.

An abundance of a particular species of mosquitoes during an outbreak is an important criterion for determining the vector responsible for transmission (16), and the fact that *A. albopictus* hatched from almost all of the larvae collected in the village suggests that this was the vector responsible for transmission during this outbreak. As *A. albopictus* tends to breed in artificial water containers near homes and to feed during the day (17), persons who are at home during the day time could be at increased risk due to prolonged exposure to these mosquitoes. We found that adult women, most of whom spend the majority of their day at or very near the home, comprised the largest proportion of cases in this outbreak. Outbreaks of Chikungunya in rural areas in other countries have also reported a preponderance of female cases (18-21). According to WHO, places with a Breteau index >20% have a high risk for dengue outbreaks (22), and possibly other mosquito-borne outbreaks as well. In this outbreak, the Breteau index was 34%, suggesting that the risk of transmission of mosquito-borne disease in Char Kushai was very high.

Studies have found that the joint pain associated with Chikungunya virus infection persists for weeks or months, and in some cases for years (21,23). We observed that 65% of cases had joint pain for more than one month.

This report is subject to limitations. First, four other villages reported similar cases, but this report includes findings from only one village, which limits the representativeness for the Upazila. Second, we did not explore the presence of asymptomatic infections in Char Kushai, so our attack rate likely underestimates the number of people infected with Chikungunya in this village.

Presently, mosquito control programmes focus on personal protection with insecticide-treated mosquito nets and use of insect repellents and aerosols, rather than environmental measures for mosquito control. In addition, these programmes usually target urban rather than rural areas. To prevent Chikungunya, environmental strategies to reduce mosquito populations in rural areas, such as reducing natural and human-made mosquito breeding sites, might be more effective. Active surveillance could provide information about the burden of Chikungunya disease, including the duration of joint pain as well as the geographic and seasonal distributions of infections, which would help prioritize and target resources for mosquito control. It would also be important to continue to study the transmission dynamics of Chikungunya during outbreaks in Bangladesh to identify other possible prevention strategies for this emerging infection.

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Uptake of hand washing with soap or soapy water from a large-scale cluster randomized community trial in urban Bangladesh

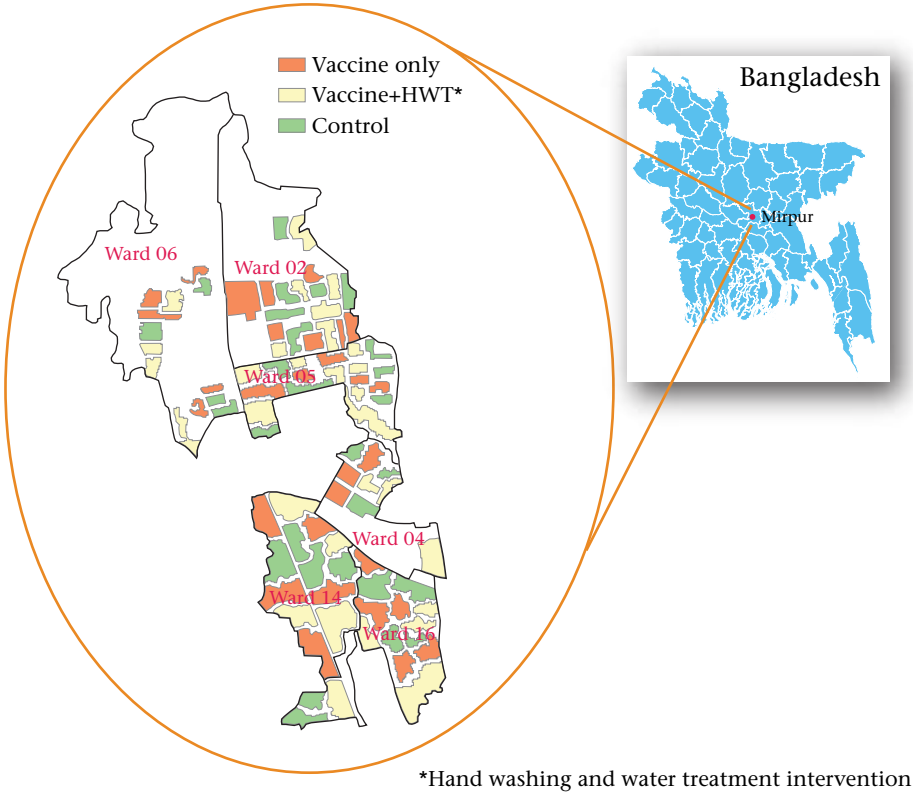
Small-scale studies have shown that intensive hand washing promotion reduces disease, but there is little evidence that large-scale hand washing promotion programs change behaviour. We deployed a community-based hand washing promotion intervention and used the presence of water and soap or soapy water at hand washing stations as a proxy indicator for hand washing behaviour and found encouraging results. A cluster randomized cholera vaccine trial conducted in a low-income urban area of Dhaka included those who received the vaccine only (Vaccine Only group), those who received the vaccine and a hand washing and water treatment intervention (Vaccine+HWT group), and those who were neither vaccinated nor received the intervention (Control group). Among the Vaccine+HWT group, the presence of water and soap or soapy water at the hand washing place increased from 22% (41/190) at baseline to 60% (102/171) at the 11-month assessment point ($p<0.001$). We found no significant increase in the presence of water and soap or soapy water among the Control group or the Vaccine Only group during the same period. Our findings suggest that hand washing behaviour changed following implementation of a large-scale intervention in a low-income urban setting that provided hardware to enable hand washing and encouraged regular hand washing. Further research on health impact of hand washing with soap in this community and the sustainability of using soapy water could help optimize recommendations for improving hand washing practices in other low-income communities.

Soap and water present together at the hand washing place leads to improved hand washing practices and fewer illnesses (1-3). Numerous small-scale studies have shown that intensive hand washing promotion improves hand washing practices and reduces risks for diarrhoea and respiratory infections (4-7). However, there is little evidence that large-scale hand washing promotion changes hand washing behaviour. As part of a large randomized controlled trial in urban Dhaka, we assessed the uptake of hand washing with soap by using the presence of water and soap or soapy water at the hand washing place as a proxy indicator.

The Introduction of Cholera Vaccine in Bangladesh (ICVB) is a 2-year randomized community trial. It began in 2011 in Mirpur, a resource-poor community of urban Dhaka, to assess the impact of the receipt of a vaccine only (Vaccine Only group), receipt of a vaccine and a hand washing and

water treatment intervention (Vaccine+HWT group) and receipt of neither the vaccine nor the intervention (Control group) on severe dehydrating cholera /diarrhoea requiring hospitalization (Figure 1). Households in Mirpur are usually organized into compounds in which several households share a common water source, kitchen, and a toilet. In the ICVB community trial, 90 clusters of almost 240,000 people in approximately 60,000 households were randomly assigned to the three study arms. Each study arm included 30 clusters (Figure 2).

Figure 1: Study site and distribution of clusters in Mirpur, Bangladesh, April 2011-July 2012

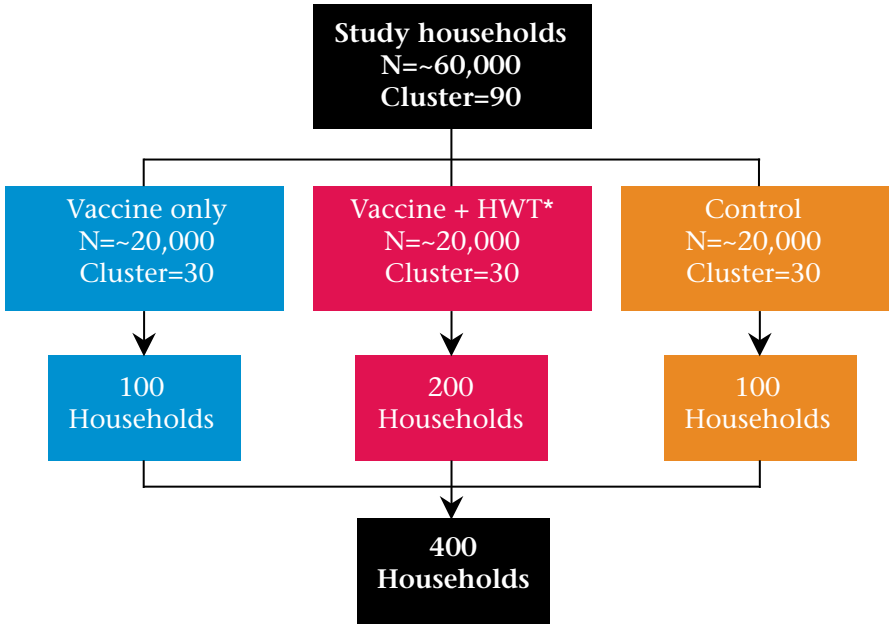


*Hand washing and water treatment intervention

From June 2011 to July 2012, a local non-governmental organization delivered the hand washing and household water treatment intervention to the Vaccine+HWT households through community hygiene promoters (CHPs). CHPs distributed hand washing supplies to the Vaccine+HWT households free of cost. The hand washing supplies included a bucket with a tap, a basin and stand and a 1.5-liter plastic bottle for making soapy water. CHPs met with household residents to discuss the most convenient place

to set up the hand washing place and also discussed their plans to keep the water bucket full. Residents were encouraged to keep soap or soapy water at the hand washing place at all times. CHPs demonstrated and taught residents how to make soapy water using a 30-gram packet of detergent powder costing less than US$0.03 mixed with 1.5 liters of water in a locally available plastic bottle. At least twice weekly, CHPs conducted meetings to encourage regular hand washing with water and soap or soapy water. They used flip charts and cue cards to illustrate health problems related to hand contamination and the importance of hand washing practices. They also encouraged Vaccine+HWT households to wash their hands after defecation, after handling child's feces and before food preparation.

Figure 2. Flow chart of randomization and monthly household selection

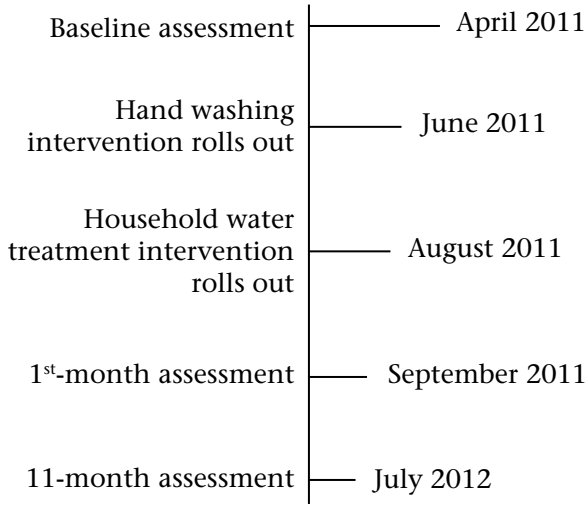


*Hand washing and water treatment intervention

After conducting a baseline survey in April 2011, we monitored a different set of 400 randomly selected households each month for 11 months (Figure 3). Interviewers collected pre-intervention data on the presence of water and soap or soapy water from 400 households among the three study arms: 100 from Vaccine Only households, 200 from Vaccine+HWT and 100 from the Control households (Figure 2). Field workers made unannounced visits to the randomly selected households at baseline and for each assessment month. If an adult (≥17 years old) member of the household provided

informed consent, field workers conducted spot-checks at the primary and secondary hand washing places used by the household to observe whether water and soap or soapy water were present.

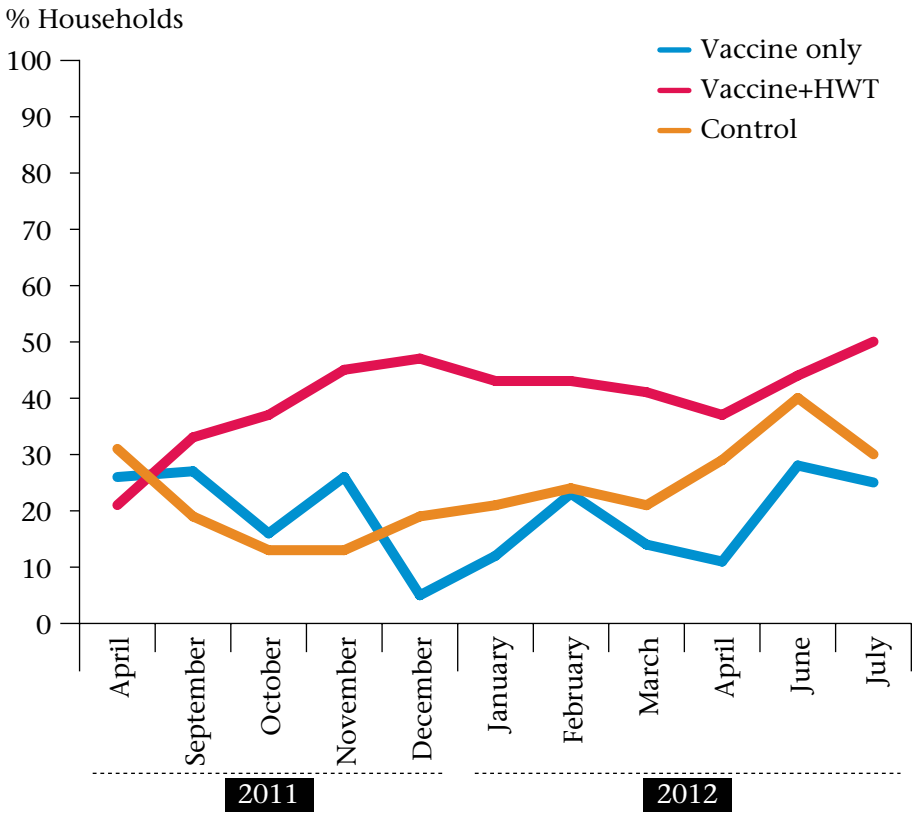
Figure 3: Timing of key study events



We evaluated data collected during the 11-month assessment period from the three study arms. We separately compared data collected from Vaccine+HWT households to that collected from Vaccine Only households and Control households. We performed an intent- to- treat analysis, considering households to be from the Vaccine+HWT group if they were initially assigned to this group, even if they refused the hand washing supplies or missed any part of the hand washing intervention due to absence. The proportion test was used for all comparisons and the data were analyzed using STATA version 10.

The presence of water and soap or soapy water at the hand washing place increased from 22% (41/190) at baseline to 60% (102/171) in the Vaccine+HWT households ($p<0.001$) (Figure 4). At the 11 month-assessment, the presence of water and soap or soapy water was 30% higher in the Vaccine+HWT households compared to the Control households and 35% higher compared to the Vaccine Only households ($p<0.01$; Vaccine+HWT compared to each of the other groups; Figure 4). There was no increase in the presence of water and soap/soapy water among the Control households at baseline [31% (30/96) at baseline; 31% (28/90) at 11-months] or the Vaccine Only households [28% (26/92) at baseline; 25% (23/91) at 11-months].

Figure 4: Proportion of households with observed presence of water and soap or soapy water at hand washing place in Mirpur, Bangladesh from April 2011-July 2012



*Hand washing and water treatment intervention

Reported by: Water, Sanitation and Hygiene Research Group, Centre for Communicable Diseases, icddr,b

Supported by: Bill and Melinda Gates Foundation

Comments

Hand washing with soap is difficult to measure. Although self-reported hand washing practices are easy to collect, they are not considered reliable (8,9). In our study we used the presence of water and soap or soapy water together at a hand washing place as a proxy indicator of hand washing behaviour. Based on this indicator there was a significant uptake of hand washing with water and soap or soapy water resulting from a large-scale intervention in a low-income urban setting that provided hand washing supplies and encouraged regular hand washing. The strength of our study

was that collecting the proxy indicator was relatively easy to implement and not labor intensive thus could be replicated in other settings.

This study is subject to at least one important limitation. The presence of hand washing supplies does not necessarily mean that the supplies were used for hand washing or that they were used at the critical times promoted by the intervention, such as after defecation, after handling child's feces and before food preparation. However, evidence from earlier studies has shown that the presence of soap and water together at the hand washing place reflects improved hand washing behaviour (1-3).

Our findings suggest that hand washing behaviour changed following implementation of a large-scale intervention in a low-income urban setting that provided hardware to enable hand washing and encouraged regular hand washing.

Validation of using the presence of water and soap or soapy water together at a hand washing place as a proxy indicator should be considered. Further research on the health impact of hand washing with soap in this community and the sustainability of using soapy water could help optimize recommendations for improving hand washing practices in other low-income communities.

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Outbreak of illness and deaths among children living near lychee orchards in northern Bangladesh

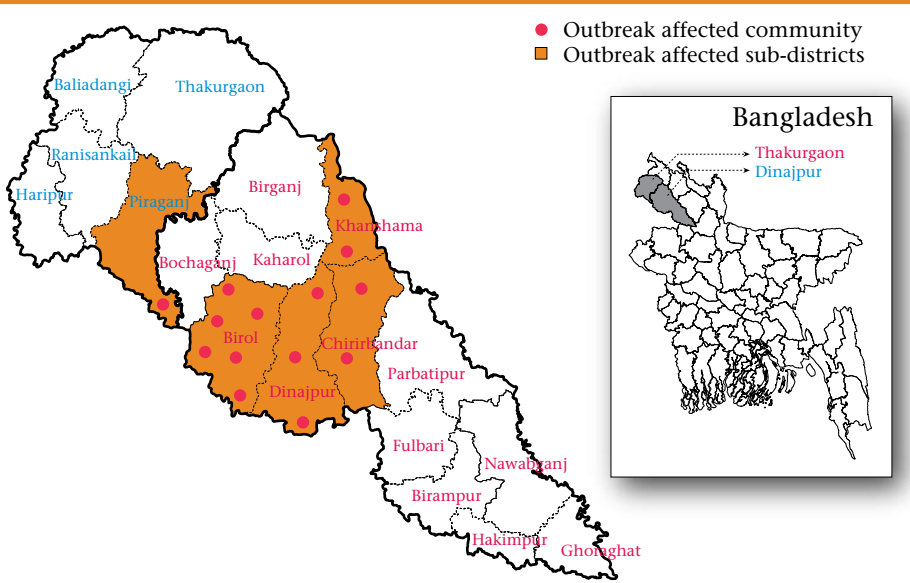
Unintentional pesticide poisoning among children is a global public health concern. In June 2012, the Institute of Epidemiology, Disease Control and Research (IEDCR) and icddr,b investigated an outbreak of possible unintentional pesticide poisoning among children aged two to ten years in Dinajpur and Thakurgaon Districts. The outbreak involved 14 children, 13 (93%) of whom died. In 64% of the cases, the illness started with a sudden outcry in the morning and most cases went on to have convulsions followed by unconsciousness within several hours. Medical files were available for nine cases, and four had mid-dilated or fixed pupils and six had lung crepitations on auscultation. The median time from onset to unconsciousness for six cases for whom information was available was 2.5 hours. The median time from onset to death for all cases was 20 hours. During the 24 hours before onset of illness, all of the cases either visited lychee orchards (n=11) or consumed lychees from nearby orchards (n=7) in which multiple pesticides were frequently used during a short lychee harvesting period. The clinical manifestations and course of illness suggest that this outbreak was due to poisoning, likely from pesticides used in nearby lychee orchards. Interventions are needed to limit children's exposures to pesticides in Bangladesh.

Globally, pesticide poisoning is a growing public health concern (1). In Bangladesh, pesticide poisoning related deaths represented 8% of all hospital deaths for people aged 15-49 years in 2009 (2,3). However, pesticide poisoning among children may be underreported in Bangladesh since many poisonings are unintentional and the exposure to pesticides may be unrecognized. Since 2008, the Institute for Epidemiology, Disease Control and Research (IEDCR), in collaboration with icddr,b, has identified three clusters of unintentional pesticide poisoning among children living in areas pesticides were being used, although the exact route of exposures remains unknown (4).

On June 16, 2012, a physician from Dinajpur Medical College Hospital (DjMCH) notified IEDCR about a cluster of fatalities at the hospital among children with clinical features suggestive of encephalitis. In response to this outbreak, a combined team of physicians, epidemiologists and social scientists conducted an investigation between June 17 and July 14, 2012, to describe the clinical manifestations of cases and to determine the timeline of events, possible causes of illness, and exposure histories of cases.

The team visited DjMCH and reviewed hospital records to identify suspected cases, defined as children who had been admitted to the hospital with convulsions with or without fever, altered mental status and unconsciousness. The team asked the family caregivers present in the hospital about clinical signs and symptoms of the cases and the timeline of events using a questionnaire and also visited each of the case-households in five sub-districts of Dinajpur and Thakurgaon Districts (Figure 1) affected by the outbreak. Using open-ended interviews with the family caregivers and neighbours of cases and lychee orchard caretakers in the community as well as observations of case-households and their surroundings, the team collected information about the frequency and types of pesticides used in or near case-households, where pesticides were used, and histories of exposure to areas where pesticides were used. In addition, the team reviewed the available medical records of cases.

Figure 1: Locations of communities affected by the outbreak of illness and death among children living near lychee orchards in Dinajpur and Thakurgaon Districts, Bangladesh, 2012



Between May 31 and June 23, 2012, 14 hospitalized patients at DjMCH met our suspected case definition and 13 died (case fatality 93%) (Table 1). The median age of the cases was 4.7 years (range 2-10 years). Nine cases were male and five were female. In the majority of cases (64%), the illness started with sudden outcry in the early morning followed within hours by fatigue, convulsions and unconsciousness. The most common symptoms were convulsions (100%), unconsciousness (86%), frothy discharge from the mouth (86%) and altered mental status (71%) (Table 1). Medical records were available for nine cases; four had mid-dilated or fixed pupils and six had lung crepitations. The median time from onset of illness to unconsciousness for six children for whom information was available was 2.5 hours (range: 30 minutes to 15 hours). The median time from onset of illness to death for all cases was 20 hours (range: 6-130 hours).

Table 1: Clinical manifestations of cases reported by family caregivers of the outbreak of illness and deaths among children living near lychee orchard in Dinajpur and Thakurgaon Districts, Bangladesh, 2012

Symptoms	Number of cases N=14 (%)
Death	13 (93)
Median time from onset of illness to death	20 hours (range: 6-130 hours)
Convulsion	14 (100)
Coma	12 (86)
Frothy discharge from the mouth	12 (86)
Altered mental status	10 (71)
Fever	10 (71)
Outcry	9 (64)
Twisting hands and legs	6 (43)
Weakness	6 (43)
Difficulty breathing	6 (43)
Vomiting	5 (36)
Excessive sweating	5 (36)
Locked jaw and/or tongue biting	4 (28)
Urinary incontinence	4 (28)
Defecation	4 (28)
Diarrhoea	3 (21)
Muscle fasciculation	3 (21)
Cold skin	3 (21)
Excessive thirst	2 (14)
Black stool	1 (7)

Among the 14 cases, 13 were identified from four sub-districts of Dinajpur and one was from a sub-district of Thakurgaon; these areas are well-known for their wide diversity of types of lychees. All of the cases either visited lychee orchards (n=11) or consumed lychees from nearby orchards (n=7) within 24 hours of their illness onset. The family members of the cases mentioned that before eating lychees, the children usually peel them with their teeth without washing them. Eight case-households bordered 10 lychee orchards, one was located within approximately 10 meters of a lychee orchard, four were located within approximately 100 meters of a lychee orchard; and one was not located near any lychee orchards. Most of the cases entered nearby orchards to play, collect dropped or cracked lychees to eat, or collect lychees from small branches. Two cases were very young and visited nearby lychee orchards with their mothers. The case from the household that was not located near any lychee orchards reportedly ate dropped lychees from local orchards that were purchased at a market.

Lychee orchard caretakers who were interviewed indicated that residents of the affected communities are frequently hired by lychee wholesalers who lease orchards to be orchard caretakers. Nine of the 14 case-households had members who worked in lychee orchards. In addition, members of two case-households owned lychee orchards and equipment to apply pesticides was found in both of these households. Pesticides were observed in only one case-household.

The caretakers mentioned that the duration between lychee flowering to fruit harvesting was approximately 36-40 days (Figure 2). They also reported that before flowering, they sprayed fertilizer (boron) once on the leaves of lychee trees (Table 2). They reported that during flowering and fruit development, they use Cypermethrin to protect the flowers and small lychees from insects and the sun; they sprayed other pesticides and plant growth regulators to improve growth, protect flowers, and prevent fruit from dropping; and as fruit matured, they sprayed multiple pesticides and hormones two to three times a week, and more frequently following rains that could wash the chemicals away. The neighbour of one case said:

> *From two weeks prior to lychee fruit collection, the caretakers sprayed pesticides and other medicine (chemicals) two to three times a week. They mixed three to four types of medicine (chemicals) together and sprayed in the evening.*

Before harvesting, orchard caretakers reported using Carbendazim to colour the fruit and they also reported that they sometimes sprayed hair shampoo on lychees in an attempt to remove spots. While visiting the lychee orchards, the team identified 19 types of empty pesticide and other chemical bottles and bags discarded in the lychee orchards near case-households and one family reported collecting empty bottles to use for oil containers in their home.

The lychee orchard caretakers from one sub-district mentioned that truck and bus drivers went on strike for five days during the second week of June and that there was no way to transport the lychees to markets around the country. This was the peak week for harvesting the Madraji lychee variety and the caretakers mentioned that since the lychees were mature, it was difficult to keep the ripened lychees on the tree during the strike. The wholesalers provided pesticides and vitamins to the caretakers to protect the mature lychees from dropping and cracking. During the strike, they sprayed the orchards daily with pesticides and other chemicals to prevent lychees from dropping.

Figure 2: Distribution of cases and timelines of lychee production and harvesting and the transport strike, Dinajpur and Thakurgaon Districts, Bangladesh, 2012

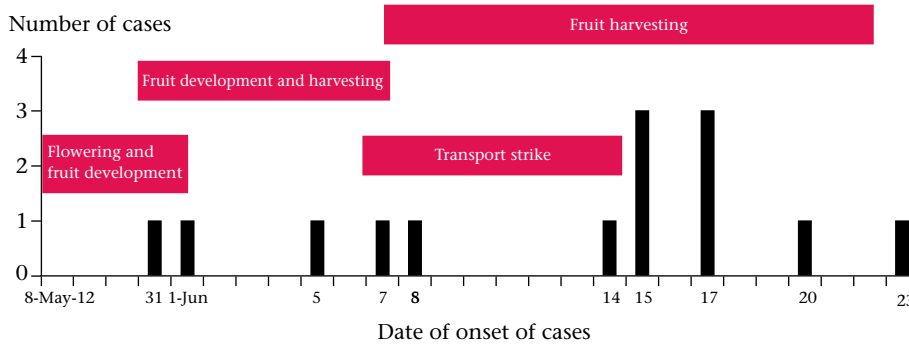


Table 2: Types of pesticides and chemicals used in lychee orchards in villages affected by the outbreak during May-June 2012, Dinajpur and Thakurgaon Districts, Bangladesh

Type of chemical	Common names
Insecticides	Cypermethrin, Endosulfan, Alphacypermethrin, Lambda-cyhalothrin
Fungicides	Mancozeb + Carbondyzin, Dithiocarbamates, Carbondyzin, Pyraclostrobin + Metiram, Difenoconazole+ Propiconazole
Micronutrients	Soluble Boron, Soluble Potash
Calcium carbonate Foliar Spray	Calcium chloride or calcium nitrate, Sodium laureth sulfate
Plant growth regulators	Ethephon

The mother of one case mentioned that her family could not stay in their home during pesticide spraying because the smell of pesticides was so strong. The mother of another case mentioned that there were no restrictions in place for people to enter the lychee orchard during or after spraying pesticides and she added that her child went to play in the lychee orchard several times immediately after pesticides were sprayed.

Reported by: Dinajpur Medical College Hospital, Dinajpur; Institute of Epidemiology, Disease Control and Research, Ministry of Health and Family Welfare, the Government of the People's Republic of Bangladesh (GoB); Surveillance and Outbreak Investigation Research Group, Centre for Communicable Diseases, icddr,b

Supported by: Institute of Epidemiology, Disease Control and Research, Ministry of Health and Family Welfare, GoB; and Centers for Disease Control and Prevention, Atlanta, Georgia, USA

Comments

The clinical manifestations of cases and the rapid progression from onset to death suggest that this outbreak was due to pesticide poisoning (5). Close proximity of lychee orchards to case-households, heavy use of multiple pesticides in the lychee orchards during the short lychee growing season, and the frequent and sustained exposures to lychee orchards and fruit among children increased their exposure to pesticides (6). The children were likely exposed to pesticides through contact with their skin, ingestion, and perhaps inhalation, and these multiple exposures may have increased their risk of poisoning.

Children are at increased risk for pesticide poisoning in a contaminated environment because they frequently put their fingers and other objects in their mouths (7). Also, peeling lychees with their teeth may have exposed them to high levels of pesticides which likely remained on the lychee skin (8). In addition, cracked lychees may have had pesticides on the lychee flesh which the children then consumed.

The onset of this outbreak corresponded with the lychee harvesting period (Figure 2). Outbreaks of child illness with similar clinical manifestations during the lychee harvesting season have also been reported from India and Vietnam (9,10). Although the etiology of these outbreaks is still unknown, providers and public health officials should consider pesticide poisoning when they note clinical manifestations among children suggestive of encephalitis during lychee season in areas where lychees are grown in Bangladesh and other countries.

Confirming a diagnosis of pesticide poisoning is difficult because acute specimens are required and the laboratory testing must be targeted to the specific compounds suspected in the poisoning. A major limitation of this investigation was our inability to obtain laboratory specimens to determine

etiology of illness; children presented to hospital in serious conditions and no specimens were collected from cases within 24 hours of onset of illness. In addition, we do not know all of the potentially toxic pesticides these children were exposed to or the exact nature of their exposures. Nonetheless, the clinical presentation and timeline suggests a toxic rather than an infectious cause. In addition, both consumption and exposure to lychees within 24 hours of onset of illness were likely underestimated because many of the children's activities may not have been observed. It is also likely that some cases were not recognized because case ascertainment was limited to children who were admitted to DjMCH and many people who have severe illness in Bangladesh do not seek care at hospitals (11). Moreover, other possible pesticide poisoning cases may not have been detected–either because they did not meet the suspected case definition, they presented to a hospital other than DjMCH, or their clinical manifestations were less severe.

Raising awareness about the dangers of pesticides to children among families residing near lychee orchards or living with lychee orchard caretakers may reduce children's exposures to pesticides. A focused ethnographic study performed throughout the lychee season would be very helpful to explore types, doses and frequencies of pesticides used in lychee orchards; evaluate perceptions, beliefs, and attitudes toward pesticide use in communities; and describe behaviours that expose children to pesticides. The ultimate goal of such an ethnographic study would be to develop interventions for families and caretakers to prevent children's exposures to pesticides. Increasing awareness among physicians about the signs and symptoms of pesticide poisoning and collecting specimens for testing at the time of presentation would help characterize the number of cases and deaths from unintentional pesticide poisoning by time, place, and person and help determine which pesticides are most commonly responsible. The use of different pesticides in the lychee orchard should be evaluated by government agriculture officers to define the toxicity and likelihood of particular pesticides to cause morbidity and mortality. In addition, currently there is no monitoring of pesticide use in lychee orchards in Bangladesh and no restrictions for children on visiting and working in lychee orchards that have been sprayed with pesticides. Guidance should be developed locally, and possibly nationally, to protect children who live near lychee orchards from unintentional pesticide poisonings.

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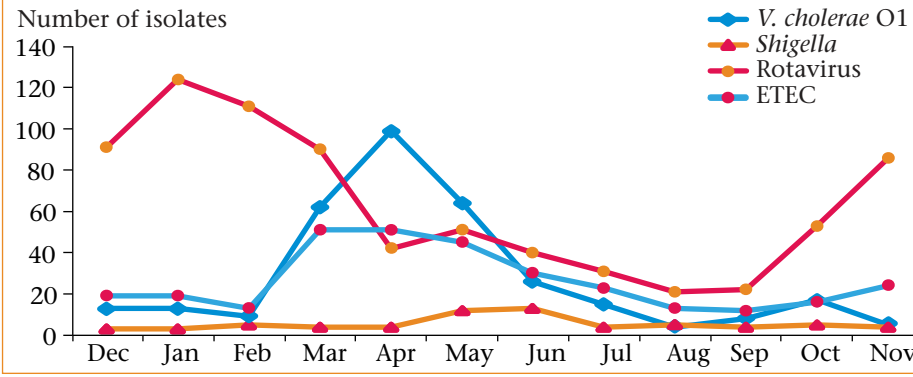
Surveillance updates

With each issue of 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 in Bangladesh.

Proportion of diarrhoeal pathogens susceptible to antimicrobial drugs: December 2011-November 2012

Antimicrobial agents	*Shigella* (n=66)	*V. cholerae* O1 (n=336)
Nalidixic acid	Not tested	Not tested
Mecillinam	87.9	Not tested
Ampicillin	57.6	Not tested
TMP-SMX	24.2	1.2
Ciprofloxacin	53.0	100.0
Tetracycline	Not tested	4.5
Azithromycin	75.8	99.7
Ceftrioxone	95.5	Not tested

Monthly isolation of* V. cholerae *O1,* Shigella*, Rotavirus and ETEC: December 2011-November 2012

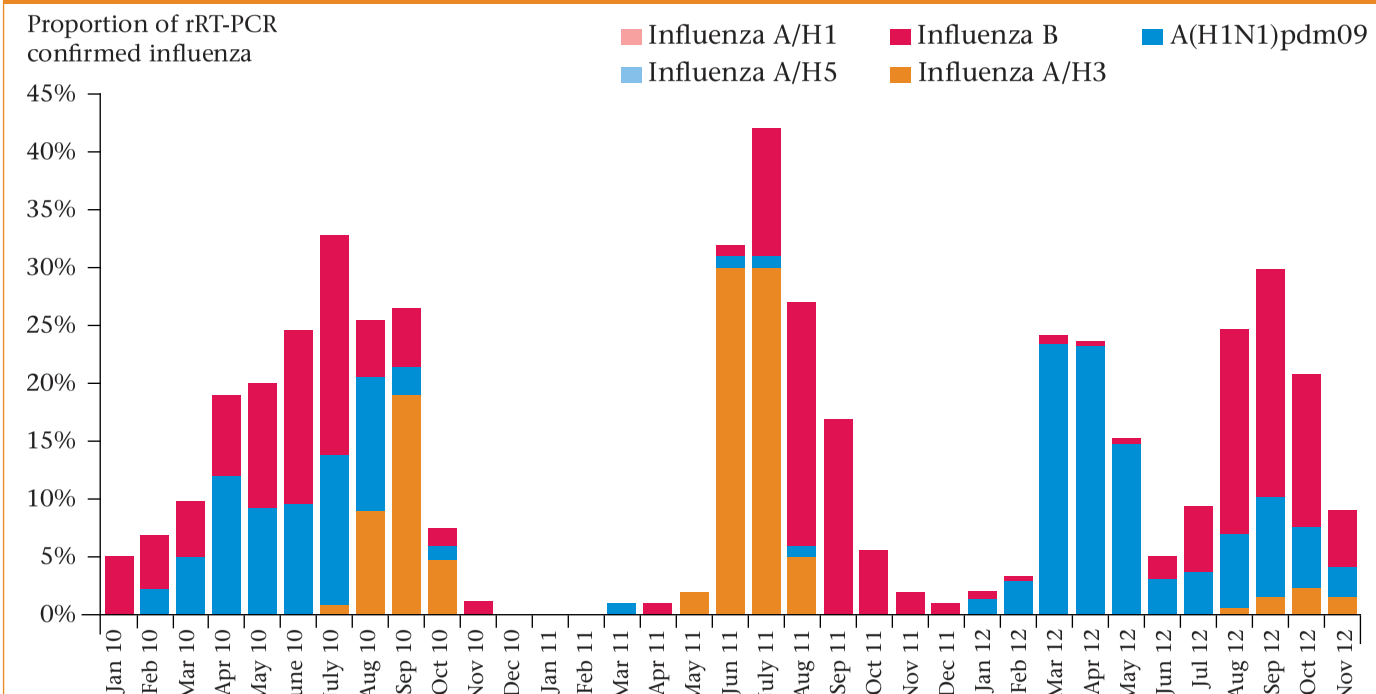


Antimicrobial susceptibility pattern of* S. typhi *among children <5 years during October-December 2012

Antimicrobial agent	Total tested (n)	Susceptible n (%)	Reduced susceptibility n (%)	Resistant n (%)
Ampicilin	31	30 (97.0)	0 (0.0)	1 (3.0)
Cotrimoxazole	31	29 (93.5)	0 (0.0)	2 (6.5)
Chloramphenicol	31	30 (97.0)	0 (0.0)	1 (3.0)
Ceftriaxone	31	31 (100.0)	0 (0.0)	0 (0.0)
Ciprofloxacin	31	0 (0.0)	31 (100.0)	0 (0.0)
Nalidixic Acid	31	0 (0.0)	0 (0.0)	31 (100.0)

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 between January 2010 and November 2012



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)

Children playing in lychee orchards. *Inset*: Spray machine (left); Pesticides used (right)

This publication of HSB is funded by icddr,b and its donors who provide unrestricted support for its operations and research. Currently donors providing unrestricted support include: Government of the People's Republic of Bangladesh, Australian Agency for International Development (AusAID), Canadian International Development Agency (CIDA), Swedish International Development Cooperation Agency (Sida) and Department for International Development (DFID). We gratefully acknowledge these donors for their support and commitment to icddr,b's research efforts.

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