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Inside

Hospital-Based Rotavirus and Intussusception Surveillance in Bangladesh

In preparation for the introduction of a rotavirus vaccine into the routine immunization programme of Bangladesh, icddr,b in collaboration with the Institute of Epidemiology, Disease Control and Research started the Hospital-Based Rotavirus and Intussusception Surveillance in July 2012. The research team enrolled and collected fresh stool from every fourth child <5 years admitted with acute gastroenteritis (AGE) at five surveillance hospitals. Stool samples were tested at the virology laboratory of icddr,b to detect rotavirus antigen through enzyme immune assay. Twenty-five percent of rotavirus isolates were genotyped. Surveillance physicians also identified children aged <2 years diagnosed with intussusception. We found that 71% of children <5 years of age admitted with AGE had evidence of rotavirus infection; two of these children died. The majority (51%) of patients with rotavirus infection were between 6-11 months of age. G1, G2, G9 and G12 rotavirus strains have been observed and to date, 13 intussusception cases have been identified. Vaccination can

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reduce the high proportion of rotavirus-associated hospitalizations and continued surveillance for rotavirus and intussusceptions among children in hospitals is important for monitoring the impact of vaccination and any possible adverse events.

Globally, rotavirus was responsible for an estimated 453,000 deaths among children aged <5 years in 2008 (1). A study done at Matlab Hospital in Bangladesh estimated that from 2000 to 2006, rotavirus was responsible for 33% of hospitalized acute gastroenteritis (AGE) cases among young children (2). To combat rotavirus infection, vaccination programmes were initiated in several countries in the Americas and Europe and showed progressive reduction of rotavirus-associated AGE (3,4). A vaccine trial conducted in Matlab showed 43% effectiveness of the vaccine for preventing AGE among children aged <2 years (5). Previous rotavirus vaccine campaigns in the United States were interrupted due to concerns about an increased risk of intussusception (invagination of the intestine which can cause obstruction) following vaccination (6). No adverse effects of rotavirus vaccination have been reported from the United States since vaccination restarted there in 2006, but recently a fivefold increased risk of intussusception among infants and young infants (<3 months), respectively, after administering the first dose of rotavirus vaccine was reported from the routine immunization programmes in Mexico and Australia (7-9).

The Government of Bangladesh plans to introduce a rotavirus vaccine into the routine immunization programme. To better estimate rotavirus-associated mortality and morbidity in Bangladesh before vaccination, the Institute of Epidemiology, Disease Control and Research (IEDCR) under the Ministry of Health and Family Welfare and icddr,b began the Hospital-Based Rotavirus and Intussusception Surveillance (HBRIS) with technical assistance from US Centers for Disease Control and Prevention (CDC) in July 2012. The surveillance aims to describe the frequency of rotavirus-associated hospitalizations and circulating strains across the country among children <5 years, as well as the frequency of intussusception-related hospitalizations among children <2 years. Baseline estimates of intussusception-related hospitalizations will allow health officials in Bangladesh to identify any increase in intussusceptions associated with vaccination.

Surveillance began in three tertiary hospitals of Dhaka, Rajshahi, and Sylhet in July 2012 and expanded to two other divisions, Chittagong and Rangpur, starting in February 2013 (Figure 1). Field assistants trained by icddr,b identified children aged <5 years admitted with AGE, defined as the occurrence of ≥3 watery or looser-than-normal stools or ≥1 episode of forceful vomiting within a 24 hour period, with symptoms lasting ≤7 days. Field assistants collected approximately 4 ml of fresh stool and surveillance physicians recorded demographic and clinical information from every fourth child admitted who met the AGE case definition. The stool sample was stored in a -70°C dry nitrogen container and transported every 15 days to the icddr,b Virology Laboratory to detect rotavirus antigen in stool through enzyme immune assay (EIA). Quarterly, 20-25% of rotaviruses were selected for genotyping. We calculated the proportion of AGE hospitalizations due to rotavirus by dividing the number of children confirmed with rotavirus EIA tests by the number of children tested. We used a 20-point Ruuska Vesikari severity scale to measure the clinical severity of patients and categorized patient illness as severe with a score of 11 or more (10). Surveillance physicians identified hospitalized children aged <2 years diagnosed with intussusception during surgery and/or through radiology by either air or liquid contrast enema or through ultrasound.

Figure 1: Hospital-Based Rotavirus and Intussusception Surveillance hospital sites by divisions

Hospitals	Date surveillance started
1. Jahurul Islam Medical College Hospital, Kishoregonj	July 2012
2. Rajshahi Medical College Hospital, Rajshahi	July 2012
3. Jalalabad Ragib-Rabeya Medical College Hospital, Sylhet	July 2012
4. World Mission Prayer League, Dinajpur	February 2013
5. Bangabandhu Memorial Hospital, Chittagong	February 2013

Between July 2012 and March 2013, 2,462 patients meeting the AGE case definition were identified and 605 had clinical information collected and stool tested for rotavirus. Most of the patients with AGE (1,023) were aged 6-11 months with a median age of 11 months. EIA testing identified rotavirus antigen in stool from 71% (428/605) of children hospitalized for AGE. Among children with rotavirus infection, 51% were aged 6-11 months and 64% were male. Most patients with intussusception (eight) were 6-11 months of age and all were males (Table 1).

Table 1: Demographic and laboratory information of the acute gastroenteritis (AGE) study participants

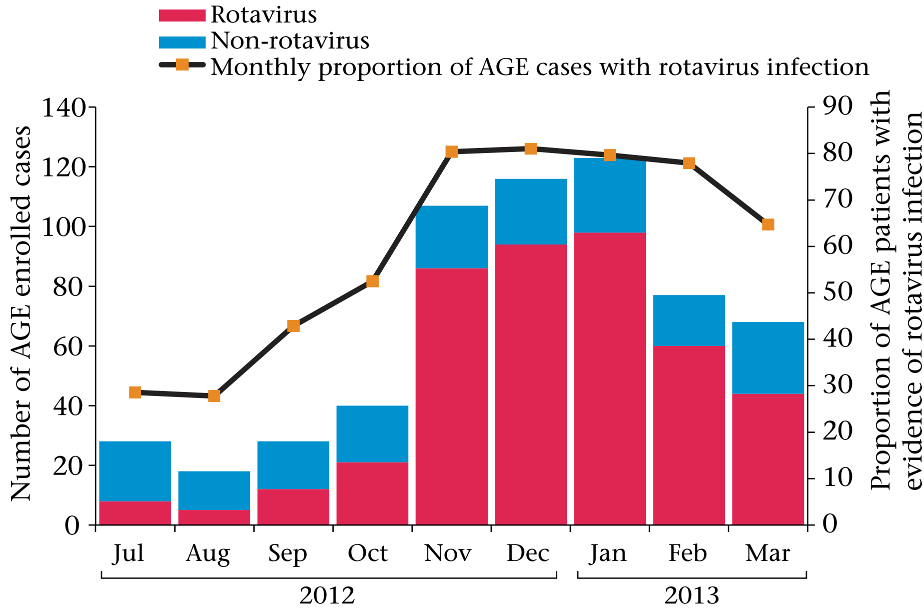
	Acute gastroenteritis			Confirmed intussusception cases N=13
	Hospitalized N=2,462	Enrolled N=605	EIA-Positive for the rotavirus antigen N=428 (%)	
Age group (in months)				
0-5	208	48	28 (7.0)	5
6-11	1,023	296	219 (51.0)	8
12-17	672	152	108 (25.0)	-
18-23	254	60	48 (11.0)	-
24-59	305	49	25 (6.0)	-
Median age (in months)	11	11	-	6
Male	1,662	388	275 (64.0)	13
Hospital name				
RMCH	991	243	163 (38.0)	8
JIMCH	577	143	107 (25.0)	1
JRRMCH	819	202	143 (33.0)	4
LAMB	23	5	5 (1.0)	-
BBMH	52	12	10 (2.0)	-

RMCH: Rajshahi Medical College Hospital; JIMCH: Jahurul Islam Medical College Hospital; JRRMCH: Jalalabad Ragib-Rabeya Medical College Hospital; LAMB: World Mission Prayer League; BBMH: Bangabandhu Memorial Hospital

The proportion of AGE patients with evidence of rotavirus infection peaked during November 2012 to February 2013 (Figure 2).

According to the Ruuska Vesikari clinical severity scale, 84% of confirmed rotavirus cases had severe illness. Sixty rotaviruses were genotyped, and a total of four genotypes were found: G1P[8] was the most commonly identified (45%) and the second most commonly identified genotype was G12P[8] (26%).

Figure 2: Number and proportion of acute gastroenteritis (AGE) patients with evidence of rotavirus infection and non-rotavirus infection by month



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Comments

Although our surveillance data are still preliminary, they suggest that the proportion of childhood hospitalizations for AGE associated with rotavirus may be much higher than the 25-38% previously reported from Bangladesh and other Asian countries (2,11-13). The seasonal peak and average age of children hospitalized for rotavirus infection in our surveillance were consistent with previously reported data from Dhaka and Matlab (2,14).

To date, we have found two rotavirus-associated deaths. One of them (12 months old) was reported to have died due to severe dehydration and another (6 months old) was reported to have had associated congenital heart disease. The rotavirus genotypes we identified were consistent with data reported from Bangladesh during 1992 to 2009 and rotavirus vaccines during this time were effective against these genotypes (5,15-17). We found that all intussusception cases were male; the reason for this male predominance is unclear and may reflect increased risk among males, greater healthcare seeking for male children, or both.

Our surveillance data confirm the urgent need for rotavirus vaccine in Bangladesh to prevent severe illness among children. Continuous surveillance throughout and following vaccine implementation is imperative to assess the effectiveness of vaccination in reducing rotavirus-associated morbidity and mortality as well as ascertaining any increase in intussusceptions following vaccination. A monthly surveillance report is published on the IEDCR surveillance website (www.iedcr.org) as well as circulated to stakeholders of surveillance hospitals.

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Preparedness of primary healthcare facilities to respond to infectious disease outbreaks in flood-prone sub-districts of Bangladesh

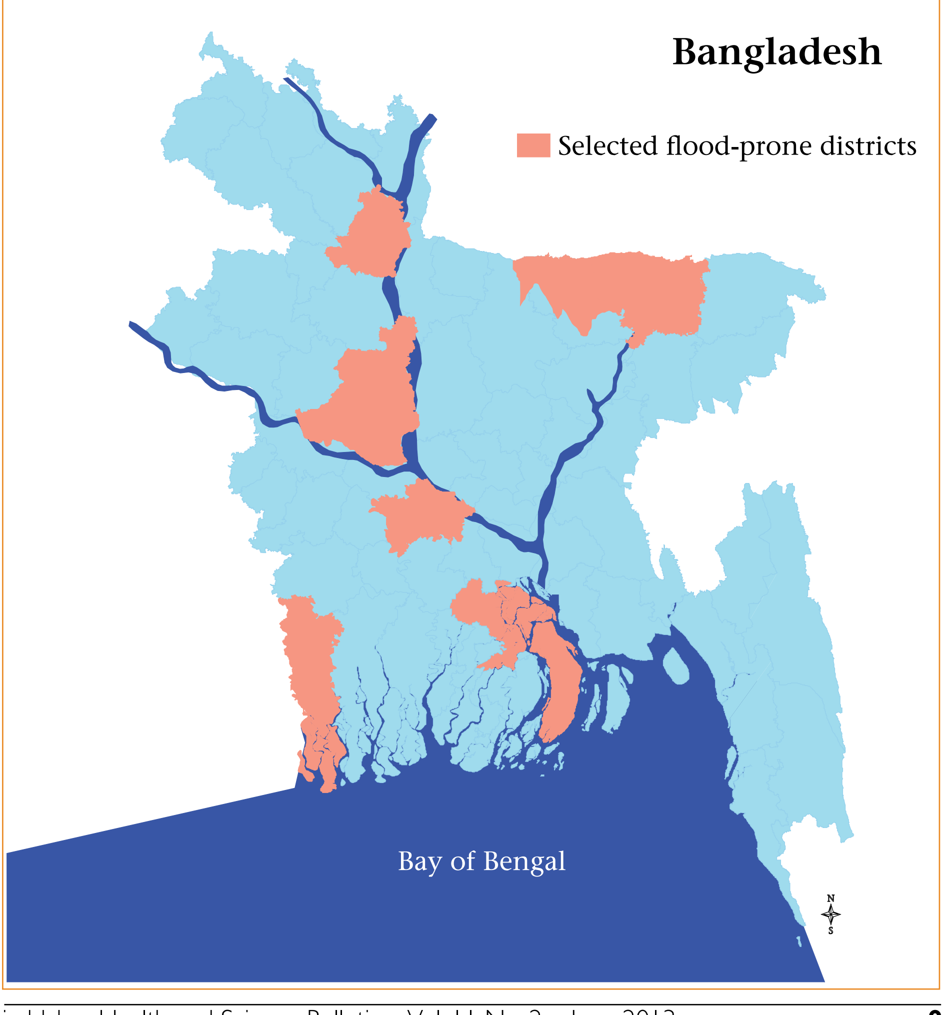
Global climate change is increasing Bangladesh's vulnerability to floods and raising the potential for infectious disease outbreaks. This assessment identified gaps in preparedness of government primary-care facilities or upazila health complexes (UHCs) in flood-prone sub-districts. We used a self-administered survey among 69 UHC managers to assess seven UHC core capacities critical for outbreak response. The major deficiencies observed were in structural, stockpiling, and human resources capacities. Ninety-one percent of the respondents felt that UHCs had limited preparedness for outbreak response. Insufficient training of healthcare providers, low motivation of clinical staff, substantial staff shortages with rapid turnover, and lack of epidemiologists posted at UHCs were major impediments to preparedness. Development of a contingency plan that secures emergency financing and supplies and establishes a mechanism for engaging field workers during outbreaks could enhance the capacity of UHCs during an outbreak response.

Geographic location, population density, and a weak coastal protection system make Bangladesh vulnerable to climate change and natural disasters. Climate change is predicted to increase the frequency and intensity of natural disasters including floods in Bangladesh (1-3). People in flood-affected areas often have poor access to safe water, sanitation, and healthcare services; live in overcrowded conditions; and are more likely to experience outbreaks of diarrhoeal, acute respiratory, and vector-borne diseases (4-6).

Infectious disease outbreaks in flood-prone areas can spread quickly and affect a large population within a fairly short time span, thereby straining local healthcare resources (4,7-9). In Bangladesh, the government's primary care hospitals at the sub-district level, known as upazila health complexes (UHCs), are the first line of defense in responding to infectious disease outbreaks. The UHC workforce can play an important role in detecting outbreaks, treating affected cases, and communicating with community residents regarding available healthcare services (10-12). In 2012, researchers from icddr,b and the Institute of Epidemiology, Disease Control and Research (IEDCR) quantitatively assessed the UHCs' preparedness to respond to infectious disease outbreaks. The team defined preparedness as having infrastructure, human resources, programmes, and systems in place to limit the impact of an outbreak. The team also identified factors contributing to the level of preparedness and identified strengths and weaknesses of UHCs to manage infectious outbreaks as perceived by the health complex managers known as upazila health and family planning officers (UHFPOs).

We conducted a cross-sectional survey in 69 UHCs in nine flood-prone districts to assess the core capacities necessary for emergency outbreak response (Figure 1). We adapted a self-administered questionnaire from checklists developed by the World Health Organization (WHO) for health facility assessment (8,9). We purposively selected UHCs from areas with

Figure 1: Map of Bangladesh showing the flood-prone districts where the assessment of primary healthcare facilities to respond to infectious disease outbreaks was conducted, 2012



different flooding patterns (inland areas, coastal areas, and areas susceptible to flash flooding) in Bangladesh (3). We approached UHFPOs from nine selected districts attending a workshop at IEDCR and sought their informed consent for participation. We distributed a questionnaire and corresponding glossary to 76 consenting UHFPOs and enclosed a prepaid envelope addressed to IEDCR for return of the questionnaire within two weeks.

We measured UHC preparedness in seven core capacities: structural, non-structural, functional, human resources, laboratory, stockpiling of emergency supplies, and communication (Table 1). We then determined the percentages of UHCs reporting each of these capacities.

Table 1: Description of seven core capacities used to measure outbreak preparedness in upazila health complexes (UHCs) in nine flood-prone areas of Bangladesh, 2012

Core capacity	Description
Structural	Guidelines on outbreak management and separate physical facilities including patient evaluation areas and vehicles for transporting infectious patients.
Non-structural	Infection control policies, personal protective equipment (PPE), and current infection control practices.
Functional	UHC healthcare providers can detect, manage, and prevent infectious outbreaks.
Human resources	Staff capable of responding efficiently to infectious disease outbreaks.
Laboratory	Infrastructure to appropriately collect, transport, store and test infectious specimens.
Stockpiling	Emergency supplies and infrastructure for managing health crises.
Communication	Infrastructure for communicating health crises.

We observed a 91% (69/76) response rate from the UHFPOs. We analyzed the geographic distribution and accessibility of UHCs to the people they serve. Fifty-five percent (38/69) of UHCs were located in urban settings and 50% (19/38) of the UHCs in urban settings were located ≥2 kilometres from the nearest communities they served. Twenty-nine percent (20/69) of UHFPOs reported that the roads between UHCs and their catchment areas were not well-paved. Eighty-nine percent of the UHCs had one ambulance with basic life support facilities and 62% (43/69) had back-up generators in case of electricity outages.

Although 67% (46/69) of UHCs had surge capacity to handle up to 20 additional patients, there were no stockpiles of medicines or supplies for responding to infectious disease outbreaks related to floods except for oral rehydration salts (Table 2). None of the UHCs had conducted a risk analysis for responding to potential outbreaks or had developed an emergency preparedness plan. All UHCs reported substantial shortages in human resources, particularly in clinical service providers (Table 3). Staff shortages were more acute in rural than urban UHCs; 28% of rural compared to 14% of urban UHCs did not have consultant physicians on staff.

Table 2: Percentages of key indicators for outbreak response in the participating upazila health complexes as reported by the upazila health and family planning officers (UHFPOs), 2012

Key indicators	% of UHFPOs reporting the indicator (N=69)
Structural capacity	
Outbreak response and prevention guideline/SOP available	59
Separate evaluation/triage area for infectious patients	0
Separate room for cohorting infectious patients if needed	17
Separate arrangements for infectious patient transportation	0
Non-structural capacity	
Implements infection control policy	75
Surveillance for hospital-acquired infection	6
Availability of decontaminants and PPE	74
Mechanism for protecting staff from occupational exposures	0
Functional capacity	
Training of field staff in outbreak detection	25
Outbreak verification and event confirmation	99
At least one training of UHFPOs in outbreak response	22
Risk assessment conducted systematically	36
Appropriate event reporting and feedback within 24 hours	84
Availability of functional rapid response teams	100
Existence of infectious case management guideline	94
Human resources capacity	
Conducts periodic training needs assessment	16
CME and training plan and programme developed	6
Adequate number of field workers	82
Adequate number of clinicians to manage infectious patients	42
Adequate number of laboratory/administrative staff	65
Post-incident stress management for staff	0

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Continuation of Table 2

Key indicators	% of UHFPOs reporting the indicator (N=69)
Laboratory	
Diagnostic capacity for specific infections	80
Mechanism to strengthen laboratory services	2
Networking with national laboratories	93
Mechanism for sample collection, storage, and transport	93
Bio-safety plan and programme	41
Stockpiling and emergency supplies capacity	
Existence of emergency preparedness/contingency plans	0
Emergency procurement capacity	0
Surge capacity to accommodate 20 additional cases	67
Communication capacity	
Emergency communication plan/SOP/guidelines	41
Designated spokesman for emergency/risk communication	83
Digital communication with district and national healthcare	100
IEC materials for community awareness	80

CME: Continued medical education; IEC: Information, education and communication; SOP: Standard operating procedures; PPE: Personal protective equipment

Table 3: Existing staff positions and percentage of positions filled in rural and urban upazila health complexes (UHCs) in nine selected flood-prone sub-districts, 2012

Position	Median (IQR) number of positions in participating UHCs	Median (IQR) number of positions filled in participating UHCs	Percentage of UHCs with all existing posts filled	
			Rural (%)	Urban (%)
Consultant physician	4 (4-9)	1 (0-2)	4	7
Medical officer	9 (2-25)	4 (2-9)	12	14
Nursing staff	10 (7-15)	6 (3-10)	49	52
Paramedic	10 (3-16)	7 (3-14)	48	45
Laboratory staff	2 (1-2)	2 (0-2)	44	45
Field staff	50 (37-69)	42 (32-63)	8	14
Administrative staff	7 (6-8)	6 (5-7)	20	21
Vehicle driver	1 (0-1)	1 (0-1)	88	93
Others	5 (4-6)	4 (3-5)	42	48

IQR=Inter-quartile range

Ninety-one percent (63/69) of UHFPOs thought their UHCs had limited capacity to respond to infectious disease outbreaks. When asked to identify strengths of UHCs for effective outbreak response, those most frequently reported were: a large field staff (92%), community clinics (76%), community healthcare providers (64%), availability of a nationwide digitalized health information system (62%), and willingness of UHFPOs to respond to health emergencies (52%). When asked to identify weaknesses of UHCs for effective outbreak response, those most commonly reported were: inadequate training of healthcare providers (97%), shortages of clinical staff (83%), low motivation of clinicians to engage in public health efforts (83%), poor risk communication capacity (82%), lack of separate vehicles to transport infectious patients (82%), poor laboratory infrastructure (81%), rapid turnover of clinical staff (62%) and no epidemiologist posted at UHCs (60%).

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Comments

The experience in Bangladesh during the 2009 influenza pandemic suggested that response to public health emergencies could be enhanced by utilizing the existing UHC infrastructure and workforce (13). However, public health systems in low-income countries including Bangladesh are often underfunded, understaffed, and struggling to deal with the existing disease burden. We evaluated UHCs' current capacities and identified their major strengths and weaknesses to provide evidence for interventions, identify priority areas for investing constrained resources, and obtain a baseline for monitoring progress.

We found that UHCs in flood-prone areas of Bangladesh were poorly prepared to respond to infectious disease outbreaks. Among seven core capacities measured, major deficiencies were identified in three: structural, stockpiling and human resources. UHC structures were poorly equipped because they lacked separate evaluation or triage areas, isolation rooms, and vehicles for infectious patients, leading to opportunities for disease transmission. WHO has highlighted the importance of local-level contingency planning as a necessary strategy for providing adequate healthcare during outbreaks. Other important factors include maintenance of inventories, authority to procure emergency drugs locally, and a decentralized supply of emergency equipment and medications that is determined on the basis of risk analyses (14-16). Lack of contingency plans, absence of emergency funds, lack of authority of UHFPOs to buy necessary medicines locally, and centralized distribution of emergency supplies contribute to poor stockpiling and limited emergency supply capacity. Inadequate stockpiles delay management and prevent timely responses that are critical to early control and prevention of infectious disease outbreaks. UHFPOs reported a substantial shortage in human resources, particularly of healthcare providers such as consultant physicians, medical officers and nurses in the UHCs. In addition, low motivation among clinical staff, their rapid turnover rate and the lack of an epidemiologist at sub-national health facilities led us to determine that UHCs have a poor human resources capacity. Urban UHCs were relatively better equipped than rural UHCs for emergency response, which was not unexpected because improvement of health systems in Bangladesh is mostly focused on developing the urban healthcare facilities to ensure provision of enhanced curative rather than preventive care (17).

Our findings are subject to at least two possible limitations. First, the survey collected self-reported responses from UHFPOs and could be subject to response bias as it may be socially desirable for UHFPOs to highlight weaknesses rather than strengths in order to initiate actions from the IEDCR to enhance UHCs' preparedness. However, we validated the findings by cross-checking selected responses through direct observation in a sub-sample of UHCs. Second, the survey was conducted in only 91% of UHCs in nine purposively selected districts out of the 46 flood-prone districts in the country (18) and so may not be representative of all such UHCs.

Preparing health systems for managing crises in the face of a rapidly changing global climate is a complex issue (19). Empowering UHFPOs to locally procure emergency medicines and equipment could improve patient management. Altering recruitment processes, regulating staff transfers, and motivating healthcare providers to respond to public health emergencies through incentives could reduce staff shortages. Training and motivating all health staff in outbreak management and posting epidemiologists in UHCs could improve the efficiency of the health workforce and enhance local response. However, implementation of these recommendations would require profound structural changes within the government system or massive increases in resource allocation. Establishing a mechanism to train and utilize the extensive field workers in Bangladesh to improve outbreak detection, reporting, surveillance, and management, including the provision of psychosocial support to affected communities could be a sustainable approach for strengthening sub-national health systems to better respond to outbreaks. Development of contingency plans and a policy guideline to improve local emergency procurement could enhance outbreak response. Additionally, allocation of resources to build functional isolation rooms and improve transportation for infectious patients could improve the structural capacity of UHCs. Provision of additional incentives to retain staff in rural health facilities might help ensure equitable access and improve outbreak response in rural UHCs.

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Pulmonary tuberculosis in the Dhaka Central Jail: Control and prevention of transmission

The global burden of tuberculosis (TB) is still very high. Correctional facilities are particularly burdened with TB as a result of an aggregation of risk factors. Active screening for symptomatic pulmonary TB of all the inmates inside Dhaka Central Jail (DCJ) revealed that the TB prevalence among inmates was about 20-fold higher than the general population in Bangladesh. We describe the results of an evaluation of the first four years of an intervention aimed at controlling and preventing TB transmission in DCJ which included active screening for pulmonary TB upon entry and during incarceration in DCJ, use of microscopy to detect acid fast bacilli and culture to detect *Mycobacterium tuberculosis*, immediate isolation of persons with confirmed TB, and early initiation of anti-TB treatment. The number of pulmonary TB cases declined significantly, from 33 cases identified during the first quarter to 12 TB cases in the final quarter of the study period. We found that active screening upon entry and during incarceration was key for controlling TB in DCJ. However, an effective referral mechanism for treatment on release will need to be implemented to prevent transmission in the community.

Tuberculosis (TB) continues to be a major public health challenge in low- and middle-income countries. Even with the encouraging progress made in controlling the spread of TB during the past two decades, the global burden of TB is still very high. In 2011, there were an estimated 8.7 million incident cases and 1.4 million deaths from TB (1). Almost 60% of the world's TB cases are in the Southeast Asia and Western Pacific regions (1). Bangladesh is currently ranked 6th among 22 countries with a high burden of TB (2).

Correctional facilities are difficult settings for TB control. Incarcerated persons often come from socioeconomic groups in which TB prevalence is high and they frequently engage in behaviours, such as alcohol and drug use, that may increase their risk for infection (3). Many inmates have acquired TB before incarceration and many of the correctional facilities in the world are extremely overcrowded (3,4). Confining a high-risk population in an overcrowded setting with poor hygiene and inadequate ventilation creates an ideal environment for transmission of TB (4,5). The core elements of effective TB control in any setting are early case detection and successful treatment. There are three main strategies for finding TB cases in correctional facilities: case-finding through self-referral, screening on entry and active case-finding among inmates (3). These strategies are complementary and should be established at the same time. Using one strategy in isolation is unlikely to effectively detect TB cases in correctional facilities (3).

It has been estimated that approximately 10 million persons are incarcerated worldwide on any given day (6). Many are from marginalized and disadvantaged segments of society where the risk of TB infection is high (3). The presence of people at high risk for TB coupled with overcrowded conditions in jails and prisons facilitates acquisition and transmission of TB (7). The prevalence of TB in correctional facilities greatly exceeds the prevalence of TB in the general population, often being five to 10 times and in some cases up to 50 times higher (7-9).

Data on TB in correctional facilities in Bangladesh are scarce. The investigation team from icddr,b started active screening for pulmonary TB among incarcerated persons at Dhaka Central Jail (DCJ), the largest correctional facility in Bangladesh, in 2005 to determine the prevalence of TB in DCJ and determine associated risk factors (10). Active screening for pulmonary TB consisted of asking all inmates upon entry and during incarceration in DCJ about symptoms of TB. Microscopy was used to detect acid fast bacilli (AFB) and culture was used to detect *Mycobacterium tuberculosis* among those with symptoms suggestive of pulmonary TB.

DCJ houses about 11,000 inmates at any time, although its official capacity is only 2,600 inmates (10). From October 2005 to September 2007, approximately 11,000 incarcerated persons in DCJ were actively screened for TB by the study team and the prevalence of TB was found to be 2,227 per 100,000 population, which was more than 20 times higher than in the general population of Bangladesh (10,11). A risk factor analysis showed that factors associated with developing active TB included history of exposure to TB patients, previous history of imprisonment, and malnutrition (defined as body mass index [BMI] <18.5 kg/m^2) (10). Among cases with history of exposure to TB patients, 75% were exposed in DCJ and 37% of cases were detected within six months of arriving at DCJ, suggesting that a substantial number of inmates enter DCJ with active TB or during the early stages of infection (10).

In January 2009, the icddr,b team established ongoing active screening for pulmonary TB at DCJ and a system to isolate and treat those inmates found to have pulmonary TB. The objective of this study was to describe findings from the first four years (January 2009 to December 2012) of the screening and intervention programme.

Beginning in January 2009, every inmate entering DCJ was screened for symptoms of pulmonary TB using a simple questionnaire. In addition, we developed a system to screen inmates who had entered DCJ before the start of the analysis period and to rescreen those who had been screened on entry by conducting active screening sequentially in the DCJ blocks in which inmates were housed. Screening began in one of the 17 housing blocks at DCJ and was successively carried out in the other blocks until screening in each of the 17 blocks was completed, then the process was repeated. Inmates were classified as having suspected pulmonary TB if they reported having a cough for ≥3 weeks. We collected three sputum samples from all suspected cases and the samples were transported to the icddr,b Tuberculosis Laboratory in a cool box, in accordance with standard laboratory guidelines for TB, and processed on the same day. We examined specimens for the presence of AFB using microscopy by Ziehl-Neelsen staining and specimens were cultured on Lowenstein-Jensen solid media. Inmates were classified as having confirmed pulmonary TB if AFB were detected either by microscopy or on culture. We immediately isolated inmates with confirmed pulmonary TB and DCJ Hospital staff started them on anti-TB treatment following the National Tuberculosis Control Programme guidelines (Figure 1). We also performed drug-susceptibility testing (DST) using the proportion method for *M. tuberculosis* isolated on culture to determine whether confirmed TB cases were infected with multidrug-resistant TB (MDR-TB). Cases identified with MDR-TB were given second line TB treatment. Data were analyzed using regression models to assess the association between changes in incidence of TB from quarter to quarter (linear regression coefficient (ß) with 95% confidence intervals).

During the study period, the icddr,b team screened 140,055 inmates and a total of 2,462 suspected TB cases were identified, of whom 298 (12%) were found to have pulmonary TB on the basis of positive AFB results on microscopy and/or *M. tuberculosis* isolated on culture (Table 1). Sixty (20%) of the inmates with pulmonary TB had negative AFB results on microscopy but positive results on culture. The proportion of confirmed pulmonary TB cases among those screened was almost seven times higher among male (0.2%, 296/133,475) than female (0.03%, 2/6,580) inmates. Of the DST results available from 91 patients with pulmonary TB, only one (1.1%) was found to have MDR-TB.

During the study period, the number of pulmonary TB cases detected quarterly decreased from 33 cases during the first quarter of the study period to 12 in the final quarter of the study period and a trend analysis showed a statistically significant decline over the study period (p=0.005) (Figure 2).

Reported by: Tuberculosis and Leprosy Research Group, Centre for Communicable Diseases, icddr,b

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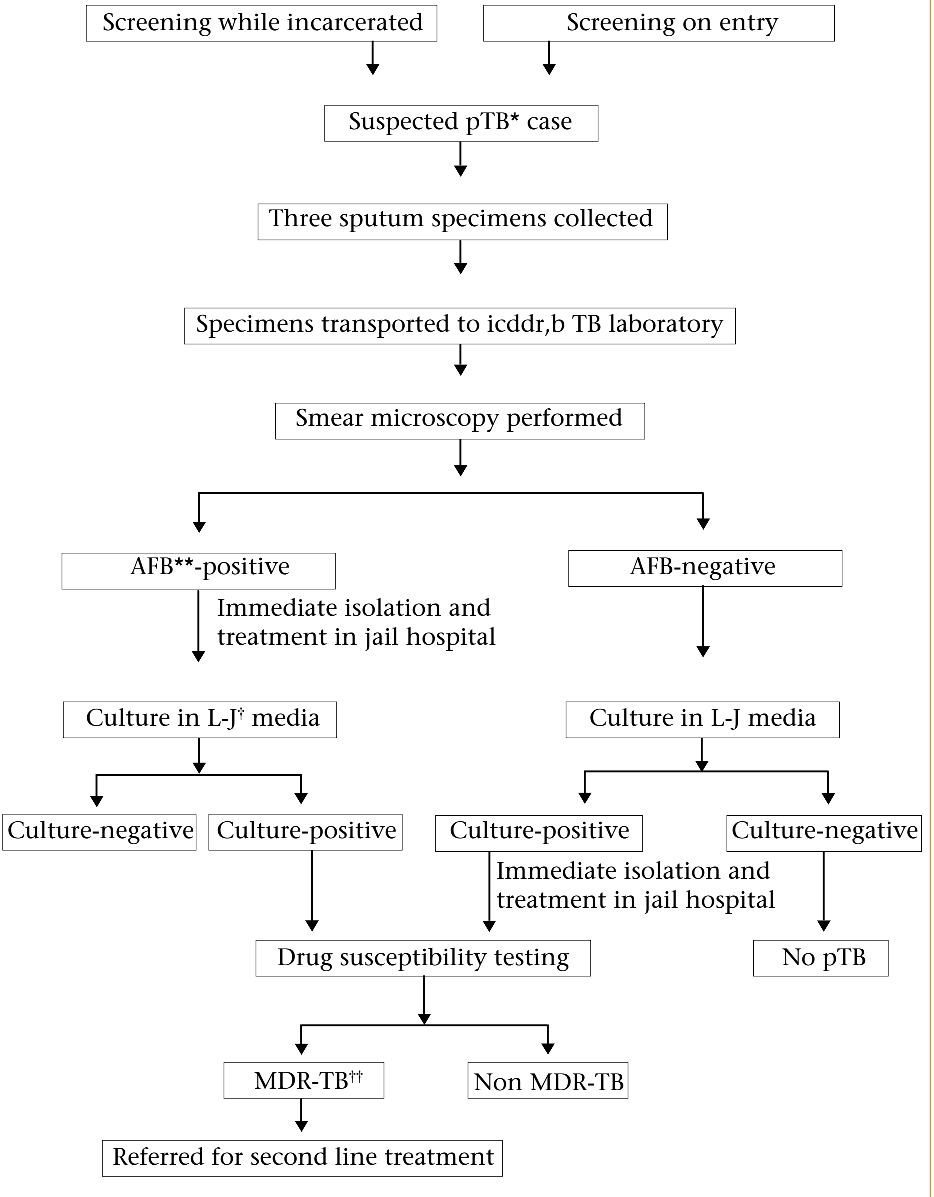
Figure 1: Flow chart of pulmonary tuberculosis (pTB) intervention at Dhaka Central Jail, January 2009 to December 2012



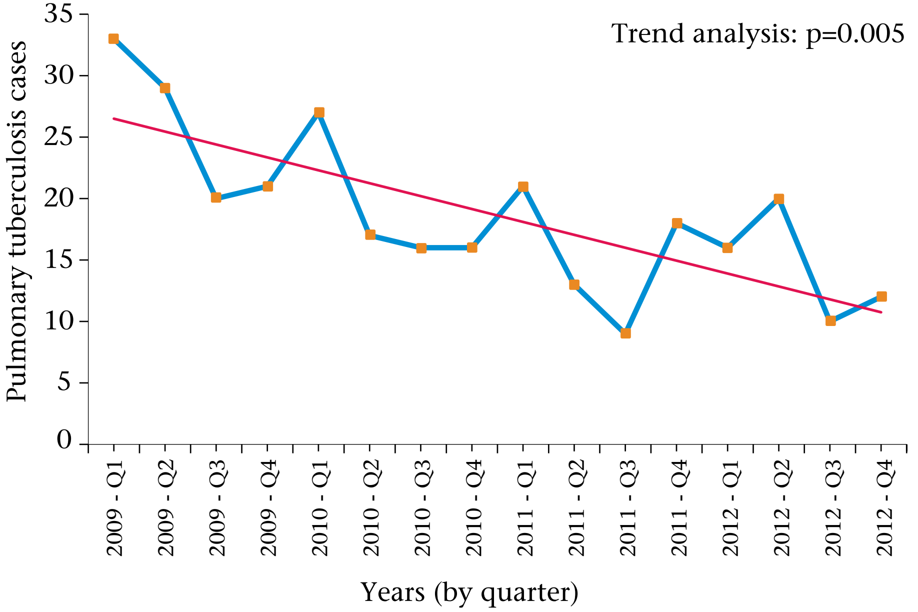
*pTB: pulmonary TB case
**AFB: acid fast bacilli
†L-J: Lowenstein-Jensen
††MDR-TB: Multidrug-resistant tuberculosis

Table 1: Tuberculosis screening at the Dhaka Central Jail, January 2009 to December 2012

	Male n (%)	Female n (%)	Total
Inmates screened	133,475	6,580	140,055
Suspected pulmonary TB cases, number (%)*	2,455 (1.8)	7 (0.1)	2,462 (1.8)
Samples culture-positive for TB, number (%)†±	296 (12.1)	2 (28.6)	298 (12.1)
Samples positive on microscopy for acid fast bacilli, number (%)**	236 (79.7)	2 (100)	238 (79.9)
Confirmed pulmonary TB cases, number (%)*	296 (0.2)	2 (0.03)	298 (0.2)

*Proportion among inmates screened
†Proportion among suspected cases
± Three sputum samples were collected from each of the 2,462 suspected cases for testing
**Proportion among culture-positive TB samples

Figure 2: Pulmonary tuberculosis cases detected in the Dhaka Central Jail, January 2009 to December 2012



Comments

We identified a substantial number of pulmonary TB cases in DCJ during the 48-month study period. A considerable proportion (20%) of culture-positive cases had negative results for AFB on microscopy. The declining trend in detected pulmonary TB cases suggests that implementing active screening upon entry and during incarceration in DCJ, diagnostic testing of suspected cases, immediate isolation of inmates with laboratory-confirmed TB and early initiation of effective anti-TB treatment significantly reduced the TB case burden and TB transmission in DCJ.

This study was subject to at least one limitation. We screened inmates for symptoms suggestive of pulmonary TB but it is likely that we failed to detect all pulmonary TB cases. The use of chest radiography for those with symptoms would have enhanced detection of pulmonary TB, particularly among the 20% of inmates who had *M. tuberculosis* isolated on culture but negative results on microscopy, and could have reduced the time from detection to isolation and treatment and assisting with the control of TB transmission.

The conditions that favor TB transmission in correctional facilities also put the general community at risk from onward transmission by staff and visitors, as well as by inmates upon their release (3). The interventions taken at DCJ likely contributed to the declining trend in case detection. These interventions could be scaled up and replicated in other correctional facilities in Bangladesh and other countries in an effort to control TB in these difficult settings. One potential improvement to the intervention would be the use of rapid molecular tests, such as GeneXpert, which can detect TB in just hours compared to the 4-6 weeks necessary for isolation of *M. tuberculosis* on culture. GeneXpert has the added benefit of identifying MDR-TB (12) and thus can inform decisions about which TB treatment regimen to initiate. Use of GeneXpert would be particularly helpful for persons with negative results for AFB on microscopy, but for whom *M. tuberculosis* is isolated on culture. Future studies should evaluate the impact GeneXpert can have on reducing the delay in beginning treatment and improving treatment outcomes among incarcerated populations.

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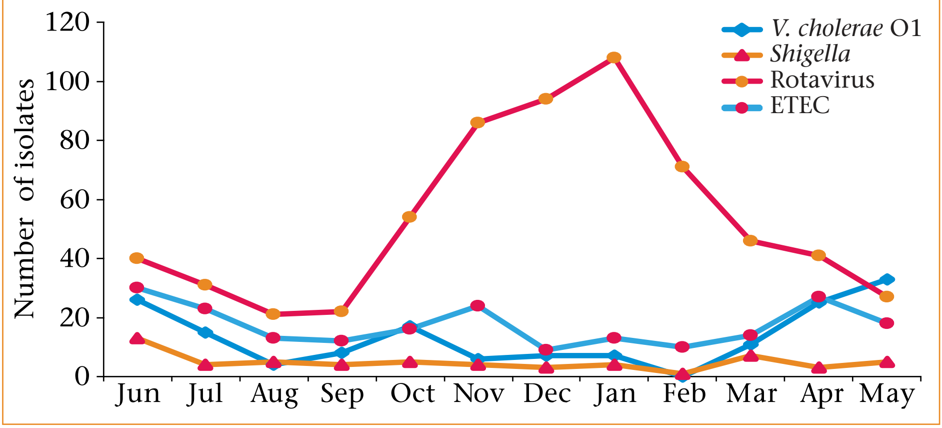
Surveillance updates

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: June 2012-May 2013

Antimicrobial agents	*Shigella* (n=58)	*V. cholerae* O1 (n=159)
Mecillinam	87.9	Not tested
Ampicillin	60.3	Not tested
TMP-SMX	24.1	0.0
Ciprofloxacin	50.0	100.0
Tetracycline	Not tested	2.5
Azithromycin	80.7	100.0
Ceftrioxone	100.0	Not tested

Monthly isolation of* V. cholerae *O1,* Shigella, *Rotavirus and ETEC: June 2012-May 2013

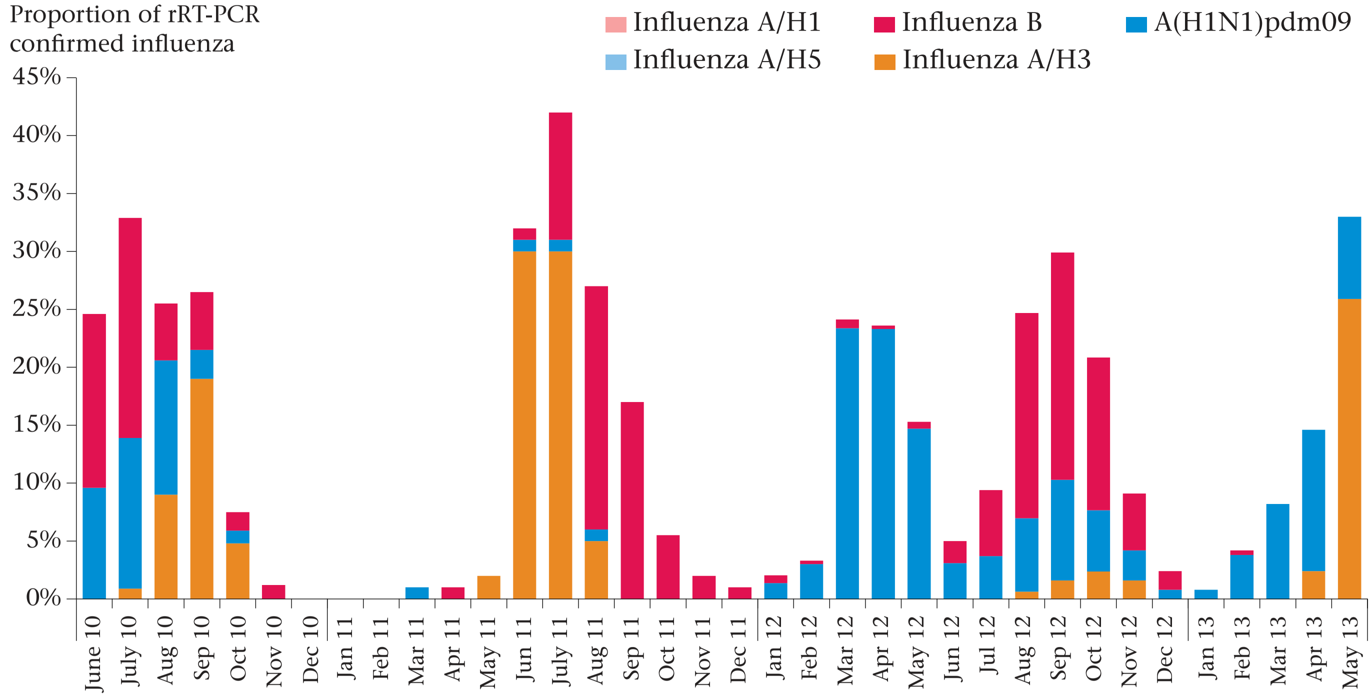


Antimicrobial susceptibility pattern of* S. typhi *among children <5 years during April-June 2013

Antimicrobial agent	Total tested (n)	Susceptible n (%)	Reduced susceptibility n (%)	Resistant n (%)
Ampicilin	22	13 (59.0)	0 (0.0)	9 (41.0)
Cotrimoxazole	22	12 (55.0)	0 (0.0)	10 (45.0)
Chloramphenicol	22	13 (59.0)	0 (0.0)	9 (41.0)
Ceftriaxone	22	22 (100.0)	0 (0.0)	0 (0.0)
Ciprofloxacin	22	2 (9.0)	20 (91.0)	0 (0.0)
Nalidixic Acid	22	2 (9.0)	0 (0.0)	20 (91.0)

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 June 2010 and May 2013



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)

Screening inmates upon entry to Dhaka Central Jail

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