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Latent tuberculosis infection among healthcare workers in chest disease hospitals, Bangladesh

Bangladesh has the sixth highest burden of tuberculosis (TB) in the world. Chest disease hospitals in Bangladesh primarily admit TB patients, and healthcare workers at these hospitals are at risk of TB infection from their daily exposure to TB patients. We aimed to estimate the prevalence of latent TB infection among healthcare workers at chest disease hospitals in Bangladesh. We invited 501 healthcare workers from four chest disease hospitals to undergo a two-step tuberculin skin test (TST) to identify latent TB infection. We considered induration diameter of ≥ 10 mm as positive for latent TB infection after two-step TST testing among those without evidence of active TB. We compared prevalence of latent TB infection between occupational groups of healthcare workers and by hospital using the chi-square test. Among 501 healthcare workers, 90% (449) completed testing. The overall prevalence of latent TB infection among healthcare workers was 54%; the highest was among laboratory staff (65%). The prevalence of latent TB among healthcare workers at the Chittagong Chest Disease Hospital was significantly



higher (67%) than it was among workers at the other three chest disease hospitals (p value=0.01). The prevalence of latent TB infection in this study is similar to the prevalence of latent TB infection among healthcare workers in other countries with high TB burden. Research to explore different TB infection control interventions could identify potential strategies to reduce healthcare associated TB infection.

Bangladesh is a low-income country with a population of 155 million, it has the sixth highest tuberculosis (TB) burden and ninth highest multidrug-resistant (MDR)-TB burden in the world (1). In 2012, more than 170,000 cases of TB were reported of whom 63% were smear-positive, meaning they had an increased capacity to infect others prior to treatment. According to the Bangladesh National Tuberculosis Drug Resistance Survey 2010-2011, the researchers found 1.4% of newly diagnosed cases and 29% of retreated cases to be infected with MDR-TB strains (2). Latent TB is another form of TB. Persons with latent TB are asymptomatic and are not infectious. Persons with latent TB have approximately 10% risk for developing active TB during their lifetime usually occurring within the first 2 years after infection (3).

Chest disease hospitals primarily admit TB patients, and healthcare workers from these hospitals are at risk of TB infection from their daily exposure to patients with active TB, particularly those with smear-positive infection and in settings with limited use of TB infection control measures (4-6). Although prevalence of latent TB infection among healthcare workers has been estimated to be 54% (range 33% to 79%) in selected low- and middle-income countries (7), very few data exist on prevalence among healthcare workers in Bangladesh. To identify the prevalence of latent TB infection among healthcare workers and facilitate the National Tuberculosis Control Programme's (NTP) implementation of the Tuberculosis Infection Control policy in Bangladesh, we sought to estimate the prevalence of latent TB infection among healthcare workers at chest disease hospitals in the country.

We conducted a cross sectional study in four chest disease hospitals: National Institute of Diseases of the Chest and Hospital (NIDCH), Dhaka; Chest Disease Hospital, Khulna; Chest Disease Hospital, Rajshahi; and Chest Disease Hospital, Chittagong. These hospitals are the largest TB specialty hospitals in the country and provide treatment to TB patients.

We invited all healthcare workers, including doctors, nurses, pharmacists, administrators, and laboratory and support staff working in the four facilities to participate. All participants provided informed written consent prior to participation. The study was approved by the institutional review board of icddr,b. After consent was obtained, two trained medical technologists administered a two-step tuberculin skin test (TST): a two-tuberculin unit dose (0.1 ml) of RT23 Purified Protein Derivatives (PPD) was placed intradermally using the Mantoux method (8). Forty-eight to 72 hours after the first TST

was placed, medical technologists measured the transverse diameter of skin indurations at the TST injection site and recorded the readings. For persons whose induration sizes were visible but <10mm, we requested that they receive a second TST 14 days after the first test to stimulate the immune system and capture the boosting effect (8).

We considered an induration diameter of ≥ 10 mm as positive for latent TB infection after two-step TST testing unless subjects had evidence of active TB. We used a structured questionnaire to ask participants about number of years in the healthcare profession, job title, history of Bacille Calmette-Guérin (BCG) vaccination, and exposures to pulmonary TB patients at home. We compared the prevalence of latent TB infection among different occupational groups of healthcare workers by hospital using the chi-square test.

During March through December 2013, we approached 501 healthcare workers to participate in this study. Nineteen persons refused to participate and 33 refused to have the second TST and were excluded from analyses. Four hundred and forty-nine healthcare workers completed two-step TST testing; 78 were from Rajshahi, 81 were from Khulna, 61 were from Chittagong, and 229 were from Dhaka. The largest group of participants were nurses (45%) and 61% were female. Eighty-two percent of respondents reported receiving BCG vaccine as a child. Active TB was not detected in any of the respondents.

The overall prevalence of latent TB infection among healthcare workers at the four chest hospitals was 54%. Healthcare workers in Chittagong had the highest prevalence (67%) and those in Khulna the lowest prevalence of latent TB (40%) (p value=0.01). There were no significant differences in prevalence by occupational group (Table). Eighty-five percent of healthcare workers with latent TB reported no prior exposure to pulmonary TB patients at home.

Table: Prevalence of latent tuberculosis infection determined by two-step tuberculin skin test by facility and by characteristics of healthcare workers at four chest diseases hospitals in Bangladesh, 2013 (N=501).

Demography and exposures	TST positive %	TST positive (n)	P value
Name and location of facilities			
Chest Disease Hospital, Rajshahi	55	43	0.01
Chest Disease Hospital, Khulna	40	32	
Chest Disease Hospital, Chittagong	67	41	
National Institute of Diseases of the Chest and Hospital, Dhaka	55	126	

Table continued on next page...

Demography and exposures	TST positive %	TST positive (n)	P value
Sex			
Male	53	100	0.37
Female	52	142	
History of BCG¹ vaccination			
Yes	55	198	0.54
No	49	40	
Don't know	44	4	
Education			
0 to Primary	53	26	0.57
Secondary	49	56	
Higher Secondary Certificate/Diploma	54	107	
BA ² /BSC ³ /BA Hons ⁴ /BSC Hons ⁵	60	39	
Masters and above	56	14	
Occupational group			
Doctors	56	15	0.77
Nurses	52	105	
Administrative officers	59	24	
Laboratory staff	65	13	
Support staff	53	83	
Pharmacists	33	2	
Duration of service in years			
≤10	50	47	0.58
10-20	58	92	
20-30	52	61	
≥30	52	42	
Median, IQR ⁶		19 (11-27)	
Age in years			
18-30	50	23	0.77
30-40	54	65	
≥40	54	154	
Median, IQR		43 (36-50)	
Lived with someone diagnosed with pulmonary tuberculosis at home			
Yes	15	37	0.45
No	85	205	

¹BCG=Bacille Calmette-Guérin; ²BA=Bachelor of Arts; ³BSC=Bachelor of Science; ⁴BA Hons=Bachelors of Arts with honours (4 years degree); ⁵BSC Hons=Bachelors of Science with honours (4 years degree); ⁶IQR=interquartile range

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Comments

Fifty-four percent of healthcare workers in this study had latent TB infection, with the highest prevalence among those at the Chest Disease Hospital, Chittagong. The lack of reported exposure to pulmonary TB patients at home suggests that it is likely healthcare workers were infected from their daily exposure to TB patients at the chest disease hospitals. With the recent emergence of extensively drug-resistant tuberculosis and totally drug-resistant tuberculosis, WHO and the Stop TB Partnership, a collaboration of over 1000 international public and private organizations to eliminate TB, have emphasized the importance of implementing infection control programs (9,10).

Our findings are consistent with the results of a systematic review of latent TB infection among healthcare workers in countries with high TB burden conducted by Joshi and others in which authors estimated the same prevalence (54%) of latent infection among healthcare workers in other low-income countries with high TB incidence (7). The difference in prevalence of latent TB infection at participating hospitals could be due to differences in prevalence of smear-positive TB patients, infection control practices, locations of duty stations of healthcare workers, and bed occupancy rates at the four hospitals.

As with all studies of occupational TB, our results might have overestimated latent TB infection owing to non-occupational exposures because we could not exclude non-occupational exposures such as exposure to TB at home or in the community. However, only 15% of the healthcare workers with positive TST results reported TB exposure at home. BCG vaccination might have had an effect on TST results; however, several TST surveys conducted in countries with high TB burden found that BCG vaccination does not influence estimates of annual risk of infection among children and adults determined by TST (11-13). In addition, TST cannot differentiate between infection owing to *Mycobacterium tuberculosis* and infection owing to nontuberculous Mycobacteria, and this may have resulted in an overestimation of the prevalence of latent TB infection in this study. Although interferon-gamma release assays (IGRAs) are more specific and are less likely to be affected by nontuberculous Mycobacteria exposure (14), serial IGRA use might be problematic because of lack of data on optimum cut-offs for serial testing

and because interferon-gamma levels near test cut-off values can fluctuate, leading to erroneous conversions and reversions in serial testing (15). Many studies have shown high agreement between TST and IGRAs and estimates of prevalence based on using the two testing methods have been comparable (16-17).

The prevalence of latent TB infection among healthcare workers provides evidence of ongoing healthcare-associated TB infection, underscoring the urgent need for improved TB infection control policies and procedures in this study. Future work should include prospective serial TST testing to detect latent TB infection among healthcare workers to capture incident cases and to assess risk factors for infection to help healthcare facilities identify and prioritize targets for infection control (18). Bangladesh's NTP recently developed and adopted National Tuberculosis Infection Control Guidelines, however, assessment and implementation of these guidelines in healthcare facilities are needed (19). Future studies that explore differences in the physical characteristics of facilities and the practices of healthcare workers are needed to identify barriers to and opportunities for implementing infection control measures in hospitals in Bangladesh. The findings from this study will assist Bangladesh's NTP in its effort to control healthcare-associated TB infection more efficiently and effectively.

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Management of patients with acute respiratory illness in pharmacies in Dhaka City, Bangladesh

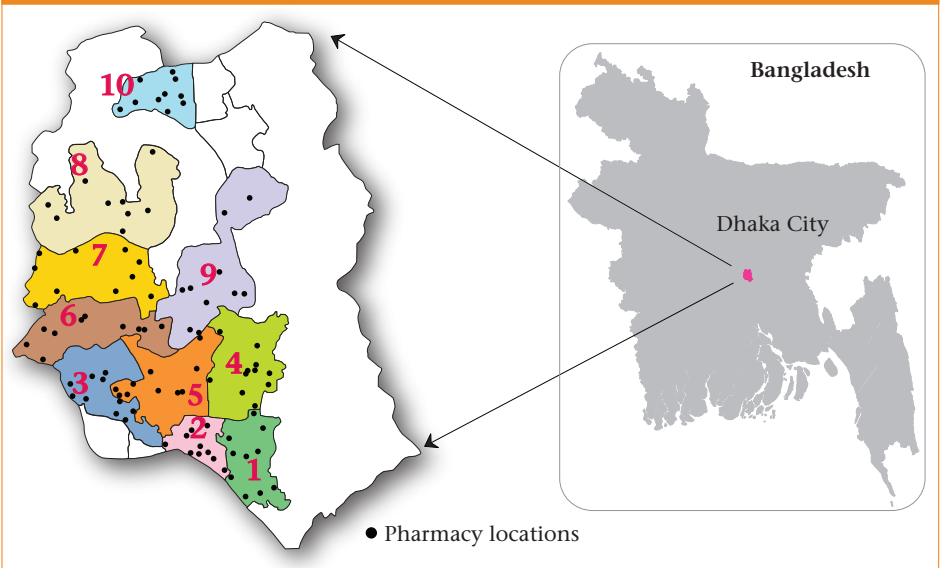
Drug sellers in Bangladesh often serve as a first point of care for the poor and less educated. To assess practices of drug sellers in the management of acute respiratory illness (ARI), we conducted a cross-sectional study of 100 randomly selected pharmacies across the city of Dhaka. We deployed field assistants pretending to be relatives of patients with different clinical scenarios of ARI to assess drug sellers' dispensing practices. Drug sellers dispensed drugs in 76% (456/600) of cases. Thirty-seven percent (224/600) of patients received antibiotics and 39% (232/600) received drugs other than antibiotics. Some patients who were not given antibiotics were advised to return for antibiotics (30%; 69/232) if they were not cured within 3-5 days and others were advised to get an antibiotic prescription from a physician (8%; 19/232). In only 6% (33/600) of consultations did drug sellers refuse to dispense medications because patients were not present. According to the Integrated Management of Childhood Illness ARI management guidelines developed by the United Nations Children's Fund and the World Health Organization, only patients diagnosed with pneumonia should receive antibiotics and patients with severe pneumonia should be referred to a healthcare facility after assessment by a healthcare provider. Drug sellers' practices for managing ARI were not in accordance with ARI guidelines on most occasions. Formal training on empirical management of ARI may promote safer dispensing practices.

In low-income countries, drug sellers at pharmacies play an important role in healthcare services, providing health advice and medicine (1,2). During the 2009 influenza pandemic, a survey in Dhaka reported that 48% of respondents with influenza-like illnesses used pharmacies as their first point of care (3).

We investigated drug sellers' practices for the management of patients with acute respiratory illness (ARI) symptoms throughout the city of Dhaka, Bangladesh. From June to September 2012, we conducted a cross-sectional study of 100 randomly selected pharmacies. We selected 10 pharmacies from each of the 10 zones of Dhaka City using ten randomly generated global positioning system (GPS) points in each zone and locating the closest pharmacy to each GPS point (Figure). After obtaining written informed consent for an interview, researchers used a structured questionnaire to collect demographic and educational information from the drug seller who

spent the most time in each pharmacy. Additionally, six field assistants visited the selected pharmacies and pretended to be relatives of patients with ARI symptoms and sought the drug sellers' advice for medications for the clinical management of the ARI patients. The field assistants did not provide any prescriptions for medications. Each of the six field assistants was given one of six different clinical scenarios (three paediatric and three adult scenarios) to present at each pharmacy they were assigned to visit. The clinical scenarios were: acute onset of cough and runny nose in children; cough and fever in children; respiratory distress in children; cough and runny nose in adults; cough and fever in adults; and cough, fever and respiratory distress in adults. If drug sellers asked about the duration of illness, field assistants said the duration was seven days for cough (typical duration of respiratory viral illnesses), three days for fever and one day for respiratory distress. If drug sellers refused to dispense medications on the first request, field assistants requested a medication a second time, stating that financial hardship prevented them from consulting with a physician and/or citing difficulties with bringing the patient with them to the pharmacy. Field assistants did not request specific types of medications. When drug sellers agreed to dispense medications, the field assistants purchased the recommended drugs and recorded the health advice provided to them by the drug sellers.

Figure: Location of 100 randomly selected pharmacies from 10 zones in Dhaka City, Bangladesh, 2012



Of the 100 participating pharmacies, 67% were licensed by the Government of Bangladesh and the rest had no official sanction. The median age of

interviewed drug sellers was 34 (interquartile range [IQR]: 28-41) years, the median number of years of education completed was 12 (IQR: 10-14), and the median number of years of work experience was 12 (IQR: 7-14). Fifty-eight percent of the pharmacies had one drug seller on staff, 48% of the interviewed drug sellers had attended accredited professional healthcare-related certification courses, and 8% had attended more than one course.

During 600 total consultations, drug sellers dispensed drugs 383 (64%) times on the first request, asked field assistants to take the patient to a physician or hospital 184 (31%) times, and refused to provide drugs because the patient was absent 33 (6%) times (Table 1). During 73 (12%) consultations, drug sellers agreed to dispense a drug despite initially refusing to do so (Table 1).

Table 1: Responses by drug sellers to acute respiratory illness (ARI) clinical scenarios, 100 selected pharmacies, Dhaka City, Bangladesh, June-September 2012

Responses by drug sellers	Clinical Scenario					
	Adults with ARI			Children with ARI		
	Cough and runny nose N=100 %	Fever with cough N=100 %	Fever, cough and respiratory distress N=100 %	Cough and runny nose N=100 %	Fever with cough N=100 %	Respiratory distress N=100 %
One or more drugs dispensed on 1 st request	98	70	49	63	76	27
Refused to dispense drugs on 1 st request: recommended contacting physician	1	29	38	32	14	70
Refused to dispense drugs on 1 st request because patient was absent	1	1	13	5	10	3
One or more drugs dispensed on 2 nd request	0	27	10	15	3	18
One or more drugs dispensed during consultation	98	97	59	78	79	45

Acetaminophen was the drug that was most commonly dispensed, being given in 238 (40%) of 600 consultations; antibiotics were dispensed in 224 (37%) consultations (including for children and adults who were reported to only have a cough and runny nose); antihistamines were dispensed in 117 (29%) consultations (most frequently for patients reported to have cough and runny nose); and bronchodilators were dispensed in 103 (17%) consultations (primarily for patients with respiratory distress) (Table 2). An average of 2.1 (standard deviation: ± 0.95) drugs were dispensed per consultation. Three or more drugs were dispensed in 89 (15%) consultations.

Table 2: Drugs dispensed by drug sellers for acute respiratory illness (ARI) clinical scenarios, 100 selected pharmacies in Dhaka City, Bangladesh, June-September 2012

Drugs dispensed	Clinical Scenario					
	Adults with ARI			Children with ARI		
	Cough and runny nose N=100 %	Fever with cough N=100 %	Fever, cough and respiratory distress N=100 %	Cough and runny nose N=100 %	Fever with cough N=100 %	Respiratory distress N=100 %
Acetaminophen	10	94	52	3	79	0
Antihistamines	74	25	10	44	23	1
Bronchodilators	0	4	36	8	8	47
Steroids	1	1	6	0	0	4
Antibiotics (1 st request)	43	46	40	25	41	8
Antibiotics (2 nd request)	0	9	5	1	0	6
Antibiotics (in total)	43	55	45	26	41	14
Other types of drugs	55	56	24	30	20	10
Drugs other than antibiotics	55	42	14	52	38	31
Three or more drugs	17	30	23	1	16	2

Amoxicillin was the antibiotic most frequently dispensed, being given in 86 (14%) of 600 consultations followed by azithromycin, which was dispensed in 66 (11%) consultations.

Drug sellers provided additional advice during 142 (31%) of the 456 consultations during which medicines were given. The most common advice given was to return to the pharmacy for antibiotics if the patient was not cured within 3-5 days (69 consultations; 49%), avoid cold drinks (22 consultations; 16%), obtain a physician's prescription for antibiotics if not cured (19 consultations; 13%), and to use a nebulizer (13 consultations—advice to use nebulizers was only given for children with respiratory distress; 9%).

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Comments

In Bangladesh, a 2007 national survey revealed that 95% of healthcare providers are unregulated, informal and often lack qualifications in their field (4). According to that survey drug sellers comprised 8% of the total population of healthcare providers in Bangladesh and comprised 16% of healthcare providers in urban areas (4). That survey also reported that no drug seller had received a minimum level of training in healthcare or drug dispensing (4). In our study, 48% of drug sellers reported that they had participated in at least one professional healthcare-related course.

The majority of persons with ARI typically present with symptoms such as cough, stuffy/runny nose and sore throat with or without fever (5). Persons with these symptoms frequently have self-limiting viral illnesses that do not require antibiotics (5).

According to the Integrated Management of Childhood Illness (IMCI) ARI management guidelines developed by the United Nations Children's Fund and the World Health Organization, acetaminophen is considered the only appropriate drug choice for patients with a common cold (cough and stuffy/runny nose) and fever along with home remedies for coughing relief and a follow-up visit if any danger signs develop (6). According to the guidelines, patients diagnosed with pneumonia should receive appropriate antibiotics or in cases of suspected severe pneumonia be advised to seek care from a health facility after assessment by a healthcare provider (6). However, our study showed inconsistent referral practices and frequent prescribing of antibiotics without clinical assessment of patients. Several types of antibiotics were commonly prescribed for both children and

adults with mild-to-severe ARI. According to Bangladesh's 2005 National Drug Policy, drug sellers are prohibited from dispensing any antibiotics without a physician's prescription (7). However, antibiotics were dispensed in over 40% of consultations involving adult patients and one-quarter of consultations involving paediatric patients when only cough and runny nose were present. Moreover, antibiotics were dispensed in approximately half of consultations for adults and children with cough with fever. These findings indicate a lack of knowledge about the potential consequences of inappropriately prescribing antibiotics and may be driven in part by financial considerations of drug sellers. Several studies in other countries and a study in rural Bangladesh have also reported inappropriate use of antibiotics for ARI (8-12). Inappropriate use of antibiotics, especially in densely populated developing countries, may contribute to the spread of antimicrobial resistance globally.

There were some limitations to this study. First, we could not assess the practices of the drug sellers who did not consent to participate and it is possible that the practices of these drug sellers differed from those who did participate. Second, this study presents findings for six pre-defined clinical scenarios and not all possible clinical manifestations of ARI. Third, data were obtained by field staff who presented scenarios for fictitious patients. Thus, we cannot account for all the variations of interactions that may occur between drug sellers and their customers regarding actual patients or what decisions customers may actually make after being denied medication after requesting it. Fourth, this study was conducted in Dhaka City and may not be representative of the situation throughout Bangladesh or even in other urban areas in Bangladesh.

Based on this study we recommend that Bangladesh's Directorate General of Drug Administration, other government officials from Ministry of Health and Family Welfare and healthcare providers work with the drug sellers to promote formal training on empirical ARI management according to the IMCI and national guidelines, which may improve care and minimize inappropriate drug dispensing. Moreover, it would be very beneficial if policy-makers could develop guidelines regarding the dispensing of antibiotics in pharmacies and regulations to ensure compliance.

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Despite an overall reduction in maternal deaths in Bangladesh from 2001-2010, the proportion of jaundice-associated maternal deaths remains the same

Hepatitis E virus (HEV) is an acute infection of the liver that preferentially kills pregnant women. Maternal jaundice is frequently associated with maternal mortality in Bangladesh, and HEV probably causes many of these pregnancy-associated deaths. We analysed population-based verbal autopsy data using the 2010 Bangladesh Maternal Mortality and Health Care Survey and found that in 23% of all maternal deaths in Bangladesh, the mother suffered from acute jaundice in the illness preceding death. This result is consistent with previously published estimates showing that 19% of maternal deaths in Bangladesh in 2001 were associated with jaundice. The continued study of HEV is warranted, with a focus on more accurately measuring the incidence of HEV-related maternal and neonatal mortality and the possible role of HEV vaccine to prevent deaths in pregnant women and their newborns.

Hepatitis E virus (HEV) is a single-stranded, positive-sense RNA virus that is predominantly transmitted through the faecal-oral route resulting in hepatitis epidemics as well as sporadic cases (1). HEV infection is endemic in South Asia including Bangladesh (2,3). In men and in women who are not pregnant, the infection is usually self-limiting and has a case-fatality rate of less than 0.1% (4). However, the case-fatality rate in pregnant women may reach 20% among those infected during the third trimester of pregnancy (5). HEV infection in pregnant women leads to fulminant hepatic failure and to maternal death due to haemorrhage in a significant proportion of patients (6). Limited hospital-based studies have shown that vertical transmission to the foetus is nearly 100% and HEV infection during pregnancy increases the risk of abortions, stillbirths, and neonatal mortality (7-10). The incubation period of HEV ranges from 15 to 60 (mean 40) days from the time of exposure (11). During the first, prodromal, phase, patients may experience fever and nausea. During the second, icteric, phase, the sclerae become discoloured, jaundice (yellowing of the eyes and skin) occurs, and the urine becomes dark, making HEV clinically indistinguishable from other causes of acute viral hepatitis (4,11).

In 2012, Gurley *et al.* calculated the number, proportion and estimated rates of maternal deaths associated with jaundice using verbal autopsy data from two population-based studies in Bangladesh: the 2001 Bangladesh Maternal

Mortality and Health Care Survey (BMMS 2001) and 2003-2005 Matlab Health and Demographic Surveillance System data. The proportion of maternal mortality associated with jaundice during pregnancy was 19% in 2001 and 27% during 2003-2005 and the estimated maternal mortality ratio associated with jaundice was 54 per 100,000 live births in 2001 and 55 per 100,000 live births from 2003 to 2005 (7). Our study was designed to repeat this analysis using data from the second Bangladesh Maternal Mortality and Health Care Survey, conducted in 2010 (BMMS 2010), and compare it to data from BMMS 2001 to determine if the burden of maternal mortality associated with jaundice had changed over time.

BMMS 2010 collected extensive information about maternal health, maternal health care, and maternal mortality from a nationally representative survey of 175,000 households in Bangladesh between 2008 and 2010. In brief, sampled households were interviewed about female deaths that occurred during the previous three years, i.e. prior to when survey data was collected. A detailed verbal autopsy questionnaire was used to collect data on the signs and symptoms experienced by women in the illness episode immediately preceding death.

We analysed verbal autopsy records for all 901 deaths in females aged 13 to 49 years to determine the number and proportion of maternal deaths associated with jaundice. We defined maternal deaths as those that occurred during pregnancy or within 42 days of termination of pregnancy following a live birth, still birth, or abortion/miscarriage.

One hundred and thirty-one maternal deaths occurred in households sampled in BMMS 2010 (Table). Thirty (23%) of these women had new onset of jaundice during their pregnancy. The weighted maternal mortality ratio associated with jaundice was 45 per 100,000 live births. Of the 30 jaundice-associated maternal deaths, 11 (37%) occurred in Dhaka Division and 21 (70%) occurred in rural areas. Among these 30 women, 18 (60%) pregnancies resulted in live births, 6 (20%) ended in stillbirth, and 3 (10%) ended in abortion or miscarriage. Data in relation to outcome of pregnancy was not available for 3 (10%) of these women. Information is not available about whether the children resulting from the 18 live births survived the first month of life.

From 2001 to 2010, the maternal mortality ratio declined 40% and the maternal mortality associated with jaundice declined 27% (Table). Although the maternal mortality ratio and maternal mortality associated with jaundice during these years declined, the difference between the proportionate mortality from deaths associated with jaundice in pregnant women did not change significantly (from 19% to 23%, p -value=0.3) during 2001-2010. Twelve (40%) of the 30 maternal deaths associated with jaundice from BMMS 2010 data were categorised as deaths from haemorrhage, a known complication of HEV during pregnancy (6).

Table: Number, Proportion, and Estimated Rates of Maternal Deaths Associated with Maternal Jaundice in Bangladesh. From the 2001 and 2010 Bangladesh Maternal Mortality and Health Care Surveys (BMMS)

	Bangladesh Maternal Mortality & Healthcare survey	
	2001 ^a	2010 ^b
Number of maternal deaths	186	131
Maternal mortality ratio per 100,000 live births	322	194
Maternal deaths associated with jaundice		
Number (%)	35 (19)	30 (23)
Mortality rate per 100,000 live births	61	45
^a Data comes from Gurley <i>et al.</i> , 2012 (7) and 2001 BMMS (12);		
^b Data comes from 2010 BMMS (13)		

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Comments

In summary, 23% of maternal deaths were associated with jaundice in 2010. From 2001 to 2010, the proportionate mortality from deaths associated with jaundice in pregnant women remained the same, underscoring the fact that maternal jaundice remains an important contributor to maternal mortality. Therefore, maternal jaundice remains an important contributor to maternal mortality, though it is still unknown how many of these deaths are caused by HEV.

Although the verbal autopsy analysis did not include laboratory data that would allow differential diagnoses in individual cases, clinical studies of acute liver failure in Bangladesh have shown HEV to be the main aetiologic agent responsible for maternal deaths associated with jaundice (14-16). Approximately 12,000 maternal deaths occur in Bangladesh per year (17). BMMS 2010, collected from a population of about 175,000 reproductive-aged (13-49 years) women suggest that jaundice is associated with 23% of maternal deaths in Bangladesh. Therefore, an estimated 2,760 deaths that occurred during pregnancy in Bangladesh during 2010 were associated with jaundice. A review of the literature indicates that HEV is likely to cause >50%

of maternal deaths associated with jaundice in HEV endemic countries (7). This study has several limitations. Verbal autopsies are widely used in many low-income countries to determine the rates and cause-specific mortality of maternal deaths in regions without medical death certification and where the majority of the women die at home (18,19). Pregnancy-related deaths are not easy to diagnose using verbal autopsy methods (18), and our findings are limited because they relied upon relatives or caregivers to recognize and understand the signs and symptoms of jaundice that preceded deaths, sometimes years after they occurred. Our data rely on the assumption that the signs of jaundice—yellow eyes and skin and dark urine—can be accurately recognised, recalled and reported by persons without any medical training. Hepatocellular jaundice, the build-up of bilirubin (yellow bile pigment) in the blood, is a common sign of acute hepatitis (20) and jaundice preceding death is not diagnostic for HEV. However, we have relied upon published literature of hospital-based studies to infer that the majority of maternal deaths associated with jaundice were due to HEV (7).

Efforts to estimate the incidence of HEV mortality are warranted because HEV infection is preventable by vaccination (5,7). Effective HEV vaccines have been developed but robust data to show that they can protect women from HEV during pregnancy are not available. Thus, intervention trials to demonstrate their effectiveness in reducing maternal and neonatal mortality are urgently required (21,22).

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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: March 2013-February 2014

Antimicrobial agents	<i>Shigella</i> N=64	<i>V. cholerae</i> O1 N=267
Mecillinam	84.1	Not tested
Ampicillin	59.4	Not tested
TMP-SMX	29.0	0.8
Ciprofloxacin	43.8	100.0
Tetracycline	Not tested	1.1
Azithromycin	84.4	100.0
Ceftriaxone	100.0	Not tested

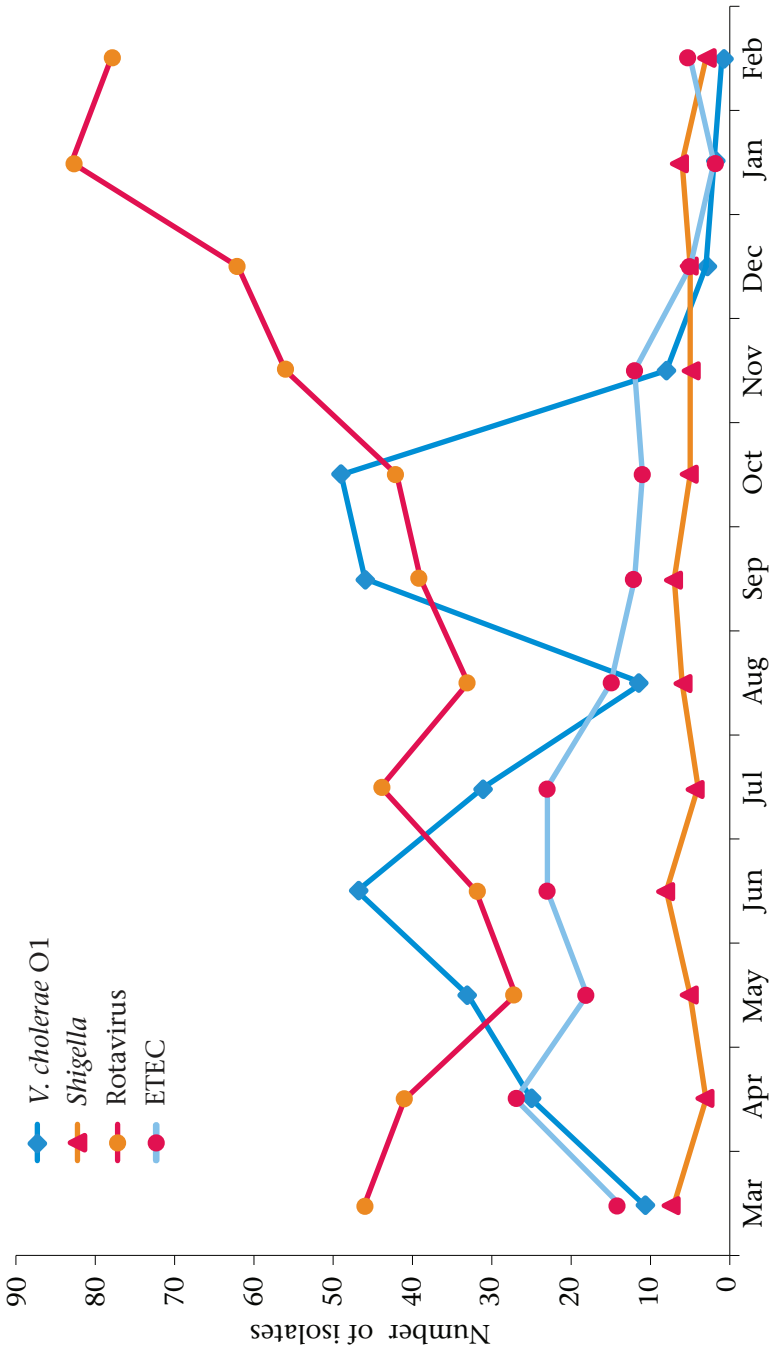
Source: Hospital Surveillance, Dhaka Hospital, icddr,b

*Antimicrobial susceptibility pattern of *S. typhi* among children <5 years during January-March 2014*

Antimicrobial agent	Total tested (N)	Susceptible n (%)	Reduced susceptibility n (%)	Resistant n (%)
Ampicillin	15	7 (47)	0 (0)	8 (53)
Cotrimoxazole	15	13 (87)	0 (0)	2 (13)
Chloramphenicol	15	13 (87)	0 (0)	2 (13)
Ceftriaxone	15	15 (100)	0 (0)	0 (0)
Ciprofloxacin	15	5 (33)	10 (67)	0 (0)
Nalidixic Acid	15	1 (7)	0 (0)	14 (93)

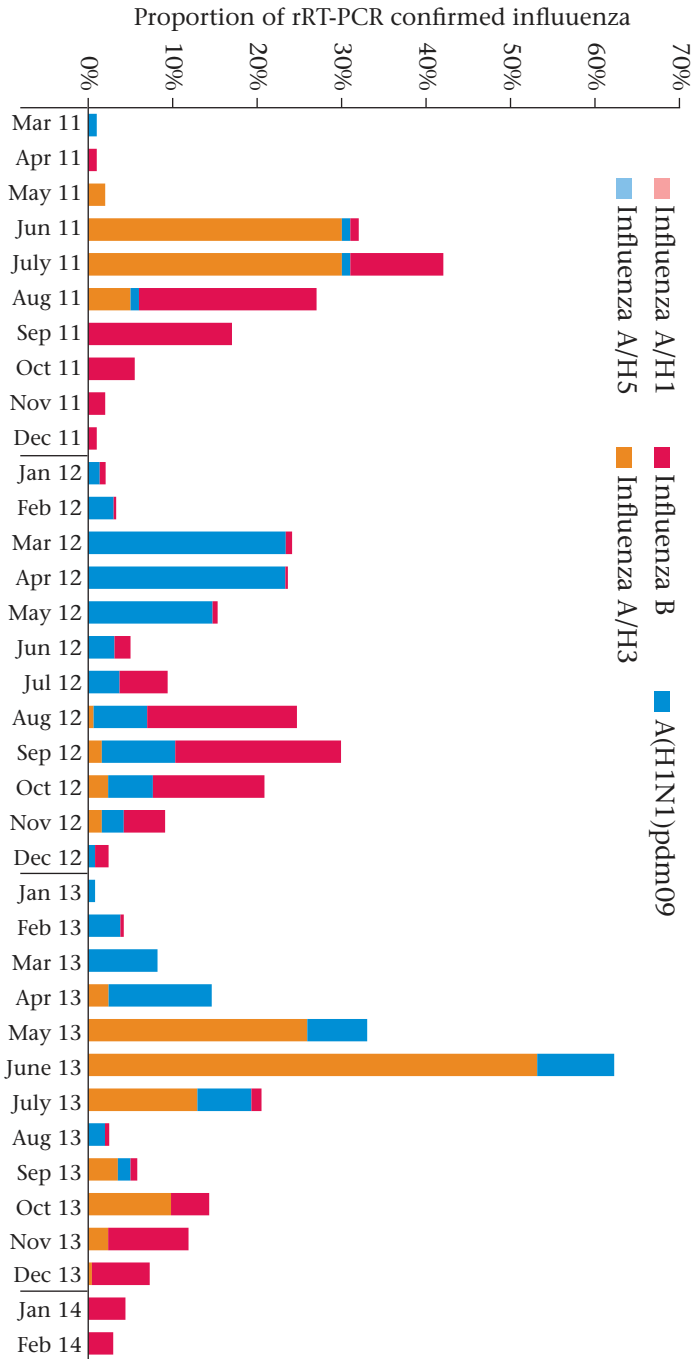
Source: icddr,b's urban surveillance in Kamalapur (Dhaka)

Monthly isolation of *V. cholerae* O1, *Shigella*, Rotavirus and ETEC: March 2013-February 2014



Source: Hospital Surveillance, Dhaka Hospital, icddr,b

Proportion of laboratory-confirmed influenza among hospitalized severe acute respiratory illness (SARI) and outpatient influenza like illness (ILI) cases between March 2011 and February 2014



Source: Patients participating in hospital-based influenza surveillance in Dhaka National Medical College Hospital, Community-based Medical College Hospital (Myrmensingh), Jahurul Islam Medical College Hospital (Kishoregonj), Rajshahi Medical College Hospital, Shahed Ziaur Rahman Medical College Hospital (Bogra), LAMH Hospital (Dhinalpur), 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)



Drug sellers serving customers at a typical pharmacy, Dhaka City

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