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Inside

The importance of viral infection in pneumonia among children under age 2 years

Pneumonia is the leading cause of childhood death in Bangladesh. This study examined the aetiology of pneumonia among young children in a rural community of Bangladesh. Two hundred and fifty-two newborns were visited weekly from birth until they reached 24 months of age by community health workers who identified and referred cases of acute lower respiratory tract infection. Sixty-seven cases of pneumonia were diagnosed. Among 58 children with chest radiographs, 30 (52 %) showed consolidation. Among 58 children with viral nasopharyngeal specimens, 26 (45%) had a positive antigen test for a viral pathogen, most commonly respiratory syncytial virus (n=21, 36%) or parainfluenza (n=4, 7%). A bacterial pathogen was isolated from blood culture in 5 of 48 patients (10%). Respiratory viruses are important causes of childhood pneumonia in Bangladesh.

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KNOWLEDGE FOR GLOBAL LIFESAVING SOLUTIONS

Acute lower respiratory tract infection is the leading cause of childhood death globally and in Bangladesh (1,2). Most studies on the infectious agents responsible for lower respiratory tract infections have been conducted in hospital settings where health care utilization patterns may skew the relative prevalence of different pathogens. This report summarizes a study that was conducted to determine the aetiology of pneumonia in a cohort of newborns followed from birth to 24 months of age who lived in Mirzapur, a rural community of Bangladesh (3).

A census was conducted in ten villages in Mirzapur Upazila during July and August 1993. Details of the data collection are reported elsewhere (4). All women who were likely to become pregnant and deliver their babies within the period of 1 year were interviewed about their menstrual history to identify newborns for the cohort. A total of 288 children were born during a 1-year period of recruitment (between October 1993 and September 1994); 256 of them (89%) were enrolled and followed. The prevalence of low birth weight (<2,500 g) was 34%, and 15% had a premature birth. Prevalence of exclusively breastfeeding up to 3 months of age was 38%. Most of the mothers and two-thirds of the fathers had ⊠5 years of schooling. About half of the households had <3000 taka (US$ 65) monthly income and had school-aged children.

A community health volunteer visited each household twice a week and asked a standard series of questions about the occurrence of respiratory symptoms noticed during the time since the last visit (3-4 days previously), according to the WHO definition of acute lower respiratory infection (5). Community health volunteers referred infants to Kumudini Hospital if they had any one sign of acute respiratory infection (laboured breathing, and observed increased respiratory rate [i.e., 50 breaths per minute or more in a child aged 2 months to 12 months, 40 breaths per minute or more in a child aged 12-24 months], wheezing, and chest indrawing). At the hospital, a paediatrician reviewed the signs and symptoms by observation and auscultation of the chest and made a clinical diagnosis of the patient. All pneumonia cases were recommended for hospital admission for investigation and treatment. Chest radiographs were conducted in the hospital and were read by a radiologist. All hospitalized cases received standard medical treatment. Immediately after admission, 1.5 ml venous blood was collected in a Wample Isolator (Wampole Laboratories, Cranbury NJ) for bacterial culture and a nasopharyngeal aspirate for viral identification was collected. Nasopharyngeal aspirates were tested in batches by enzyme-linked immunosorbent assay (ELISA) for respiratory syncytial virus, influenza A, influenza B, parainfluenza 1,2 and 3, and adenovirus (6).

The characteristics of children who developed pneumonia were compared to children who did not develop acute lower respiratory illness using multiple logistic regression.

During the household surveillance, field workers identified 256 episodes of acute lower respiratory tract infections and referred them for evaluation. After examining the patients, paediatricians diagnosed 67 cases (26%) as pneumonia. This translates into an incidence of clinical pneumonia of 13 episodes per 100 children/years among children under age 2 years. All the pneumonia cases were advised hospitalization; 62 cases (93%) were admitted and 5 were treated at home. Among 58 patients who had chest radiograph taken 30 (52%) had pneumonic consolidation.

Nasopharyngeal aspirates were collected from 58 (87%) of the pneumonia cases. Twenty-six (45%) of the nasopharyngeal aspirates had viral antigens detected by ELISA. The most commonly identified agents were respiratory syncytial virus and parainfluenza. Influenza B was identified in one patient (Table 1).

Table 1: Organisms detected in nasopharyngeal secretion and blood culture from pneumonia cases in a cohort of newborns from birth to 24 months of age in rural Mirzapur, Bangladesh

Aetiologic agents	n	%
Nasopharyngeal secretion (n = 58)		
Virus detection	26	45.0
Respiratory syncytial viruses	21	-
Parainfluenza 2	3	-
Parainfluenza 3	1	
Influenza B	1	-
Blood culture (n = 48)		
Bacteria isolation	6	12.5
Pseudomonas aeruginosa	1	-
Branhamella catarrhalis	1	-
Staphylococcus aureus	2	-
Staphylococcus epidermidis	1	-
Streptococcus pneumoniae	1	-
No bacteria isolated	42	87.5

Blood cultures were collected from 48 (72%) of the pneumonia cases. A bacterial pathogen was isolated from 5 patients. *Streptococcus pneumoniae* was isolated from one patient.

In the multiple logistic regression model, children who lived in a one-room house had a 3.7 times higher probability of acquiring viral pneumonia than children living in a house with more than one room (p=0.041, CI 1.05-12-83). Children had a 3.2 times higher probability of developing viral pneumonia if they lived in a house that had school-aged children than in a household that had no school-aged children (p=0.058, CI 0.95-10.81). Low birth weight and father's earning capacity did not significantly affect risk of viral pneumonia.

Reported by: Child Health Unit, Public Health Sciences Division, ICDDR,B

Supported by: United States Agency for International Development, Washington, DC

Comment

This is the first community-based study identifying the pathogens associated with pneumonia, in Bangladesh. In this study, 45% of nasopharyngeal aspirates identified viral antigens. This proportion is similar to the results of hospital-based studies in India, The Gambia, and Central Australia (7,8,9).

Bacteria were less commonly identified in this cohort than viruses, but blood culture is quite insensitive for the diagnosis of bacterial pneumonia (10). Indeed, all pneumonia cases received antibiotics for case management in the hospital. In a community study in Bangladesh, mortality from acute lower respiratory infection was significantly reduced by intervention with antibiotics (11), suggesting bacterial aetiologies. Many serious respiratory infections are thought to be caused by co-infection with both bacteria and viruses (12).

Crowding and having a school-aged sibling increased the risk of viral pneumonia among children under age 2 years, a pattern reported elsewhere in Asia (13). This suggests that interventions to reduce respiratory disease among school-aged children may reduce pneumonia mortality among younger children at highest risk.

Acute respiratory infection is the leading cause of death among children in Bangladesh. These data suggest that both bacteria and viruses contribute to this problem.

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Field evaluation of simple rapid tests in the diagnosis of syphilis

In Bangladesh, syphilis infection rates range from 1-6% in the general population to 15–43% among high-risk groups. Currently, some primary health care clinics use the rapid plasma reagin test to screen for syphilis, although this test has proved to be unreliable in this setting. We tested 684 sex workers for syphilis using two new rapid tests, the immunochromatographic strip test and rapid test device, and compared the performance of these tests to the WHO standard in ICDDR,B's reference laboratory. We also compared performance of the tests between high and low skilled staff. The immunochromatographic strip test performed well in the primary health care setting with high sensitivity (94%), specificity (93%), positive predictive value (77%) and negative predictive value (98%). Considering the low cost (Tk 22 or US$ 0.31) as well as the rapid and reliable results produced by the immunochromatographic strip test, it should be considered for use in syphilis screening in primary health care clinics where the less reliable rapid plasma reagin test is currently used.

Syphilis is one of the most common sexually transmitted infections in developing countries. Once diagnosed, syphilis infection is easy to treat. However, untreated syphilis causes neurologic illness and potentiates transmission of the human immunodeficiency virus (HIV) (1,2). Untreated syphilis can also affect pregnancies, resulting in spontaneous abortion, stillbirth, prematurity and congenital syphilis (3).

In Bangladesh, the prevalence of syphilis in groups vulnerable to HIV infection is high (15-43%) (4,5). Several studies reported that the prevalence of syphilis among the general population in Bangladesh ranged between 1 to 6% (6,7).

The World Health Organization (WHO) guideline for the serological diagnosis of syphilis recommends the use of rapid plasma reagin test and *Treponema pallidum* haemagglutination assay as standard tests for screening and diagnostic purposes (8). The rapid plasma reagin test is used in many primary health care clinics in developing countries, including Bangladesh. Though the rapid plasma reagin test is inexpensive (about Tk 8 or US$ 0.11/test), it requires a centrifuge machine and rotator that are not available in most settings where patients are evaluated in Bangladesh; it takes one hour to complete and it requires a skilled technician to

correctly interpret the results. In addition, due to the non-specificity of the rapid plasma reagin test, a confirmatory test, *Treponema Pallidum* haemagglutination assay (about Tk 28 or US$ 0.40 /test) is required which needs a more sophisticated laboratory setting. Although the rapid plasma reagin test achieves valid results in sophisticated laboratories, its performance in primary health care clinics when conducted by paramedics in Bangladesh was poor, with only 13% sensitivity and 96% specificity in a population of pregnant women (9). A simpler, more reliable rapid test is needed for diagnosing syphilis in primary health care clinics in Bangladesh.

The immunochromatographic strip test and syphilis rapid test device are two commercially available rapid diagnostic tests for syphilis that identify serum antibodies to a recombinant *T. pallidum* specific antigen (ACON Laboratories Inc.). These tests kits can be stored at room temperature, involve few steps, can be used on whole blood, require minimum technical training, no specialized equipment, and yield easily interpretable results in 10-15 minutes. The cost ranges between Tk. 22-29 (US$ 0.31-0.41) per test kit. Both tests are yet to be evaluated at the field level with paramedics performing the tests. In this study we evaluated their performance in a primary health care clinic where paramedics performed the tests. We hypothesized that these tests would be more sensitive and easier to perform than the rapid plasma reagin test currently being used in primary health care clinics in Bangladesh.

Female sex workers, regardless of symptoms, attending the primary health care clinic run by ICDDR,B in a vagrant home at Mirpur, Dhaka between August 2004 and August 2005 were eligible for enrolment in the study. After providing informed consent, each participant provided socio-demographic and illness history information, as well as a 10 ml blood sample.

Each blood specimen was split into two aliquots. One aliquot remained at the clinic where three paramedics (those who have paramedic training or a diploma in nursing without training in serology) performed three separate rapid tests for syphilis: the rapid plasma reagin, immunochromatographic strip test and rapid test device. The second aliquot was taken to the ICDDR,B laboratory where laboratory technicians (those who have a Masters in Biological Science and training in serology) performed the three rapid tests as well as the *Treponema Pallidum* haemagglutination assay. All staff except the study coordinator were blinded to the results of all other syphilis tests performed. The sensitivity, specificity, positive predictive value and negative predictive value were calculated for each test by comparing it to the rapid plasma reagin and *Treponema Pallidum* haemagglutination assay results from ICDDR,B's laboratory (WHO

Standard test). Study participants were treated as recommended by the National STI Management Guideline based on the results of the standard test (10).

A total of 684 sex workers were enrolled in the study. Their mean age was 21 years (range 11-45). Two-thirds had no formal education. Thirty-nine percent were divorced or separated and 42% were never married. Eighty-seven percent of participants earned less than 5,000 taka per month. Forty-seven percent had a history of at least one pregnancy and 6% had a history of spontaneous abortion. Five percent of participants reported current genital ulcers and 8% reported a history of genital ulcers.

The prevalence of syphilis infection (both rapid plasma reagin and *Treponema Pallidum* haemagglutination assay positive) was 21% and active syphilis (rapid plasma reagin titre >1:8 and *Treponema Pallidum* haemagglutination assay positive) was 6% in this study group based on results from ICDDR,B's laboratory. All three rapid diagnostic tests performed in ICDDR,B's laboratory compared well to the standard (Table 1). The immunochromatographic strip test had the highest sensitivity (94%), specificity (93%), positive predictive value (77%) and negative predictive value (98%) of all the rapid tests when performed in the primary care clinic. The immunochromatographic strip test was the only rapid test that performed as well in the clinic setting as it did in ICDDR,B's laboratory.

Reported by: Laboratory Sciences Division and Health Systems and Infectious Diseases Division, ICDDR,B

Supported by: United States Agency for International Development, Dhaka

Comment

The immunochromatographic strip test was more reliable for diagnosing syphilis infection than the rapid plasma reagin test, which is currently used in primary health care clinics in Bangladesh.

All tests had higher sensitivity, specificity, positive predictive value and negative predictive value when conducted by highly trained technologists in ICDDR,B's laboratory than when conducted by paramedics in the primary health care clinic. However, the performance of the immunochromatographic strip test in the laboratory was not significantly different than its performance in the field. The ability of a rapid test to perform well in the primary health care setting when conducted by paramedics is crucial in Bangladesh because this is where the majority of all syphilis cases present and are screened.

Table 1. Comparison of performance of the rapid plasma reagin, immunochromatographic strip and the rapid test device for the diagnosis of syphilis to the standard showing the differences in performance between high and low skilled staff (N=684).

Test	High skilled (%)	Low skilled (%)	p-value*
Rapid plasma regain			
Sensitivity	100.0	86.6	0.000
Specificity	99.0	91.1	0.000
Positive predictive value	96.6	71.9	0.000
Negative predictive value	100.0	96.2	0.000
Immunochromatographic strip			
Sensitivity	97.1	94.3	0.238
Specificity	92.0	92.6	0.731
Positive predictive value	76.2	77.0	0.864
Negative predictive value	99.2	98.4	0.255
Rapid test device			
Sensitivity	95.0	86.6	0.014
Specificity	92.9	92.9	1.000
Positive predictive value	78.0	76.4	0.721
Negative predictive value	98.6	96.3	0.033

* the statistical comparison between results from high skilled and low skilled staff

In this study, the rapid plasma regain test performed much better in the primary health care setting than in a previous study (9). This is probably due to differences in training of paramedics performing the test immediately preceding the study. Despite the similar performance of the rapid plasma regain and the immunochromatographic strip tests in the clinic, the immunochromatographic strip test may still be the preferred option because lab infrastructure and confirmatory tests are not required.

Considering the low costs (Tk 22 or US$ 0.31) and high reliability of the immunochromatographic strip test when performed by paramedics, primary health care and antenatal clinics in Bangladesh should consider using this rapid test for the diagnosis of syphilis. The ability of rapid tests to produce a quick result without the need for a confirmatory test could enhance the capacity of primary health care clinics to treat positive cases and reduce the burden of syphilis in Bangladesh.

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Antibiotic resistance and genetic diversity of *Shigella sonnei*

Shigella sonnei is a significant cause of diarrhoea. From 1999 to 2003, 445 strains of *S. sonnei* were isolated from patients admitted to ICDDR,B's Dhaka Hospital. We analyzed a random subset of 184 strains. More than 60% of the isolates were resistant to nalidixic acid, 89% to trimethoprim-sulphamethoxazole- and 9.5% to ampicillin. Pulse field gel electrophoresis (PFGE) analysis of the strains identified 5 unique types with many subtypes. Endemic strains of *S. sonnei* isolated from patients in Bangladesh are genetically diverse; antimicrobial resistance of *S. sonnei* in Bangladesh is increasing.

Bacillary dysentery caused by *Shigella* species is a serious public health problem (1,2). Shigellosis is caused by any one of the four species of *Shigella*, *S. dysenteriae*, *S. flexneri*, *S. boydii* and *S. sonnei*. Few studies of clonal diversity and antimicrobial resistance patterns of *S. sonnei* are available from low-income countries, including Bangladesh. The aim of this study was to investigate antimicrobial resistance patterns of *S. sonnei* among diarrhoeal patients in Bangladesh and to determine their clonal distribution based on the phenotypic and genotypic characteristics. This article summarizes a recently published complete report (3).

One hundred eighty-four clinical strains of *S. sonnei* were randomly selected from 445 strains isolated in ICDDR,B's Clinical Microbiology Laboratory following standard microbiological and biochemical methods (4) from patients admitted to the Dhaka Hospital at ICDDR,B between January 1999 and December 2003. Strains were sub-cultured on MacConkey agar (Difco, Becton Dickinson & Company Sparks, MD, USA) plates and serological reactions were performed after about 18 h of incubation by the slide agglutination test (5).

Bacterial susceptibility to antimicrobial agents was determined by the disc diffusion method as recommended by the Clinical and Laboratory Standards Institute with commercial antimicrobial discs (Oxoid, Basingstoke, United Kingdom). The antibiotic discs used in this study were ampicillin (10 µg), streptomycin (10 µg) tetracycline (30 µg), mecillinam (25 µg), nalidixic acid (30 µg), sulphamethoxazole-trimethoprim (25 µg), ciprofloxacin (5 µg), norfloxacin (10 µg), ofloxacin (5 µg), mecillinam (25 µg), azithromycin (15 µg), and ceftriaxone (30 µg).

Intact agarose-embedded chromosomal DNA from clinical isolates of *S. sonnei* were prepared, and PFGE was performed using the contour-clamped homogeneous electric field (CHEF-DRII) apparatus from Bio-Rad Laboratories (Richmond, CA, USA).

Among the 184 strains, 164 (89%) were resistant to trimethoprim -sulphamethoxazole, 110 (60%) to nalidixic acid, and 17 (9.5%) to ampicillin. Furthermore, 18 strains (4%) were resistant to four first line antimicrobials (ampicillin, tetracycline, sulphamethoxazole, and streptomycin). Only 19 stains (4%) were sensitive to all antibiotics. None of the strains were resistant to ciprofloxacin, norfloxacin, ofloxacin, mecillinam, azithromycin, and ceftriaxone.

Of 184 strains, 100 were randomly selected for PFGE analysis. These strains yielded five unique PFGE types designated as A (88%), B (4%), C (2%), D (2%) and E (4%). Type A was further subdivided into 5 subtypes (A1 to A5), types B and E into two (B1 to B2) and three subtypes (E1, E2 and E3) respectively. Multiple different antimicrobial resistance patterns were associated with PFGE type A strains (Table 1).

Reported by: Clinical Sciences Division and Laboratory Sciences Division, ICDDR,B

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Comment

Infection with *Shigella* is usually a self-limited disease, but patients with serious clinical illness, or who are at high risk of transmitting the pathogen to others are generally recommended for treatment (6).

Historically, ampicillin or trimethoprim-sulphamethoxazole has been the drug of choice in the treatment of shigellosis. However in this study, a majority (89%) of *S. sonnei* strains were resistant to trimethoprim-sulphamethoxazole, suggesting that trimethoprim-sulphamethoxazole is not an appropriate empiric treatment for shigellosis. A much smaller proportion of *S. sonnei* strains (9.5%) were resistant to ampicillin, but hospital based surveillance of all *Shigella* strains shows a much higher proportion of ampicillin resistance (See surveillance update section). None of the tested strains were resistant to ciprofloxacin, norfloxacin, ofloxacin, mecillinam, azithromycin or ceftriaxone.

The diversity of PFGE patterns and antimicrobial resistance patterns suggest that there is not a single strain of unusually resistant *S. sonnei* emerging. Instead, diverse strains of *S. sonnei* have developed anti-microbial resistance probably reflecting widespread exposure to anti-microbials. This suggests that as more expensive antimicrobials come into wider use, *Shigella* species will likely develop resistance.

Thus, health care providers should restrict the use of anti-microbials to only those cases where it is clearly indicated, and should monitor antimicrobial resistance patterns. The Health and Science Bulletin will continue to publish anti-microbial resistance of common pathogens in Bangladesh each quarter.

Table 1. Characteristics of S. sonnei *strains isolated in Bangladesh*

No. of strains tested	PFGE pattern	Antibiogram (No. of strains)*
27	A1	Sxt^R Nal^R (17), Sxt^R (10)
28	A2	Sxt^R Nal^R (26) Sxt^R (2)
20	A3	Sxt^R (9), Sxt^R Nal^R (11)
2	A4	Sxt^R Nal^R (2)
2	A5	Amp^R Sxt^R (2)
4	A6	Amp^R Sxt^R (2) Sxt^R Nal^R (2)
4	A7	Sxt^R Nal^R (4)
1	A8	Sxt^R (1)
2	B1	All sensitive (2)
2	B2	All sensitive (2)
2	C	All sensitive (2)
2	D	All sensitive (2)
2	E1	All sensitive (2)
1	E2	All sensitive (1)
1	E3	All sensitive (1)

* Sxt = Sulfamethoxazole, Nal = Nalidixic Acid, Amp = Ampicillin, R = Resistant

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ANNOUNCEMENT

40th Anniversary of the Demographic Surveillance System (DSS) in Matlab

ICDDR,B is pleased to announce that the **40th Anniversary of the Demographic Surveillance System – Matlab** (now known as HDSS – Health and Demographic Surveillance System) will be held from 7 to 9 March 2007 in Dhaka following the Centre's 11th Annual Scientific Conference (ASCON).

Starting in 1966, Matlab DSS is the longest-running demographic surveillance system in a developing country and has made an immense contribution to global health and population research. During the anniversary celebration, notable population researchers who have made significant contributions to health and demographic surveillance will attend to share their experience and views on the evolution as well as the future of DSS.

For the celebration, an Organizing Committee has been formed, with Dr. Peter Kim Streatfield, Head of HDSS and the Population Programme at ICDDR,B, as Chair of the Organizing Committee. For further information on the event, please contact:

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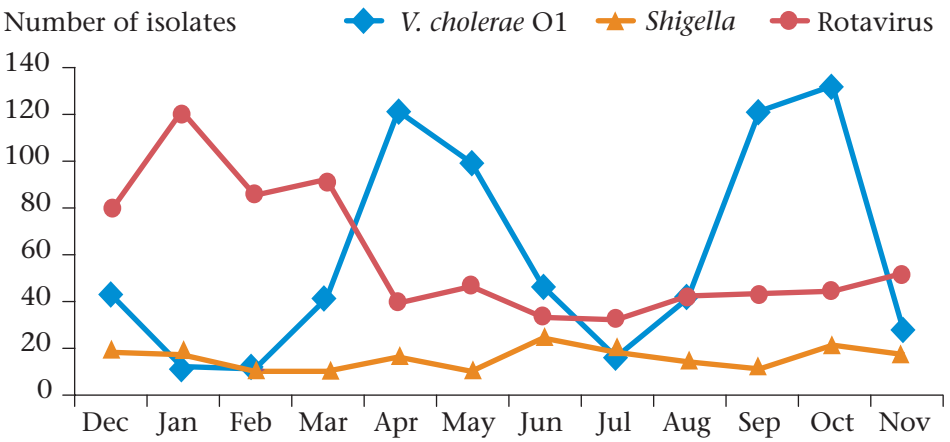
Surveillance update

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

Proportion of diarrhoeal pathogens susceptible to antimicrobial drugs: December 2005-November 2006

Antimicrobial agents	*Shigella* (n = 187)	*V. Cholerae* O1 (n =709)
Nalidixic acid	27.3	Not tested
Mecillinam	96.8	Not tested
Ampicillin	54.5	Not tested
TMP-SMX	33.2	3.0
Ciprofloxacin	99.5	100.0
Tetracycline	Not tested	54.3
Erythromycin	Not tested	8.3
Furazolidine	Not tested	0.1

Monthly isolation of V. cholerae *O1,* Shigella *and Rotavirus: December 2005-November 2006*



Antimicrobial resistance patterns of 123 M. tuberculosis *isolates: October 2005-September 2006*

Drugs	Resistance type		Total (n=123)
	Primary (n=110)	Acquired* (n=13)	
Streptomycin	30 (27.3)	4 (30.8)	34 (27.6)
Isoniazid (INH)	12 (10.9)	5 (38.5)	17 (13.8)
Ethambutal	9 (8.2)	2 (15.4)	11 (8.9)
Rifampicin	11 (10.0)	6 (46.2)	17 (13.8)
MDR (INH+ Rifampicin)	6 (5.5)	4 (30.8)	10 (8.1)
Any drugs	38 (34.5)	7 (53.8)	45 (36.3)

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

Antimicrobial susceptibility of N. gonorrhoeae *isolated during July-September 2006 (n=20)*

Antimicrobial agents	Susceptible (%)	Reduced susceptibility (%)	Resistant (%)
Azithromycin	100.0	0.0	0.0
Ceftriaxone	100.0	0.0	0.0
Ciprofloxacin	20.0	0.0	80.0
Penicillin	25.0	20.0	55.0
Spectinomycin	100.0	3.4	0.0
Tetracycline	10.0	0.0	90.0
Cefixime	100.0	0.0	0.0

Antimicrobial susceptibility pattern of S. pneumoniae *among children <5 years during August-October 2006*

Antimicrobial agents	Total tested (n)	Susceptible n (%)	Reduced susceptibility* n (%)	Resistant* n (%)
Ampilillin	11	11 (100.0)	0	0
Cotrimoxazole	11	5 (45.5)	0	6 (54.5)
Cloramphenicol	11	10 (90.9)	0	1 (9.1)
Ceftriaxone	11	11 (100.0)	0	0
Ciprofloxacin	11	10 (90.9)	0	1 (9.1)
Gentamicin	11	0 (0.0)	0	11 (100)
Oxacillin	11	10 (90.9)	1 (9.1)	0

Source: Data obtained from children participating in PneumoADIP surveillance - a joint collaboration of ICDDR,B and Dhaka Shisu Hospital which has been conducted in Dhaka Medical College Hospital, Chittagong Medical College Hospital, Sir Salimullah Medical College Hospital, ICH-Shishu Sasthya Foundation, Chittagong Maa Shishu O General Hospital, Dhaka Shishu Hospital, Kumudini Hospital-Mirzapur, and ICDDR,B's rural surveillance in Mirzapur.

* Confirmed by MIC

Antimicrobial susceptibility pattern of S. typhi *among children <5 years during August-October 2006*

Antimicrobial agents	Total tested (n)	Susceptible n (%)	Reduced susceptibility* n (%)	Resistant* n (%)
Ampicillin	26	8 (30.8)	0	18 (69.2)
Cotrimoxazole	27	8 (29.6)	1 (3.7)	18 (66.7)
Chloramphenicol	26	7 (26.9)	0	19 (73.1)
Ceftriaxone	27	26 (96.3)	1 (3.7)	0
Ciprofloxacin	27	24 (88.9)	1 (3.7)	2 (7.4)

Source: Data obtained from children participating in PneumoADIP surveillance - a joint collaboration of ICDDR,B and Dhaka Shisu Hospital which has been conducted in Dhaka Medical College Hospital, Sir Salimullah Medical College Hospital. ICH- Shishu Sasthya Foundation, Chittagong Maa Shishu O General Hospital, Dhaka Shishu Hospital and Kumudini Hospital, Mirzapur

* Confirmed by disc diffusion

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