

Impact of a training intervention on use of antimicrobials in teaching hospitals

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Abstract

Background: Antimicrobials are often used inappropriately in paediatric wards of medical college hospitals in Bangladesh. Most of the antimicrobials are prescribed based on clinical grounds—signs and symptoms. This intervention study assessed the effectiveness of a training intervention on antimicrobials prescribing by physicians in paediatric wards of tertiary care level hospitals.

Methodology: This study was conducted at medical college hospitals in Bangladesh during the period from 1998 through 2000. The pre-intervention survey of antimicrobial use was conducted during 1998 in five hospitals. The post-intervention survey was conducted after the interactive training during the succeeding year in three of the original five hospitals, of which one was the intervention hospital and two control hospitals. A total of 3,466 admitted paediatric patients' treatment charts (2,171 in the pre-intervention and 1,295 in the post-intervention surveys) were reviewed.

Results: The most commonly used antimicrobials were ampicillin, gentamicin, amoxicillin, cloxacillin and ceftriaxone. Appropriate antimicrobial therapy for the most common infectious diseases, pneumonia and diarrhoea, increased by 16.4% and 56.8% respectively in the intervention hospital compared with the two control hospitals and these improvements were significant ($p < 0.001$ and $p = 0.002$, for pneumonia and diarrhoea respectively).

Conclusions: An interactive, focussed educational intervention, targeted at physicians, appears to have been effective in improving appropriate antimicrobial prescribing for the most common paediatric infectious diseases in a medical college hospital in Bangladesh.

Key Words: intervention, antimicrobial use, teaching hospitals, Bangladesh

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Introduction

Antimicrobials are critical elements in the therapeutic armamentarium of modern medicine. These drugs are prescribed by various types of health care providers both in developed and developing countries, sometimes without adequate knowledge about the use and consequences of the use of these important therapeutic drugs [1]. It is estimated that antimicrobials often account for 15% to 30% of drug expenditure of a country, the highest share of any single therapeutic group of drugs [2]. The use of antimicrobials is influenced by a number of complex factors and in both developed and developing countries antimicrobials are frequently inappropriately used and many consequences of inappropriate antimicrobial use occur, such as increase in bacterial resistance, adverse reactions, and over expenditure [3-7]. Antimicrobial utilization appears to be highest in paediatric wards of hospitals

in the developing world, and adverse consequences from commonly used antimicrobials such as ampicillin are relatively more common in the children of a country [4,7,8]. Strategies for reducing the inappropriate use of antimicrobials are being explored in order to minimize adverse consequences of antimicrobial use and to maximize the efficiency of use of these drugs. A number of measures have been identified to influence the use of antimicrobials in hospital settings. Managerial and regulatory approaches may work in the short term, but by themselves may meet resistance from the prescribers. An educational strategy seems to be instructive, and it has been shown to be effective in modifying prescribing patterns of physicians and thus use of antimicrobials [4,9-12].

There are eight well-established medical college hospitals in Bangladesh. These hospitals are teaching hospitals and provide tertiary health care to the

people of the country. These hospitals also act as referral hospitals for the secondary and primary level

the hospital. After necessary processing, data were entered into the computer-based statistical

Table 1: Percentage of appropriate antimicrobial treatment of pneumonia, and diarrhoea before and after educational intervention by medical college hospitals

Survey Periods	Pneumonia			Diarrhoea		
	Intervention Hospital % of appropriate treatment	Control Hospital-1 % of appropriate treatment	Control Hospital-2 % of appropriate treatment	Intervention Hospital % of appropriate treatment	Control Hospital-1 % of appropriate treatment	Control Hospital-2 % of appropriate treatment
After intervention	83.1	30	51.3	86.8	81.8	65.5
Before intervention	66.7	27.6	64.9	28.0	79.6	79.7
Change	+ 16.4	+ 2.6	+ 13.6	+ 56.8	+ 2.2	- 14.2

hospitals in the country. A few small-scale studies [13,14] of antimicrobial use demonstrated that the use of these drugs is very often inappropriate even at this tertiary level of health care facilities and more common in paediatric wards.

The aim of this study was to discover the existing patterns of use of antimicrobials in paediatric wards of the medical college hospitals and to evaluate the impact of an educational intervention in improving appropriate use of antimicrobials for the most common infectious paediatric problems in Bangladesh.

Materials and Methods

Two surveys of antimicrobial use were conducted at selected medical college hospitals in Bangladesh. A total of 3,466 pediatric patients' treatment charts were reviewed: 2,171 in the first and 1,295 in the second survey.

The period of data collection was four months in each of the pre-intervention and the post-intervention surveys from January through April in 1998 and in 1999 respectively. All admitted paediatric patients who received antimicrobials for their treatments were considered study subjects. The patients and their treatment files were identified from the drug supply register kept in each ward. The study instrument (data collection forms, which, in addition to the patients' general information, also contain specific information such as name, dose schedule, route of administration, date of discontinuation and generic name of antimicrobials used, and information regarding laboratory investigations) were completed by examining the treatment files. Each patient was followed on a daily basis until his/her discharge from

programme—Statistical Package for Social Science (SPSS), Version 9-01 for Windows for analysis.

The data derived from both survey periods were analyzed. The proportions of inappropriate antimicrobial treatment of the most common infectious diseases were calculated. The constructed consensus-based Standard Treatment Guidelines (STGs) were considered as the gold standard in judging appropriateness. The analyses were performed as a whole and for each of the selected medical college hospitals for selected variables. In addition to descriptive statistics such as frequency tabulations, mean, standard deviation and median, statistical tests, such as Pearson Chi-square and logistic regression tests, were applied to determine statistically significant difference and/ or to adjust for pertinent variables as necessary.

The educational intervention was a short interactive training of 20 sessions during five consecutive working days targeted at all the physicians of the paediatric wards of a pre-selected hospital. To examine the impact of the educational intervention on the extent of change of antimicrobial use and related clinical outcomes, certain important issues, such as core indicators of antimicrobial prescribing practices, mean duration of hospital stay, disease-specific mortality and costs, were considered for comparison within and between hospitals, before and after the educational intervention.

Results

Pneumonia and diarrhoea were the most common infectious diseases of the admitted paediatric patients and the most commonly used antimicrobials were ampicillin, gentamicin, amoxicillin, cloxacillin and

ceftriaxone in both the pre-intervention and the post-intervention survey periods.

period, were not markedly different from those during the pre-intervention survey period of the

Table 2: Results of the logistic regression model for appropriateness of antimicrobial treatment of pneumonia and diarrhoea by Medical College Hospitals, adjusted for gender, age, weight, status (dead/alive) at discharge of patients from hospitals and periods during the post-intervention survey from January through April 1999.

Pneumonia					Diarrhoea			
Variables	Odds Ratio	Test Statistic (Wald Test)	Confidence interval	Significance	Odds Ratio	Test Statistic (Wald Test)	Confidence interval	Significance
Medical College Hospitals	-	97.0896	-	< 0.0001	-	9.9101	-	0.0070
Intervention Hospital	4.8072	34.5396	2.8473 - 8.1157	<0.001	5.3769	9.5410	1.8491-15.6348	0.0020
Control Hospital(1)	0.4184	12.8665	0.2599- 0.6736	0.003	2.4927	2.0165	0.7066- 8.7940	0.1558
Control Hospital(2)	Reference Category				Reference Category			
Gender	1.0179	0.0166	0.7771-1.3332	0.8975	1.7354	3.6175	0.9833 - 3.0624	0.0572
Age	1.0042	0.6545	0.9942 -1.0142	0.4185	1.0007	0.006	0.9821 - 1.0971	0.9385
Weight	0.9412	3.7923	0.9996-1.1292	0.0515	1.1065	2.6630	0.9799 - 1.2495	0.1027
Status (dead/alive)	0.7061	1.3091	0.3891-1.1231	0.2526	0.0724	11.6733	0.0162 - 0.3275	0.0006
Periods	1.7916	5.6304	1.10686 -2.8998	0.0177	1.9176	2.2734	0.8226 - 4.4701	0.1316

The percentages of appropriate antimicrobial treatment for the most common infectious diseases, pneumonia and diarrhoea, markedly increased (Table 1) and were statistically significant in the medical college hospital in which the training programme had been conducted (intervention hospital) compared with the control medical college hospitals (Wald Test, $X^2_{(df = 2)} = 97.1$, $P = 0.0001$ and $X^2_{(df = 2)} = 9.9$, $P = 0.007$ for pneumonia and diarrhoea, respectively, which is shown in Table 2).

While the difference in percentage of appropriate antimicrobial treatment of patients with pneumonia in the intervention hospital (I) before and after the educational intervention was obvious with a marked improvement after the intervention by 16.4%, difference in percentage of appropriate antimicrobial treatment of patients with diarrhoea was more obvious with a more marked improvement after the intervention by 56.8%.

The data shown in Table 2 suggests that medical college hospitals in general have significant influence on the probability of appropriate antimicrobial treatment of both pneumonia and diarrhoea, and the intervention hospital has more such influence.

In both the pre-intervention and the post-intervention survey, nearly half of the patients received two or more antimicrobials in combination for their treatment and the intravenous route of administration of these drugs was preferred by the hospitals' physicians. The clinical outcomes, such as mortality and duration of hospital stay of the paediatric patients in the post-intervention survey

study but there was a substantial reduction in antimicrobial costs in the intervention hospital compared with the control hospitals.

Discussion

During the past two decades the extent of antimicrobial development has been such that it is not always easy to choose appropriate antimicrobials for the treatment of particular diseases [15]. Many surveys have shown that inappropriate prescribing of antimicrobials, and hence inappropriate use of these drugs, is widespread even in hospital practice [16]. The inappropriate use of antimicrobials subjects patients to unnecessary adverse effects of these drugs, encourages the emergence and proliferation of antimicrobial resistant microorganisms, and wastes money [5,8,17]. Furthermore, in certain situations, the inappropriate prescribing habits of one physician can directly affect the patients of his/her colleagues through the development of and/or cross-infection by antimicrobial resistant microorganisms.

In this study, the aim of constructing the consensus-based STGs and conducting training with these materials targeted at a particular group of physicians of a hospital was to improve the prescribing habits of physicians and thus appropriate use of antimicrobials. To have comparability between two surveys, certain issues that might affect the outcome of the intervention, such as periods of surveys, case-mix, antimicrobial rank by order of frequency, patients' details (age, sex, and nutritional

status), hospitals and hospitals' physicians, were considered critically.

The pre-intervention and the post-intervention surveys were conducted at the same time of the consecutive two years from January through April in 1998 and in 1999. The number and personal details of the admitted pediatric patients who received antimicrobial treatment (such as age, gender, and nutritional status) were similar between the pre-intervention and the post-intervention survey periods, with a predominance of male patients and the majority of the patients being malnourished as appeared in other studies [18,19]. The physicians who usually wrote the prescriptions in each of the survey periods had a similar educational and training level. In particular, none of the physicians in the paediatric wards of the intervention hospital was transferred or newly posted. As all of the medical college hospitals included in the study were of similar level by function and were government institutions, the availability of antimicrobials also expected to be similar in these hospitals, although this was not measured. The most commonly used antimicrobials for admitted paediatric patients in the respective hospitals were similar in both the pre-intervention and the post-intervention survey periods. For evaluation of the educational intervention, the important clinical actions, such as appropriateness of the antimicrobial treatment for pneumonia or diarrhoea and the cost of the treatment of these diseases, were given special attention.

There were substantial increases in the proportion of appropriate antimicrobial treatment of these diseases as well as reduction of costs in the intervention hospital compared with the control hospitals. These findings are almost similar to those of another tertiary care hospital based study in Thailand [20].

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