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EFFECT OF EDUCATIONAL INTERVENTION ON PRESCRIBING PATTERN OF ACUTE DIARRHOEA IN CHILDREN UNDER-FIVE IN TERTIARY AND SECONDARY CARE HOSPITALS IN PUNJAB, INDIA: A MULTICENTRE STUDY

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ABSTRACT

Background: Diarrhoeal disease is a major cause of morbidity and mortality in children under five years of age. It is the second leading cause of child mortality after acute respiratory tract infections. Dehydration is the main cause of death, which can be prevented with timely treatment. Rotavirus is the most common causative agent. This study aimed to evaluate the impact of educational intervention on paediatricians regarding the appropriateness of treatment for acute childhood diarrhoea according to WHO guidelines, and to reduce unnecessary drug prescriptions. **Materials and Methods:** This was a multicentre, interventional, cross-sectional study conducted over three years and four months. The effect of an educational intervention on the prescribing practices of 30 paediatricians was assessed by analysing 1,296 prescriptions (649 before and 647 after the intervention). The primary endpoint was an increase in the prescription of ORS and zinc. Secondary endpoints included a reduction in the prescription of probiotics, antibiotics, and antiprotozoal drugs. **Results:** After the intervention, all paediatricians prescribed ORS (93% vs. 100%; p = 0.500) and zinc (67% vs. 100%; p = 0.0020, statistically significant). The prescription of probiotics decreased (83% vs. 66%; p = 0.0625), while prescriptions of oral antibiotics (57% vs. 33%; p = 0.0156), injectable antibiotics (30% vs. 3%; p = 0.0078), and other medicines such as anthelmintics, antiprotozoals, and antispasmodics (50% vs. 30%; p = 0.0313) were significantly reduced. **Conclusion:** Educational intervention had the greatest impact on the use of ORS and zinc, both of which reached 100% prescription rates in all healthcare centres. At the same time, prescriptions of unnecessary medicines such as antibiotics, probiotics, injectables, antiprotozoals, and anthelmintics were substantially reduced.

Keywords: WHO prescribes indicators, multicentre study, prescribing patterns, treatment guidelines, probiotics, and educational intervention.

INTRODUCTION

Except during the neonatal period, diarrhoeal disease is a leading cause of morbidity and mortality in children under five years of age. Globally, it is the second most common cause of child mortality after acute respiratory tract infections such as pneumonia,[1,2] accounting for an estimated 443,832 child deaths annually.[3] Worldwide, nearly 1.7 billion cases of childhood diarrhoeal disease occur every year.[4]

In 2017, the WHO reported that 8% of deaths in children under five were due to diarrhoea.[5] Rotavirus is the primary causative agent in approximately 80% of cases, while enterotoxigenic E. coli accounts for about 20% of acute childhood diarrhoea.[6]

Dehydration is the most common cause of death in acute diarrhoeal illness,[7] and it can be prevented with timely treatment. In 2004, a joint statement by WHO and UNICEF recommended the use of zinc supplementation for 14 days as adjunct therapy, along with low-osmolarity oral rehydration solution (ORS), to reduce diarrhoeal mortality.[8,9]

Zinc was included in the WHO Essential Medicines List in 2005.[10] In India, the Indian Academy of Paediatrics published guidelines in 2004 emphasizing the use of zinc and low-osmolarity ORS, which were further revised in 2006.[11,12] Subsequently, in 2007, the Government of India introduced zinc as an adjunct to low-osmolarity ORS for more effective diarrhoea management, ensuring its availability through the National Rural Health Mission.[13] By 2008, zinc was incorporated into the Diarrhoeal Disease Control Programme.[14] Evidence from multiple efficacy studies has demonstrated that zinc reduces the incidence, frequency, severity, persistence, and recurrence of diarrhoea within three to four months following treatment, thereby lowering mortality. It represents a simple, inexpensive, and effective intervention for managing diarrhoeal episodes in children.[15] However, adherence to recommended treatment guidelines for acute diarrhoea in India remains low, with frequent prescriptions of antibiotics, probiotics, and antispasmodics.

A cross-sectional study published in 2015 from Amritsar City revealed that government tertiary care hospitals showed the highest adherence to WHO guidelines.[16] Building on this, the present study was conducted at multiple healthcare centres across Punjab, India, to assess prescribing patterns on a larger scale, evaluate the impact of educational intervention on paediatricians, and further explore the reasons for unnecessary prescriptions of antibiotics and other drugs despite proven evidence supporting zinc and low-osmolarity ORS. Intervention strategies were specifically designed to reduce irrational prescribing practices.

MATERIALS AND METHODS

A multicentre, interventional, prospective, cross-sectional study was conducted across Punjab over a period of three years and four months. The pre-intervention phase was carried out between December 2016 and September 2018, and the post-intervention phase between October 2018 and March 2020. The study was undertaken at multiple centres in Chandigarh and Amritsar, to assess prescription patterns on a larger scale.

Intervention:

Two main strategies were employed

1. Structured Proforma: A structured proforma which included 16 questions was provided to 30 postgraduate paediatricians working in various health sectors. The questions assessed their knowledge of WHO and other treatment guidelines, commonly prescribed medicines, and feeding practices during diarrhoeal episodes, as well as other aspects of acute diarrhoea management in children under five.
2. Educational Presentation: A session was delivered at a local meeting of the Indian Academy of Paediatrics, attended by 35 paediatricians, including all those who had completed the proforma. The presentation emphasised WHO treatment guidelines for acute childhood diarrhoea and highlighted findings from the pre-intervention phase, demonstrating non-adherence to standard guidelines and frequent prescribing of unnecessary medicines (e.g., antibiotics, antiprotozoals, anthelmintics, antispasmodics). The paediatricians were informed that this was a quality-improvement project with the aim of promoting rational prescribing and to stop prescribing un-necessary medicines.

Inclusion Criteria

1. Prescriptions written by the 30 participating paediatricians for children under five years of age with acute diarrhoea, both before and after the intervention.

Exclusion Criteria

1. Prescriptions for children older than five years.
2. Cases with severe dehydration requiring inpatient care.
3. Acute bloody diarrhoea (dysentery).

Ethical Considerations

Approval was obtained from the Institutional Ethics Committee (GMC/Principal/IEC/2016/795, dated 14.10.2016; Code no. GMCIEC00795). Verbal informed consent was obtained from the parents of children whose prescriptions were included.

Data Collection

A total of 1,440 prescriptions for acute diarrhoea were collected from various hospitals across Punjab. Of these, 1,296 prescriptions (90%) were analysed to maintain uniformity and ensure accuracy. More prescriptions were obtained from government tertiary and secondary care hospitals compared to private hospitals, as government facilities manage a higher patient volume. Prescriptions were collected from pharmacy outlets and paediatric outpatient departments of two government tertiary, two private tertiary, three governments secondary, and four private secondary hospitals.

Data Analysis

The impact of the educational intervention on prescribing practices was assessed by comparing pre- and post-intervention prescriptions. Data were entered into Microsoft Excel. Descriptive data were expressed as numbers and percentages. Categorical variables were analysed using McNemar's test with 2×2 contingency tables, calculated using the MedCalc online statistics calculator. A p-value of <0.05 was considered statistically significant. In addition, prescribing patterns were evaluated against core indicators provided by the WHO.[17]

RESULTS

A total of 30 paediatricians' prescriptions were evaluated by analysing 1,296 prescriptions, of which 649 were collected before and 647 after the intervention.

Following the intervention, all paediatricians prescribed ORS (93% vs. 100%; p = 0.500) and zinc (67% vs. 100%; p = 0.0020, statistically significant). The prescription of probiotics decreased (83% vs. 66%; p = 0.0625), while prescriptions of oral antibiotics (57% vs. 33%; p = 0.0156), injectable antibiotics (30% vs. 3%; p = 0.0078), and other medicines such as anthelmintics, antiprotozoals, and antispasmodics (50% vs. 30%; p = 0.0313) were significantly reduced [Table 1].

The percentage change in treatment modalities across different healthcare centres was also compared. After the intervention, ORS and zinc were prescribed in 100% of prescriptions across all healthcare facilities [Figure 1].

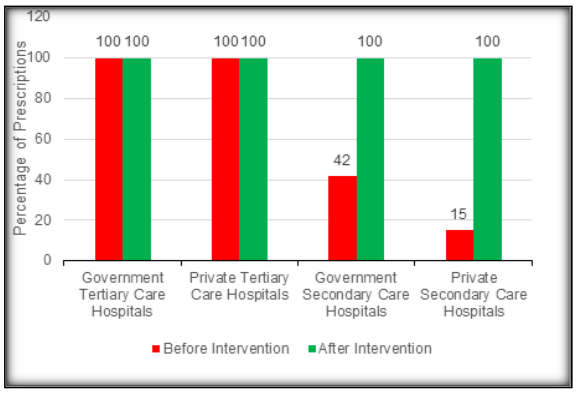

Figure 1: Impact of intervention on zinc prescriptions in various setups

At the same time, there was a marked reduction in probiotic prescriptions (19% to 9% in government tertiary care hospitals; 91% to 65% in private tertiary care hospitals). Prescriptions of oral antibiotics also declined significantly (18% to 7% in government tertiary care; 35% to 10% in private tertiary care; 82% to 60% in government secondary care; 95% to 63% in private secondary care hospitals) [Figure 2]. A similar trend was observed in the use of injectable antibiotics (5% to 0% in government tertiary care; 5% to 1% in private tertiary care; 10% to 1% in government secondary care; 12% to 2% in private secondary care hospitals). Prescriptions for anthelmintics, antiprotozoals, and antispasmodics also decreased significantly (5% to 2% in government tertiary care; 7% to 1% in private tertiary care; 77% to 62% in government secondary care; 96% to 60% in private secondary care hospitals) [Table 2].

The average cost per day of various treatment modalities was also assessed and is presented in tabulated form [Table 3].

Knowledge Assessment:

The structured proforma revealed that paediatricians had excellent knowledge regarding acute diarrhoea and WHO recommendations for its management. However, despite adequate knowledge, a clear discrepancy was observed between knowledge, attitude, and actual prescribing practices.

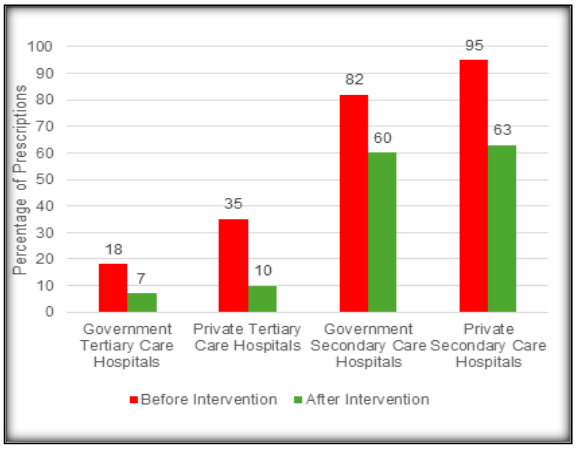

Figure 2: Impact of intervention on antibiotics prescriptions in various setups

Table 1: Impact on Paediatricians Attitude after Educational Intervention (x=30):

S.No.	Treatment Modality	Paediatricians attitude on prescription after Educational Intervention Before X=30 No. (%)	After X=30 No. (%)	Percentage Difference* Increase(+)/ Decrease(-)	95% Confidence Interval*	p value**
1.	ORS	28 (93)	30 (100)	+7	-2.26 to 15.59	0.500
2.	Zinc	20 (67)	30 (100)	+33	16.46% to 50.20%	0.0020
3.	Probiotics	25 (83)	20 (66)	-17	-30.00% to -3.33%	0.0625
4.	Oral antibiotics	17 (57)	10 (33)	-24	-38.47% to -8.20%	0.0156
5.	Injectable antibiotics	9 (30)	1 (3)	-27	-42.49%to-0.84%	0.0078
6.	Others antiprotozoals, anthelminthics, antispasmodics etc.	15 (50)	9 (30)	-20	-34.31% to -5.69%	0.0313

X=number of paediatricians
%=percentage
* By medcalc online statistics calculator, using 2x2 contingency tables,
** By using Mc Nemer's test, Level of significance was determined by the 'p' value (p <0.05- significant)

Table 2: Comparison of Prescriptions of Various Set-ups Before Versus After Intervention

Medicines used in prescriptions	Govt. Tertiary Care N=199	n=190	Private Tertiary Care N=98	n=92	Govt. Secondary Care N=273	n=287	Private secondary Care N=79	n=78
	Before No. (%)	After No. (%)	Before No. (%)	After No. (%)	Before No. (%)	After No. (%)	Before No. (%)	After No. (%)
ORS	199 (100)	190 (100)	98 (100)	92 (100)	273 (100)	287 (100)	73 (93)	78 (100)
Zinc	199 (100)	190 (100)	98 (100)	92 (100)	115 (42)	287 (100)	2 (15)	78 (100)
Probiotics	38 (19)	17 (9)	95 (97)	60 (65)	273 (100)	287 (100)	79 (100)	78 (10-0)
Oral Antibiotics *	36 (18)	13 (7)	34 (35)	9 (10)	224 (82)	172 (60)	75 (95)	49 (63)
Inj. antibiotics	10 (5)	0 (0)	5 (5)	1 (1)	27 (10)	3 (1)	9 (12)	2 (2)
Others- antiprotozoals, anthelminthics, antispasmodics etc.	10 (5)	4 (2)	7 (7)	1 (1)	210 (77)	178 (62)	76 (96)	47 (60)

N=number of prescriptions before intervention
n=number of prescriptions after intervention
%=percentage of prescriptions
*=Ornidazole,ofloxacin,metronidazole,co-trimaxazole

Table 3: Cost of Various Treatment Modalities per Day in Rupees:

Average Expenditure Per Day	
Treatment Modality	**Rupees**
ORS+zinc	12
ORS+zinc+probiotics	82
ORS+zinc+probiotic+antibiotics	95
ORS+zinc+ probiotics+antibiotics+antiprotozoal+anthelmintics+antispasmodics	103

DISCUSSION

The present study provided a true picture of the prescribing patterns for acute diarrhoea in children less than five years of age and highlighted the irrational use of antibiotics, particularly in secondary care and private hospitals. In contrast, government tertiary care hospitals showed relatively lower use of antibiotics and unnecessary medicines, likely due to their continual exposure to academic activities such as Continuing Medical Education (CMEs), conferences, seminars, and access to journals, which help them stay updated with treatment guidelines.

After the educational intervention, there was a significant reduction in the use of unnecessary medicines, especially antibiotics, anthelmintics, and antiprotozoals. At the same time, prescriptions of ORS and zinc reached 100%, which is a notable achievement of this study, particularly in government and private secondary care hospitals. Both WHO and Indian guidelines recommend against the routine use of antibiotics in diarrhoea since most cases are viral in origin. The addition of probiotics not only lacks strong evidence of benefit but also adds to the cost of treatment. Inappropriate use of antibiotics such as cotrimoxazole, metronidazole, and ornidazole–ofloxacin combinations, apart from escalating treatment costs, also poses risks of adverse drug reactions and contributes to antimicrobial resistance. This increased cost of treatment imposes a financial burden on both families and society. The expenditure on antibiotics, probiotics, and other unnecessary drugs could be saved if prescribers adhered strictly to standard treatment guidelines.

Possible reasons for the continued prescription of antibiotics and injectables include:

1. Parental pressure, as families often expect antibiotics and injections for faster recovery.
2. Influence from pharmaceutical retailers, who promote their products to paediatricians.

Several researchers have used prescription audits to reduce unnecessary antibiotic use. In many developing countries, poorer prescribing practices in private healthcare facilities have been well documented.[18]

When comparing our study with a cross-sectional study conducted in Ujjain, India, it was reported that only six out of 843 prescriptions adhered to the recommended use of ORS and zinc for treating acute diarrhoea, while antibiotics were prescribed in 71% of cases.[19] What distinguishes our study is that the Ujjain study included prescriptions from practitioners across different systems of medicine (allopathy, ayurveda, homeopathy) and informal providers, whereas our study was limited strictly to allopathic prescriptions. Similarly, a study from New Delhi reported antibiotic prescription rates of 43% in public facilities and 69% in private facilities.[20] In comparison, our study found that antibiotics were most frequently prescribed in

secondary private hospitals (95%), though this was reduced to 63% after the educational intervention.

International studies have also reported widespread irrational antibiotic use for acute diarrhoea. A study from Bangladesh showed that only 27% of children received appropriate treatment for acute watery diarrhoea.[21] In Peru, prescribing practices were found to be influenced more by social expectations than by knowledge or adherence to guidelines,[22]— a finding consistent with our observations. A study conducted in Thailand similarly demonstrated overuse of antibiotics in the treatment of acute diarrhoea,[23] which was also evident in our study before intervention.

This study, however, has some limitations. First, it was conducted in only one state, which limits the generalisability of the findings. Second, a formal sample size calculation was not performed. Third, the number of targeted paediatricians (n = 30) was relatively small; inclusion of a larger number of paediatricians could have increased the impact and reliability of the findings. To further validate and generalise the results, future research should be conducted with larger samples across multiple regions.

CONCLUSION

The educational intervention had a maximum effect on the use of ORS and zinc, which reached 100% in all prescriptions, while the prescriptions of other medicines such as probiotics, oral antibiotics, injectables, antiprotozoals, anthelmintics, and antispasmodics decreased. There is a need for prescribers to strictly follow the WHO Standard Treatment Guidelines for acute diarrhoea in children. They should also spend a few extra minutes with parents to explain the natural course of the disease rather than prescribing unnecessary medicines, as this would greatly help in improving parental compliance. Furthermore, prescribers are encouraged to regularly self-audit their prescription patterns, preferably on a monthly basis, to assess the rationality of their prescribing practices in accordance with standard treatment guidelines.

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