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# Integrated Management of Childhood Illness: efficiency of primary health in Northeast Brazil

## Atenção integrada às doenças prevalentes da infância: eficiência na atenção primária de saúde no Nordeste

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### ABSTRACT

**OBJECTIVE:** The Integrated Management of Childhood Illness is a strategy designed to address major causes of child mortality. The aim of this study was to assess the impact of the strategy on the quality of child health care provided at primary facilities.

**METHODS:** Child health quality of care and costs were compared in four states in Northeastern Brazil, in 2001. There were studied 48 health facilities considered to have had stable strategy implementation at least two years before the start of study, with 48 matched comparison facilities in the same states. A single measure of correct management of sick children was used to assess care provided to all sick children. Costs included all resources at the national, state, local and facility levels associated with child health care.

**RESULTS:** Facilities providing strategy-based care had significantly better management of sick children at no additional cost to municipalities relative to the comparison municipalities. At strategy facilities 72% of children were correctly managed compared with 56% in comparison facilities ( $p=0.001$ ). The cost per child managed correctly was US\$13.20 versus US\$21.05 in the strategy and comparison municipalities, respectively, after standardization for population size.

**CONCLUSIONS:** The strategy improves the efficiency of primary facilities in Northeastern Brazil. It leads to better health outcomes at no extra cost.

**DESCRIPTORS:** Child Welfare. Comprehensive Health Care. Health Care Costs. Child Health Services, organization & administration. Quality of Health Care.

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## RESUMO

**OBJETIVO:** A atenção integrada às doenças prevalentes da infância é uma estratégia desenvolvida para contribuir na redução das principais causas de mortalidade infantil. O objetivo do estudo foi avaliar o impacto da estratégia sobre a saúde infantil.

**MÉTODOS:** Compararam-se a qualidade do atendimento à saúde infantil e os custos associados em quatro estados da região Nordeste do Brasil, em 2001. Foram estudadas 48 unidades de saúde onde havia implementação estável da estratégia por pelo menos dois anos antes do início do estudo e 48 unidades sem (controle) nos mesmos estados. O percentual de crianças doentes atendidas corretamente foi utilizado para avaliar a qualidade da atenção oferecida a crianças doentes. O custo total da atenção à saúde infantil foi avaliado a partir de dados coletados nos níveis nacional, estadual, municipal e de unidade de saúde.

**RESULTADOS:** As unidades que adotam a estratégia obtiveram desempenho significativamente melhor no atendimento de crianças doentes, sem custos adicionais em relação aos municípios sem. Nas unidades com a estratégia, 72% das crianças avaliadas foram atendidas corretamente, comparado com 56% nas unidades controle. O custo por criança atendida corretamente foi de US\$13.20 versus US\$21.05 nos municípios com e sem a estratégia respectivamente, após os ajustes para o tamanho das populações municipais.

**CONCLUSÕES:** A estratégia melhorou a eficiência das unidades de atenção primária de saúde da região estudada. Em unidades de atenção primária com a estratégia, a qualidade do tratamento foi melhor, sem aumento de custos.

**DESCRIPTORIOS:** Bem-Estar da Criança. Assistência Integral à Saúde. Custos de Cuidados de Saúde. Serviços de Saúde da Criança, organização e administração. Qualidade da Assistência à Saúde.

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## INTRODUCTION

In September 2005, five years after signing the United Nations Millennium Declaration, heads of states reunited to review progress towards achieving the Millennium Development Goals (MDGs). Three of the eight MDGs are exclusive to health, one of which is entirely focused on child survival, with the aim of eliminating two thirds of child mortality by 2015.<sup>14</sup> Except for very few notable examples, progress towards the child survival MDG has generally been disappointing, especially in sub-Saharan Africa.<sup>14</sup> Many factors have contributed to this, but a common factor to all countries was lack of resources. In most settings there is also a potential for achieving more with the available resources, by reducing waste and by changing the mix of activities being undertaken. Many societies continue to provide or purchase high-cost, relatively ineffective health interventions or services, while low-cost, highly effective interventions are not fully implemented. Factors other than efficiency influence the mix of health activities chosen, including patient preferences and

equity considerations. However, without information on costs and health impact of alternative strategies to reduce child mortality, policymakers operate in an information vacuum and are unable to determine whether they are advancing as rapidly as possible towards their objectives.

In mid 1990s, the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) developed the Integrated Management of Childhood Illness (IMCI) strategy with the overall goal of reducing child mortality in developing countries.<sup>13</sup> Generic IMCI training materials, based on a set of clinical guidelines for comprehensive assessment and management of sick children, were developed. These guidelines included algorithms on common diseases to be employed by primary care providers. The guidelines also emphasized the role of guiding caretakers on how to administer medicines and provide home-based care, and advise mothers about when the child should be brought back to the facility. In addition to improving health provider

skills, the IMCI strategy also aims at strengthening health care systems support and family practices related to child health.

IMCI has now been implemented in more than 100 low- and middle-income countries, although the scale of its implementation varies widely.<sup>5,7</sup> In 1996, the IMCI strategy was identified as a priority in child health care policies of Brazil's Ministry of Health, with emphasis on primary care.

Consequently, IMCI guidelines have been adapted to the national and sub-national epidemiological conditions. IMCI implementation began in 1997 in several Brazilian states, in the Northeast (States of Ceará, Pernambuco, Paraíba and Sergipe) and North (State of Pará) regions. By 2002 all states had begun to implement IMCI as part of the Family Health Program (FHP), supported by the World Bank and the Brazilian Ministry of Health. However, since 2003, IMCI training has been greatly reduced, while the Ministry of Health's Child Health Care Team has redefined its priorities. No evidence on costs and health impact of IMCI relative to routine case management has been available to support the decision of discontinuing IMCI training. It is now opportune and important to make this information available to assist policymakers in achieving both national and international health targets.

The present study is part of the Multi-Country Evaluation of IMCI, with the overall objective to assess the effectiveness, cost and impact of IMCI by comparing routine health care provided to sick under-five children in primary health facilities based on IMCI. The evaluation includes four other countries: Bangladesh, Peru, Tanzania and Uganda.<sup>8</sup> Observation-based surveys of health care received by children and guidance of their caregivers in primary care facilities in Bangladesh,<sup>4</sup> Brazil,<sup>3</sup> Tanzania<sup>6</sup> and Uganda<sup>12</sup> have all reported significant improvements in the quality of care received by children in settings where providers have been trained in IMCI case management.<sup>11</sup> Moreover, in Tanzania, IMCI was shown not to incur in higher costs relative to routine care.<sup>11</sup> The present study aimed at assessing the impact of the IMCI strategy on the quality of child health care provided at primary facilities.

## METHODS

The Brazil Multi-Country Evaluation study has a mixed retrospective-prospective design, since IMCI had already been well implemented in many municipalities at the time of the study. The study compares municipalities with stable implementation from 1999–2002 in four Brazilian states (Bahia, Ceará, Paraíba and Pernambuco) with matched comparison municipalities without IMCI implementation in the same states. The

study was restricted to municipalities with a population size between 5,000 and 50,000 inhabitants. In addition, IMCI intervention municipalities were required to have continued and appropriate coverage of health providers who managed children and were trained in IMCI over the previous two calendar years (60% or more of health providers trained in IMCI). All municipalities meeting these criteria within each of the four states were included in the evaluation and matched to comparison municipalities based on geographic region and population size. The final sample included eight IMCI and eight comparison municipalities each in the States of Paraíba and Pernambuco, seven IMCI and seven comparison municipalities in Ceará, and five IMCI and seven comparison municipalities in Bahia. To compensate for the different number of municipalities in each state, the number of facilities sampled was fixed at 12 with IMCI and 12 without IMCI in each state.

Data on the quality of case management were collected in 2002 using a health facility survey protocol designed for the Multi-Country Evaluation, measuring best pediatric practice. Teams of trained evaluators spent one full day at each facility, where they observed the case management of ill children; each child was then re-examined by a "gold standard" evaluator. Tasks assessed covered all measurable elements of the guidelines, including assessment, classification and treatment of the sick child, guidance and communication of the child's caretaker about how to continue care at home and when to return to the facility. Further details on the survey methods and results are available elsewhere.<sup>3</sup>

Four standard Multi-Country Evaluation questionnaires adapted and translated into Portuguese were used to collect cost data at federal level from the Ministry of Health and Department of Health at each of the four states; municipality level in each Department of Health in each municipality in the study and primary facility levels. In addition, a time and motion study was performed in a subsample of health facilities included in the health facility survey (32 out of 96) for assessing the percent of time health providers spent with under-five children, in order to apportion health provider time to these activities.

Start-up costs of introducing IMCI in Brazil were collected for 1996–1997, annualized over a ten-year period using a discount rate of 3%, and inflated to 2001 values using gross domestic product deflators.<sup>10,15</sup> Cost components during the start-up period included orientation and planning meetings, adaptation and preparation of IMCI training materials, and IMCI training. Start-up costs at the national level were apportioned equally to all municipalities while those incurred at the state and local levels were only apportioned to intervention municipalities.

Data on the costs of providing and maintaining services for under-five children were collected for the year 2001 in all four states and reflect the annual costs of child health care in the municipality. They included annual costs of ongoing training related to under-five care (IMCI or other), drugs and vaccines, annualized shares of capital items, the opportunity cost of staff time spent in consultation with under-fives, and administrative time of staff at local and national levels spent in attending meetings and performing supervision visits related to child health. Capital costs were annualized over their lifetime using a discount rate of 3%. Start-up and post-implementation costs were summed across all levels to obtain the total cost to the municipality of providing child health care, presented in 2001 US dollars.<sup>1</sup> Finally, to allow comparison of the total cost between IMCI and comparison municipalities taking into account differences in population, costs were adjusted to a standard municipality size of 2,000 under-five children. Further details about costing methods and analysis are to be published.

A single measure to assess quality of care in terms of management of the sick child was needed that would be equally valid in both IMCI and comparison settings. It was used the measure developed by Bryce et al. (2005),<sup>9</sup> a summary measure using only variables considered to be characteristic of good pediatric practice, whether or not IMCI guidelines were strictly followed.

The summary measure, referred to as “correct management of childhood illness,” was defined as the proportion of children managed correctly for all presenting conditions as determined by the gold-standard evaluator, ranging from 0 to 100. Correct management is defined as provision of the correct drug, in the correct formulation (amount, times per day, number of days) and for whom the health provider explained correctly to the caretaker how the drug should be administered at home. Not prescribing an antibiotic for a child who did not need one was also considered as a task performed correctly, as was not prescribing inappropriate antidiarrheals.

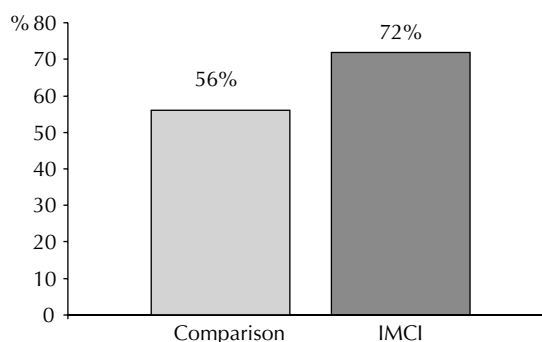
The denominator for the summary index is defined as all sick children presenting for care at the study facilities. Alternative options using subgroups of children based on illness severity (immediately life-threatening or “priority” conditions versus non-life-threatening or “non-priority” conditions) or need for referral to a higher-level facility (yes/no) were evaluated using health facility survey data. For the purposes of cost-effectiveness analysis, the proportion of sick children managed correctly in study facilities was assumed to reflect the overall level in the municipality over the course of one year.

To estimate the cost per child correctly managed in IMCI and comparison municipalities, the total costs of under-five care in a standard municipality with 2,000 under-five children were divided by the number of children visiting the health facilities during the same period who were correctly managed. The number of children correctly managed was estimated by multiplying the proportion of children managed correctly by the standardized total number of annual under-five consultations at state-run facilities. The resulting ratio represents the average cost-effectiveness ratio for each alternative. The incremental cost-effectiveness ratio is defined as the difference between the cost-effectiveness ratio at a standard IMCI and that in a comparison municipality.

## RESULTS

Of 358 children studied (175 in IMCI and 183 in non-IMCI facilities), the majority presented with non-priority illnesses (162 and 175, respectively). Of these children, 72% were correctly managed in IMCI facilities and 56% in non-IMCI facilities ( $p=0.002$ ). Only 7% of all observed children presented with priority illnesses (14 in IMCI and 9 in non-IMCI facilities), mainly severe pneumonia or diarrhea (Table 1). Of children with priority illnesses, 47% were correctly managed in IMCI facilities, compared with only 22% in comparison facilities ( $p=0.389$ ). This comparison had low statistical power due to the small number of children with severe conditions. Correct management of individual illnesses is presented in Table 1 and Table 2.

The Figure presents the proportion of children with all presenting conditions who were managed correctly in IMCI and comparison municipalities. IMCI was associated with a 30% higher quality of case management than existing training approaches ( $p=0.001$ ).



$p < 0.0001$

**Figure.** Percent of children managed correctly in Integrated Management of Childhood Illness (IMCI) and comparison facilities. Northeastern Brazil, 2001.

**Table 1.** Number of children and caretakers who received correct treatment and guidance on how to administer medication for episodes of priority illnesses. Northeastern Brazil, 2001.

Priority disease/treatment*	Children studied in	
	IMCI facilities	Comparison facilities
	N (%)	N (%)
Pneumonia	12	7
Prescribe antibiotic	11	6
Prescribe antibiotic correctly (amount, times per day, number of days)	7	2
Explain how to administer antibiotic	11	5
Correct management (all of above)	7 (58%)	2 (29%)
Diarrhea with dehydration	0	2
Prescribe ORS*	-	1
Administer ORS* at facility	-	0
Explain how to administer ORS*	-	1
Correct management (all of above)	-	0
Dysentery	2	0
Prescribe antibiotic	0	-
Prescribe antibiotic correctly (amount, times per day, number of days)	0	-
Explain how to administer antibiotic	-	-
Correct management (all of above)	0	-

ORS: oral rehydration solution

IMCI: Integrated Management of Childhood Illness

\* Based on gold standard classification, by health providers trained and not trained in Integrated Management of Childhood Illness in four municipalities

Note: IMCI priority diseases also include malaria and measles but no cases were seen during the study.

Table 3 summarizes the total cost per child of providing child health care at national, state, local and primary facility levels in IMCI and comparison municipalities, as well as the difference in costs per child in IMCI versus comparison municipalities (referred to as incremental costs). In 2001, there was no significant difference in the total cost per child in a standard IMCI municipality (US\$71.85) compared with a standard comparison municipality (US\$75.58). The largest components of costs were at the facility and local levels.

Costs of providing services at primary care facilities represented 85% to 90% of the total cost of under-five care per child, mainly due to the high number of consultations per child per year (7.58 and 6.44 in IMCI and comparison municipalities, respectively) in those municipalities. The cost per visit was lower in IMCI versus comparison municipalities hence the lower total costs at primary facility level. Local level costs contributed to total costs in similar proportions in both IMCI and comparison municipalities (13% and 10%) with the main components being personnel costs, recurrent transportation costs and other variable costs like electricity maintenance and supplies.

Table 4 combines the information on quality of care and total municipality costs of child care to report the cost per child correctly managed. As a higher proportion of sick children visiting health facilities was correctly managed in IMCI municipalities than in comparison municipalities with no differences in costs incurred, the cost per child managed correctly was considerably lower in IMCI municipalities (US\$13.07) than in comparison municipalities (US\$20.96). This indicates that IMCI leads to significant improvements in efficiency at primary care facilities, since IMCI led to a marked increase in quality of care for under-fives relative to routine care at the same level of resource use.

## DISCUSSION

The present study shows new evidence on the relationship between IMCI and correct management of sick children, with associated cost implications, at primary health facilities in Northeastern Brazil. Training health providers in IMCI case management in Northeastern Brazil was found to be associated with higher quality of child care received by sick children than routine care provided in comparison municipalities. Improving

**Table 2.** Number of children and caretakers who received correct treatment and guidance on how to administer medication for episodes of non-priority illnesses. Northeastern Brazil, 2001.

Non-priority diseases/treatment	Children studied in	
	IMCI	Comparison
	facilities N (%)	facilities N (%)
Cough / cold	166	176
N (excluding diseases for which antibiotics are likely to be prescribed)	108	91
Did not prescribe antibiotic	97 (90%)	77(85%)
Fever (no malaria)	85	96
N (excluding other illnesses for which AB would normally be required)	49	47
Prescribed paracetamol / antipyretic	41	33
Did not prescribe antibiotic	40	39
Correct management	32 (65%)	27(57%)
Diarrhea with no dehydration	44	53
N (excluding diseases for which antibiotics are likely to be prescribed)	28	35
Did not prescribe antibiotic	22	31
Correct guidance given on providing extra fluid / continued feeding	22	28
Correct management (all of above)	19 (68%)	25 (71%)
Acute ear infection	5	7
Prescribe antibiotic	5	6
Prescribe antibiotic correctly	5	4
Explain how to administer drug	5	5
Correct management (all of above)	5(100%)	4 (57%)
Chronic ear infection	0	1
N (excluding diseases for which antibiotics are likely to be prescribed)	-	1
Did not prescribe antibiotic	-	1
Correct management	-	1 (100%)
Anemia	43	72
Prescribe iron	21	28
Correct management (all of above)	21 (49%)	28 (39%)

quality without increasing costs – as was the case for IMCI in the present analysis – indicates improved efficiency. IMCI can help municipalities make the most of their scarce public health resources.

The results of the present work are comparable to those from the Multi-Country Evaluation in Tanzania where IMCI led to six fold increase in quality of care (65% compared with 16% in IMCI and comparison municipalities, respectively), at no extra costs.<sup>2,9</sup> Although the impact of IMCI training on the quality of care was higher in Tanzania than in Northeastern Brazil, likely due to their lower baseline rates, the absolute level of quality of care was higher in Northeastern Brazil. This may be partly due to differences in provider's skill levels between the two countries; where as in Brazil

health providers providing child care at the time of the study included mostly medical doctors and a small proportion of university-trained nurses, in Tanzania most health providers were medical assistants, with shorter training than their Brazilian counterparts. Also, absolute costs per child in Brazil (around US\$70 per child-year) are considerably higher than those in Tanzania (around US\$14 per child-year), particularly due to notable differences in absolute wage levels and staffing profiles between the two countries.<sup>2,9</sup>

Although this study findings support the scaling-up of IMCI-based child health care at health facilities in Northeastern Brazil and similar settings, the extent to which the observed gains in quality and efficiency of resource use at primary facilities can be maintained during periods of rapid scaling-up is worth exploring

**Table 3.** Cost of under-five care per child in a standard municipality in 2001 reais and US dollars. Northeastern Brazil, 2001

	Standard			Standard			
Level	IMCI municipality		%	Comparison municipality		%	p-value
	R\$	(US\$)		R\$	(US\$)		
National	0.13	0.04	0.00	0.13	0.04	0.00	-
State	4.23	1.4	0.02	2.17	0.72	0.01	<0.0001
Local	28.79	9.5	0.13	23.04	7.6	0.10	0.24
Primary-facility	184.57	60.91	0.85	203.76	67.22	0.89	0.76
Total*	217.72	71.85	1	229.1	75.58	1	0.86

\* No significant differences in the overall cost per child were found using t-test

**Table 4.** Cost per child correctly managed in Integrated Management of Childhood Illness and comparison municipalities based on variable C (all sick children including severe illness). Northeastern Brazil, 2001.

Measure	Brazil IMCI	US\$	Brazil Comparison	US\$
	(Real)		(Real)	
Total costs per standard municipality*	326,580	107,775	343,650	113,370
Quality measure (proportion of children correctly managed)	0.72		0.56	
Annual under-five visits at state-run facilities in a standard municipality**	11,370		9,660	
Effectiveness (number of children correctly managed)***	8,186		5,410	
Cost per child correctly managed	39.89	13.17	63.53	20.96

\* Municipality costs are standardized for a population size of 2,000 under-five children

\*\* Collected from forms available at health facilities during the study

\*\*\* Annual visits multiplied by the proportion of correctly managed children

and monitoring over time. In Uganda, another country participating in the Multi-Country Evaluation, rapid scaling-up led to lower quality of care.<sup>12</sup>

In conclusion, the present study shows that efficiency analysis, such as the estimation of the cost per child managed correctly, can answer fundamental questions posed by policymakers and program planners. In order to support evidence-based decision making, the Brazilian government should reconsider its decision to discontinue its support to IMCI training.

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