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Improving and sustaining quality of child health care through IMCI training and supervision: experience from rural Bangladesh

D M Emdadul Hoque,[1]* Shams E Arifeen,[1] Muntasirur Rahman,[1] Enayet K Chowdhury,[1] Twaha M Haque,[1] Khadija Begum,[1] M Altaf Hossain,[2] Tasnima Akter,[1] Fazlul Haque,[1] Tariq Anwar,[1] Sk Masum Billah,[1] Ahmed Ehsanur Rahman,[1] Md Hamidul Huque,[1] Aliki Christou,[1] Abdullah H Baqui,[3] Jennifer Bryce[3] and Robert E Black[3]

[1]Centre for Child and Adolescent Health (CCAH), ICDDR,B, Dhaka, Bangladesh, [2]Director General of Health Services, Ministry of Health and Family Welfare, Bangladesh and [3]International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

*Corresponding author. Centre for Child and Adolescent Health (CCAH), ICDDR,B, 68, Shahid Tajuddin Ahmed Sarani, Mohakhali, Dhaka 1212, Bangladesh. E-mail: emdad@icddrb.org, emdadas@gamil.com

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Background The Integrated Management of Childhood Illness (IMCI) strategy includes guidelines for the management of sick children at first-level facilities. These guidelines intend to improve quality of care by ensuring a complete assessment of the child's health and by providing algorithms that combine presenting symptoms into a set of illness classifications for management by IMCI-trained service providers at first-level facilities.

Objectives To investigate the sustainability of improvements in under-five case management by two cadres of first-level government service providers with different levels of pre-service training following implementation of IMCI training and supportive supervision.

Methods Twenty first-level health facilities in the rural sub-district of Matlab in Bangladesh were randomly assigned to IMCI intervention or comparison groups. Health workers in IMCI facilities received training in case management and monthly supportive supervision that involved observations of case management and reinforcement of skills by trained physicians. Health workers in comparison facilities were supervised according to Government of Bangladesh standards. Health facility surveys involving observations of case management were carried out at baseline (2000) and at two points (2003 and 2005) after implementation of IMCI in intervention facilities.

Findings Improvement in the management of sick under-five children by IMCI trained service providers with only 18 months of pre-service training was equivalent to that of service providers with 4 years of pre-service training. The improvements in quality of care were sustained over a 2-year period across both cadres of providers in intervention facilities.

Conclusion IMCI training coupled with regular supervision can sustain improvements in the quality of child health care in first-level health facilities, even among workers with minimal pre-service training. These findings can guide government policy makers and provide further evidence to support the scale-up of regular supervision and task shifting the management of sick under-five children to lower-level service providers.

Keywords Child health services, quality of care, quality indicators, health care, health facility survey

KEY MESSAGES

- Quality of care of IMCI-trained service providers is sustainable through supportive supervision including direct case observation.
- Task shifting of IMCI services is possible as quality of care by paramedics with 4 years of pre-service training was similar to that of a lower-level provider with only 18 months of pre-service training.

Introduction

In 2010, there were about 14.7 million children under five living in Bangladesh (United Nations 2010). According to the 2011 Demographic and Health Survey, under-five mortality in Bangladesh was 53 per 1000 live births (NIPORT 2012), which translates into 159 000 under-five deaths a year. About a third of these deaths were due to infectious diseases (e.g. pneumonia, sepsis and diarrhoea) often coupled with under-nutrition (Liu 2012; NIPORT 2004), and many of these deaths could have been prevented through appropriate case management by a trained health provider (Jones *et al.* 2003).

The Government of Bangladesh (GoB) adopted the Integrated Management of Childhood Illness Strategy (IMCI), developed by WHO and UNICEF, as a key strategy to meeting the fourth millennium development goal (MDG 4) and improve child survival. A key focus of IMCI is to enhance the quality of care provided to sick children in first-level health facilities by improving case management skills of first-level health workers, strengthening the health system for effective management of sick children, and promoting good community child care practices (Tulloch 1999). The quality of paediatric care has been shown to improve following the implementation of IMCI; however, the challenge remains with sustaining quality care, with studies showing that training alone, even with the recommended follow-up visits by IMCI supervisors is inadequate (Horwood *et al*. 2009; Pariyo *et al.* 2005). Regular supervision has been identified as an important factor influencing quality of care (Gouws *et al.* 2005). Pariyo and colleagues (2005) reported that health facilities that received at least one supervisory visit in the previous 6 months that included observation of case management performed significantly better than those that did not receive such supervision (mean index of integrated assessment 57 vs 49, $P = 0.001$).

Previously we reported findings from a baseline assessment of the quality of child health care provided at first-level facilities in rural Bangladesh (Arifeen *et al.* 2004; Bryce *et al.* 2004). Since then half of these facilities were randomly selected for implementation of the health-facility-based intervention components of the IMCI strategy.

The study health facilities had two different health-worker cadres with different levels of pre-service training: paramedics, referred to as medical assistant/sub-assistant community medical officers or MA/SACMOs, who are predominantly male and have 4 years of clinical training; and female reproductive health workers, referred to as family welfare visitors or FWVs, who have 18 months of training in the provision of maternal and child health and family planning services. IMCI is not included in the pre-service or usual in-service training of these paramedics. At baseline, FWVs were found to perform at least as well as MA/SACMOs, and we recommended that the GoB consider including FWVs as targets for IMCI training in the national scale-up of the strategy (Arifeen *et al*. 2005).

The final overall results of the study have been published with selected key results from the health facility surveys to support the main results (Arifeen *et al.* 2009). In that paper we showed that implementation of IMCI was associated with large and significant improvements in correct case management of sick under-five children and that the improved quality of care was sustained over the study period. In the current analysis, we explore the quality of child health care in the IMCI intervention facilities according to cadre of health service provider from baseline and at two points after the implementation of IMCI in 2002 to determine if quality of care given regular supervision can be sustained over time even in lower-level service providers.

Methods

The study was implemented in rural areas of Matlab *upazilla* (sub-district) not covered by child and reproductive health services provided by the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). The total population of the study area is about 350 000. The sampling frame included 20 of the 24 first-level outpatient facilities in the study area and their catchment areas. The remaining four facilities were excluded because substantial portions of their catchment populations received child health services from ICDDR,B in addition to government facilities. The baseline health facility assessment was carried out in 19 of the 20 facilities before randomization; the assigned health worker was not available in one facility so observations could not be conducted. We first paired the facilities/catchment area units on facility type, geographical distribution, baseline mortality levels and catchment population size to ensure balance in terms of these characteristics, and then randomly assigned one unit within each pair as IMCI (intervention) and the other as comparison.

Intervention description

Health service providers in the 10 first-level government facilities in the intervention area received 11 days IMCI clinical management training. They started implementing IMCI case management protocols in early 2002. Between 2002 and 2005, seven new staff were posted in the IMCI facilities to fill vacancies and all received the IMCI training prior to commencing work.

The project team also ensured that any additional drugs and supplies needed in the 10 IMCI intervention facilities were made available. Health facility recording and reporting systems were updated to improve information on sick child management and use of drugs in the IMCI facilities. A facility-level drug tracking and reporting system was introduced. The GoB routine recording forms were modified for the IMCI facilities for proper recording of information during the sick child management including presenting signs/symptoms, classifications, dose and duration of treatment following IMCI training. Structured formats for providing monthly reports were introduced at these IMCI facilities. Case management guidelines were changed in the intervention facilities beginning in May 2004 to allow administration of oral antibiotics in first-level facilities, instead of referral, for children aged 2 months to 5 years presenting with severe pneumonia in the absence of any of the four general danger signs (not able to drink or breastfeed, vomiting everything, convulsion and lethargic or unconscious); and in the absence of stridor or signs and symptoms of other severe classifications such as stiff neck, tender swelling behind the ear, visible severe wasting, severe palmer pallor, oedema of both feet, clouding of cornea, and deep or extensive mouth ulcers, or other causes that might trigger referral (Chowdhury *et al*. 2008). Project medical officers trained in IMCI case management and IMCI supervision visited each of the intervention facilities without prior notice on a monthly basis. Using a specially designed supervisory checklist, they reviewed the patient register to check for completeness and consistency of records and to determine overall case loads. They also checked the attendance records for the provider and the hours that the facility had been open, and the availability of needed drugs, functioning equipment and IMCI-related job aids. The supervisors also observed the IMCI-trained provider in the management of at least one sick child and provided immediate feedback and reinforcement. The duration of each supervisory visit ranged between two and two and a half hours. The monthly supervisory visit schedule was rarely missed.

Service providers at the first-level facilities in the comparison areas did not receive IMCI trainings or any other training on sick child management. The comparison facilities were supervised by their usual government supervisors—a process that the project neither facilitated or restricted. The project medical officers, who visited the IMCI facilities once a month, also visited each of the comparison facilities once every quarter to collect information regarding facility utilization. However, observation of case management was not included in these visits. Comparison area health facilities received routine government supplies of medicines.

Health facility surveys

A detailed description of survey methods was provided in the report of the baseline health facility survey (Arifeen *et al.* 2005). As in the earlier survey, the management of all sick children presenting for care at the facility during the period of observation were eligible for observation, and the unit of analysis in the assessment of care quality is the sick child.

Instruments and procedures developed by WHO for the multi-country evaluation of IMCI for the evaluation of quality of care were adapted and used. The baseline survey was carried out between August and September 2000. The two follow-up surveys were conducted at the same facilities between October and December of 2003 and 2005. The surveys were conducted in all intervention and comparison facilities by physicians trained in IMCI case management protocols and the survey tools. Data were collected through observation of case-management, exit interviews with caregivers, re-examination of each child by a 'gold-standard' surveyor, interviews with health-care providers and an audit of supplies and equipment available at the health facilities. Completed forms were reviewed and edited daily by supervisors.

The estimated sample for each facility was 15 sick children consultations (to detect a difference of 20 percentage points between IMCI and comparison facilities; based on 5% significance level, power of 80% and a design effect of 2.0). All procedures were identical to those used at baseline and are reported elsewhere (Arifeen *et al.* 2005).

Indicators used in the surveys

We used a set of seven indicators with demonstrated reliability in the assessment of the quality of facility-based child health care. These indicators had been developed by WHO (Gouws *et al*. 2005). The summary indices of quality of care measured the completeness of the health worker's assessment of the child and correct case management, and were constructed with data from direct observations of case management.

A brief description of different indicators of quality of child health care in first-level health facilities are described below.

Health worker performance

(a) Assessment of sick children

Integrated child assessment: This index assesses the quality and completeness of the assessment received by the sick child. Scores reflect how many of essential assessment tasks (14 tasks for children 24 months and older and 17 tasks for children younger than 24 months) were performed by the health worker, using equal weights for each item and scaled to range between 0 and 100. Three additional items on feeding assessment are included for children aged less than 24 months.

(b) Correct case management

Indicator for priority illness: The proportion of children classified by the gold standard surveyor as having severe illness, pneumonia, diarrhoea with dehydration, dysentery, malaria or measles, who were prescribed the drug correctly and for whom the health worker explained correctly to the caretaker how the drug should be administered at home.

Indicator for non-priority illness (mild/less severe illnesses): The proportion of children classified by the gold standard as having a cough or cold, acute or chronic ear infection, diarrhoea with no dehydration, anaemia or fever with no

malaria, who were prescribed the drug correctly and for whom the health worker explained correctly to the caretaker how the drug should be administered at home.

Indicator for all illness: A combination of mild and severe illnesses as described above.

Health system support

(a) *Availability of drugs:* Index of availability of essential oral treatments (mean) [range 0–100].
(b) *Supervision visits:* Health facility that had received at least one supervisory visit during the previous six months that included observation of case management.
(c) *Health worker knowledge:* Health worker knowledge of correct case management for severe illness and young infants. This index assesses the health workers' knowledge of correct case management for severe illness and infants less than 2 months of age, as measured by five case scenarios. Each of the scenarios describes a child or young infant presenting for care at the facility. Knowledge of the health worker in relation to the management of such a case is scored and scaled to range between 0 and 100.

Ethical approval

Ethical approval for the study was obtained from the ethical review committees of ICDDR,B in Dhaka and WHO in Geneva. Necessary permissions were obtained from the Director General for Health Services (DGHS) and the Director General for Family Planning (DGFP), as all survey facilities are administered by the Ministry of Health and Family Welfare of GoB. Informed verbal consent was obtained from the caregivers of the sick children seeking care at the health facilities. This study is registered with number ISRCTN52793850.

Data processing and analysis

The case management indicators were weighted to reflect the overall under-five caseload on the survey days, using procedures identical to those used in analyzing the baseline survey results (Arifeen *et al*. 2005). For comparisons, the chi-square test was used with a Rao–Scott correction to adjust for clustering of children at the health facility level. Statistical analysis was carried out using STATA version 8 for Windows (www.stata.com).

Results

Table 1 presents the age and sex distribution of children for whom case management was observed in the three surveys, the caretaker accompanying the child (mother vs other) and the distribution of observations by provider cadre. Differences in the sample of sick children observed across the three surveys included: an increase in the proportion of children in the youngest age group (2–11 months); shifts in the cadre of provider from FWVs to SACMOs in the IMCI facilities, and

Table 1 Characteristics of children observed and care-seeking from cadre of health-care provider in Matlab, Bangladesh during baseline (2000) and follow-up surveys in 2003 and 2005

	Baseline (2000)			**After implementation of IMCI**					
	n (%)			2003 *n* (%)			2005 *n* (%)		
	IMCI	Comp	*P*-values	IMCI	Comp	*P*-values	IMCI	Comp	*P*-values
Number of children observed	142	142		234	108		176	133	
Age in months									
2–11	47 (33.1)	37 (26.1)	0.19	89 (38.0)	26 (24.1)	0.01	74 (42.1)	42 (31.6)	0.06
12–23	33 (23.2)	42 (29.6)	0.23	63 (26.9)	24 (22.2)	0.35	55 (31.3)	42 (31.6)	0.95
24–35	29 (20.4)	22 (15.5)	0.28	29 (12.4)	25 (23.2)	0.01	32 (18.2)	19 (14.3)	0.36
36–47	22 (15.5)	24 (16.9)	0.75	34 (14.5)	15 (13.9)	0.88	12 (6.8)	19 (14.3)	0.03
48–59	11 (7.8)	17 (12.0)	0.23	19 (8.1)	18 (16.7)	0.02	3 (1.7)	11 (8.3)	0.01
Sex									
Male	86 (60.6)	72 (50.7)	0.09	121 (51.7)	64 (59.3)	0.19	96 (54.6)	67 (50.4)	0.47
Female	56 (39.4)	70 (49.3)		113 (48.3)	44 (40.7)		80 (45.5)	66 (49.6)	
Caregiver									
Mother	123 (86.6)	119 (83.8)	0.50	217 (92.8)	91 (84.3)	0.02	159 (90.3)	118 (88.7)	0.64
Other	12 (8.5)	21 (14.8)	0.10	17 (7.3)	17 (15.7)	0.02	15 (8.5)	15 (11.3)	0.42
Health workers providing care									
MA	27 (19.0)	25 (17.6)	0.76	48 (20.5)	24 (22.2)	0.72	31 (17.6)	20 (15.0)	0.55
SACMO	32 (22.5)	100 (70.4)	<0.001	114 (48.7)	58 (53.7)	0.39	85 (48.3)	74 (55.6)	0.20
FWV	77 (54.2)	17 (12.0)	<0.001	71 (30.3)	21 (19.4)	0.04	59 (33.5)	39 (29.3)	0.43
	$P < 0.0001$			$P = 0.161$			$P = 0.469$		

Family welfare visitor (FWV): female reproductive health worker (Paramedic) who has had 18 months of training in provision of maternal and child health and family planning services; Medical assistant (MA): Paramedic who has had 4 years of clinical training, typically working in a sub-centre; Sub-assistant Community Medical Officer (SACMO): Paramedic who has had 4 years of clinical training, typically working in a family welfare centre.

Table 2 Presenting conditions of sick children aged under 5 years attending first-level facilities in Matlab, Bangladesh during baseline (2000) and follow-up surveys in 2003 and 2005

Classification of presenting illness	Baseline 2000[a]			After implementation of IMCI[a]					
				2003			2005		
	n (%)			*n* (%)			*n* (%)		
	IMCI	Comp	*P*-values	IMCI	Comp	*P*-values	IMCI	Comp	*P*-values
No. of children observed (*n*)	142	142		234	108		176	133	
Fever	113 (80.4)	110 (79.2)	0.72	178 (76.9)	73 (68.4)	0.20	129 (74.3)	92 (70.3)	0.48
Cough or cold	65 (48.6)	68 (48.8)	0.65	133 (58.9)	63 (59.1)	0.98	95 (52.1)	84 (64.3)	0.04
Pneumonia	40 (27.9)	30 (21.2)	0.26	63 (25.3)	21 (19.7)	0.51	62 (37.0)	35 (26.0)	0.06
Diarrhoea	30 (21.9)	23 (15.9)	0.55	69 (28.1)	33 (30.8)	0.54	43 (23.0)	30 (22.8)	0.97
Very low weight	22 (17.2)	28 (20.4)	0.56	25 (10.7)	11 (9.5)	0.73	14 (8.3)	14 (10.6)	0.44
Anaemia	17 (12.5)	28 (20.1)	0.26	2 (0.9)	2 (1.8)	0.56	3 (1.8)	6 (4.3)	0.29
Acute ear infection	13 (9.1)	12 (8.9)	0.44	8 (4.0)	3 (2.1)	0.42	12 (7.3)	7 (5.3)	0.50
Chronic ear infection	8 (6.0)	13 (8.8)	0.58	9 (3.6)	5 (4.6)	0.55	2 (1.0)	10 (7.6)	<0.01
Dysentery	9 (5.4)	6 (4.6)	0.62	15 (5.8)	4 (3.9)	0.50	14 (7.5)	6 (4.9)	0.45
Measles	1 (1.0)	7 (6.1)	0.05	8 (3.8)	1 (1.0)	0.14	6 (3.6)	2 (1.5)	0.26
Other	49 (32.5)	46 (34.9)	0.62	82 (34.5)	42 (38.1)	0.59	34 (19.4)	15 (12.8)	0.26

[a]Percentages are weighted estimates whereas the numbers are actual, and therefore they will not exactly correspond.

from SACMOs to FWVs in the comparison facilities; and increases in the total number of observations conducted in IMCI facilities in 2003 and 2005 relative to baseline.

Table 2 shows the changes in the presenting case mix over the 5-year study period. There were no major changes in presenting illnesses of under-five children between the intervention and comparison areas apart from a significant reduction in cases of chronic ear infection in the IMCI areas in 2005; however, this might be due to the small sample size and may not represent any real difference. There was a non-significant increase in the proportion of children presenting with pneumonia in the IMCI facilities (from 28% in 2000 to 37% in 2005, *P*-value 0.20), with a corresponding decline in the proportions of children classified as having 'other' illnesses (from 32% in 2000 to 19% in 2005, *P*-value 0.07) and a decline in the proportion of children classified as having anaemia (from 12% in 2000 to 2% in 2005, *P*-value < 0.01). We also observed a high proportion of children (around 70%) presenting with combinations of fever, cough or cold, pneumonia or diarrhoea in all three survey periods (data not shown).

Table 3 summarizes the specific case-management tasks performed by the two cadre of service providers at IMCI facilities at baseline (2000) and at one (2003) and three (2005) years after the introduction of IMCI. By the end point, the quality of care provided by the FWVs with only 18 months of pre-service training was similar to that of the paramedics with 4 years of pre-service training.

Both providers performed better in assessing and classifying the child following IMCI guidelines in 2003 compared to baseline (2000) and the improved quality of care was sustained to 2005. There was no significant difference between the performance of the two types of service providers regarding most of the quality-of-care indicators except assessing the child for the presence of cough, diarrhoea and fever ($P = 0.05$) in 2003. However, in 2005, we did not find any difference ($P = 0.81$) for this indicator between the two cadres of providers.

Similarly, both providers showed improvements in correct treatment of pneumonia cases and correct prescription of antibiotics/anti-malarials in 2003 compared with baseline. Although the performance dropped slightly in 2005, it remained higher than that at baseline.

Even though injudicious use of antibiotics was very low, performance by paramedics was significantly better than the family planning visitors during the first follow-up in 2003 (94.8 vs 80.4, $P < 0.01$); however, during the second follow-up in 2005 performances were similar.

The observed difference ($P = 0.008$) in counselling on continued feeding between family planning visitors and paramedics at baseline visit disappeared ($P = 0.34$) by the second follow-up visit in 2005 and performance was high for both providers (74% by FWVs vs 87% by paramedics).

At the first follow-up visit, FWVs performed better than paramedics in advising caretakers on danger signs and when to return immediately (76% vs 41%; $P = 0.03$), however, this was not observed during the second follow-up survey where both cadres showed similar and improved performance. There was also significant improvement from baseline to second follow-up in counselling performance across both providers in regard to advising caretakers on administering of oral medication.

We also compared the quality of care between the two cadres of providers based on integrated child assessment, management of priority and non-priority illness and case management of all illnesses in 2003 and 2005 (Figure 1). Across all indexes, performance levels in the IMCI facilities were almost similar for both cadres of service providers. The only significant difference in performance was observed in the management of children with priority illness. Paramedics (MA/SACMOs) provided marginally better care for children with priority illnesses; however,

Table 3 Proportion of children and caregivers for whom specific case-management tasks were performed at first-level IMCI and comparison facilities in Matlab, Bangladesh, according to provider type over the three survey periods

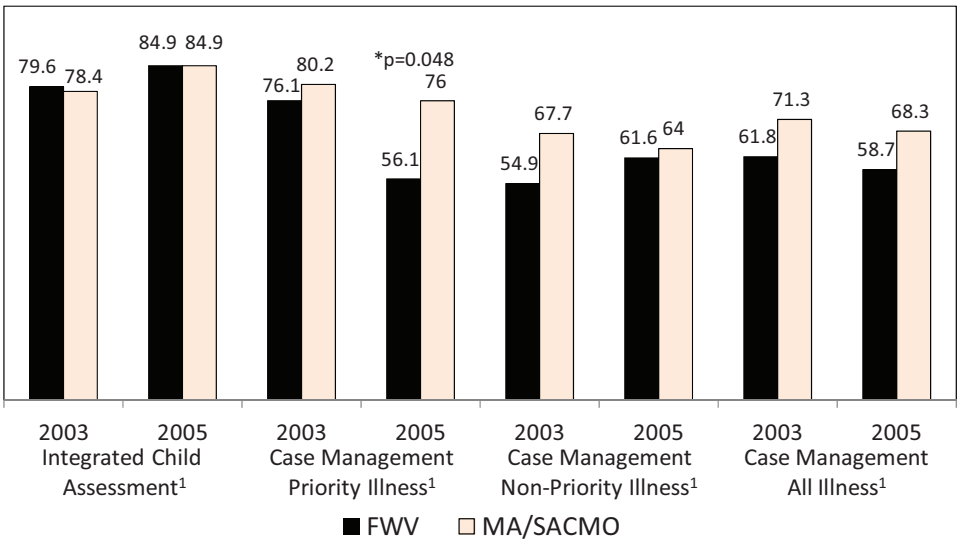
Health Facility Indicators		Statistic	2000			2003			2005		
			FWV	MA/SACMO	*P*-value[a]	FWV	MA/SACMO	*P*-value[a]	FWV	MA/SACMO	*P*-value[a]
Assessment of sick child											
Child checked for three danger signs	IMCI	%	0.0	0.0	–	85.8	61.1	0.11	100.0	91.8	0.35
			($n=77$)	($n=59$)		($n=71$)	($n=162$)		($n=59$)	($n=116$)	
	Comp	%	0.0	0.0	–	0.0	1.3	0.65	0.0	0.0	–
			($n=17$)	($n=125$)		($n=21$)	($n=82$)		($n=39$)	($n=94$)	
Child checked for the presence of cough, diarrhoea and fever	IMCI	%	7.8	25.7	0.04	66.0	88.2	0.05	80.7	84.0	0.81
			($n=77$)	($n=59$)		($n=71$)	($n=162$)		($n=59$)	($n=116$)	
	Comp	%	6.0	15.7	0.01	4.6	23.1	0.12	0.0	6.4	0.24
			($n=17$)	($n=125$)		($n=21$)	($n=82$)		($n=39$)	($n=94$)	
Child weight checked against a growth chart	IMCI	%	0.0	0.0	–	86.9	82.3	0.37	86.6	88.3	0.82
			($n=77$)	($n=59$)		($n=71$)	($n=162$)		($n=59$)	($n=116$)	
	Comp	%	0.0	0.0	–	0.0	0.0	–	0.0	0.0	–
			($n=17$)	($n=125$)		($n=21$)	($n=82$)		($n=39$)	($n=94$)	
PI-6: Child <2 years of age assessed for feeding practices	IMCI	%	0.0	0.0	–	39.4	29.1	0.42	50.2	54.6	0.81
			($n=34$)	($n=37$)		($n=49$)	($n=99$)		($n=41$)	($n=84$)	
	Comp	%	0.0	0.0	–	0.0	2.7	0.71	0.0	0.0	–
			($n=9$)	($n=70$)		($n=7$)	($n=40$)		($n=16$)	($n=64$)	
Child checked for other problems	IMCI	%	10.7	24.3	0.11	0.0	44.8	0.08	55.9	62.9	0.75
			($n=28$)	($n=21$)		($n=16$)	($n=59$)		($n=31$)	($n=60$)	
Child checked for other problems	Comp	%	60	4.3	<0.001	0.0	6.1	0.63	0.0	0.0	–
			($n=5$)	($n=58$)		($n=6$)	($n=35$)		($n=9$)	($n=36$)	
Child with very low weight is assessed for feeding problems	IMCI	%	0.0	0.0	–	33.3	24.3	0.72	48.5	51.6	0.94
			($n=9$)	($n=8$)		($n=8$)	($n=15$)		($n=2$)	($n=11$)	
	Comp	%	24.7	0.0	0.02	0.0	0.0	–	0.0	0.0	–
			($n=3$)	($n=22$)		($n=4$)	($n=7$)		($n=4$)	($n=8$)	
Index of integrated assessment (range 0–100)	IMCI	Means	21.2	25.3	0.26	79.6	78.4	0.76	84.9	84.9	0.99
			($n=77$)	($n=59$)		($n=71$)	($n=162$)		($n=59$)	($n=116$)	
	Comp	Means	22.8	18.2	0.06	18.8	20.9	0.67	11.0	10.9	97.7
			($n=17$)	($n=125$)		($n=21$)	($n=82$)		($n=39$)	($n=94$)	
Classification of sick child											
Child is correctly classified	IMCI	%	29.5	21.9	0.51	55.3	53.8	0.86	63.1	65.3	0.81
			($n=70$)	($n=53$)		($n=69$)	($n=158$)		($n=58$)	($n=111$)	
	Comp	%	47.8	13.3	<0.001	27.1	4.9	<0.01	7.3	0.0	0.07
			($n=15$)	($n=121$)		($n=21$)	($n=79$)		($n=38$)	($n=89$)	
Child with very low weight is correctly classified	IMCI	%	0.0	11.7	0.22	67.7	78.6	0.58	100.0	78.0	0.22
			($n=12$)	($n=9$)		($n=9$)	($n=16$)		($n=3$)	($n=11$)	
	Comp	%	0.0	0.0	–	0.0	0.0	–	0.0	0.0	–
			($n=4$)	($n=23$)		($n=4$)	($n=7$)		($n=4$)	($n=10$)	
Treatment of the sick child											
Child with pneumonia correctly treated	IMCI	%	0.0	17.1	0.10	100.0	94.0	0.50	76.8	82.2	0.74
			($n=17$)	($n=15$)		($n=18$)	($n=38$)		($n=14$)	($n=43$)	
Child with pneumonia correctly treated	Comp	%	0.0	4.9	<0.01	0.0	12.0	–	0.0	4.3	0.67
			($n=1$)	($n=28$)		($n=0$)	($n=17$)		($n=6$)	($n=25$)	
Child needing an oral antibiotic and/or an oral antimalarial prescribed the drug correctly	IMCI	%	0.0	10.6	0.11	81.2	67.4	0.29	70.6	80.6	0.47
			($n=28$)	($n=25$)		($n=26$)	($n=67$)		($n=25$)	($n=60$)	
	Comp	%	75.0	4.1	<0.001	17.4	12.7	0.75	0.0	3.1	0.60
			($n=4$)	($n=47$)		($n=5$)	($n=24$)		($n=11$)	($n=34$)	

(continued)

Table 3 Continued

Health Facility Indicators		Statistic	2000			2003			2005		
			FWV	MA/SACMO	*P*-value[a]	FWV	MA/SACMO	*P*-value[a]	FWV	MA/SACMO	*P*-value[a]
Child not needing antibiotic leaves the facility without antibiotic	IMCI	%	55.9	41.2	0.49	80.4	94.8	<0.01	96.0	90.5	0.44
			(*n* = 42)	(*n* = 28)		(*n* = 43)	(*n* = 91)		(*n* = 32)	(*n* = 51)	
	Comp	%	37.5	23.9	0.007	51.0	34.6	0.14	43.3	28.1	0.18
			(*n* = 11)	(*n* = 74)		(*n* = 16)	(*n* = 55)		(*n* = 28)	(*n* = 55)	
Child needing referral was referred	IMCI	%	47.4	0.0	0.27	49.2	82.3	0.39	0.0	44.2	0.30
			(*n* = 3)	(*n* = 1)		(*n* = 2)	(*n* = 4)		(*n* = 1)	(*n* = 5)	
	Comp	%	0.0	0.0	–	0.0	71.9	–	0.0	36.4	0.21
			(*n* = 1)	(*n* = 2)		(*n* = 0)	(*n* = 3)		(*n* = 1)	(*n* = 3)	
Advice and counselling given to caregiver of sick child											
Caretaker of sick child is advised to give extra fluids and continue feeding	IMCI	%	11.9	6.9	0.008	12.5	52.3	0.08	55.1	73.4	0.34
			(*n* = 64)	(*n* = 53)		(*n* = 69)	(*n* = 157)		(*n* = 58)	(*n* = 110)	
	Comp	%	11.3	0.0	<0.001	59.5	0.0	–	0.0	0.0	–
			(*n* = 15)	(*n* = 121)		(*n* = 21)	(*n* = 79)		(*n* = 38)	(*n* = 85)	
Child prescribed oral medication whose caretaker is advised on how to administer the treatment	IMCI	%	29.5	6.4	0.05	57.9	73.7	0.28	74.0	86.8	0.33
			(*n* = 34)	(*n* = 35)		(*n* = 46)	(*n* = 89)		(*n* = 33)	(*n* = 61)	
	Comp	%	28.2	2.4	<0.001	63.3	26.1	0.26	9.2	0.0	0.15
			(*n* = 11)	(*n* = 102)		(*n* = 12)	(*n* = 59)		(*n* = 26)	(*n* = 72)	
Sick child whose caretaker is advised on when to return immediately	IMCI	%	2.5	0.0	0.31	75.6	41.4	0.03	67.7	82.6	0.49
			(*n* = 70)	(*n* = 53)		(*n* = 69)	(*n* = 158)		(*n* = 58)	(*n* = 111)	
	Comp	%	0.0	0.0	–	0.0	0.0	–	0.0	0.0	–
			(*n* = 15)	(*n* = 121)		(*n* = 21)	(*n* = 79)		(*n* = 38)	(*n* = 89)	

[a]*P*-value based on chi-squared tests for proportions and *t*-tests for means.



[1] Indicators have been described in mehod in details under 'Indicators used in the survey'

Figure 1 Proportions of children and caregivers for whom specific case-management tasks were performed by providers in first-level IMCI facilities in Matlab, Bangladesh during follow-up surveys in 2003 and 2005, by provider type

on further exploration, the difference between paramedics and family planning visitors for this one indicator was mainly attributable to a single FWV. The figure also shows that improvements in quality of care were sustained over the 2-year period.

Discussion

Our study demonstrates that high-quality in-service training in IMCI case management accompanied by monthly supervision that includes observation of health worker performance,

individual feedback and availability of essential medicines can improve the quality of child health care in first-level facilities dramatically, and that this performance can be maintained and even improved (in the case of child assessment) over a 2-year follow-up period.

Good-quality IMCI training and supervision lead to high and sustained care quality across cadres of providers with very different levels of pre-service training. FWVs performed as well as SACMOs across almost all quality indicators, and maintained these performance levels over time. These findings are consistent with earlier reports of the association between IMCI training and quality of care from Uganda (Pariyo *et al*. 2005) and Brazil (Amaral *et al*. 2004), but are the first to document such large improvements and their maintenance over an extended time using a rigorous study design. The only statistically significant difference between SACMO/MA and FWV for priority illness in 2005 is largely attributable to the poor performance of one FWV who had also performed poorly in the 2003 survey. Because of this and because this difference in only one indicator may be of limited public health importance, we feel that for all practical purposes, we may rate the performance of these two cadres as equivalent.

Task shifting is one approach that can be adopted in situations where human resource shortages are a barrier to achieving health care for all (Callaghan *et al*. 2010; Fulton *et al*. 2011). Bangladesh has suffered for decades from a critical shortage of trained health providers, particularly doctors and nurses (Ahmed *et al*. 2011; O'Brien and Gostin 2011), relying on an extensive network of community-based health workers to deliver many basic health services. Task shifting involves the re-allocation of tasks usually undertaken by higher-level health workers to those with relatively lower qualifications and if coupled with appropriate ongoing training, can result in high quality and cost-effective care in hospital and community settings (Callaghan *et al*. 2010; Fulton *et al*. 2011; Dawson *et al*. 2013). However, the success of task shifting is likely to be dependent on how it is implemented. Specifically, thought needs to be given to how staff with lower qualifications will be integrated into health-care teams, how they will be supported and paid and how compliance with regulatory bodies can be negotiated (Callaghan *et al*. 2010). Bangladesh's IMCI programme currently does not routinely train FWVs on IMCI. Based on the evidence presented here, the GoB should consider task shifting from SACMO/MA paramedics to FWV or task sharing, particularly in facilities where the FWV may be the only provider, or where utilization is high. Any deliberations on the adoption of task shifting or task sharing need to take into account the potential increases in efficiency associated with training FWVs in IMCI, while recognizing that supervision is likely to be the crucial element in equalizing quality across cadres. Supervision was also likely to have been instrumental in sustaining the quality of care over time as there was no refresher training on IMCI for any staff during the study period.

While the number of sick children observed at baseline was the same in the two groups of facilities, it was substantially higher in the IMCI facilities in the follow-up surveys. As we have reported previously (Arifeen *et al.* 2009), there was a large increase in the utilization of the IMCI facilities after the introduction of IMCI, which we believe was a response to improved quality of care as well as the promotion of appropriate care-seeking that we had conducted in the catchment areas.

We have previously reported (Arifeen *et al*. 2009) that implementation of IMCI was associated with large and significant improvements in assessment and correct case management of priority, non-priority and all illnesses. Overall, the quality-of-care indicators were considerably poorer in the comparison facilities in all three surveys, with a tendency of improvement in the 2003 survey and then very low levels in 2005. We assessed the clinical and counselling skills of the service providers by direct case observation. It is well-known that people behave differently when observed; therefore there is some possibility of bias in the measurement of the quality-of-care indicators. However, the survey was carried out in a similar manner in both IMCI intervention and comparison areas, and can be assumed to have led to similar degrees of positive observation bias. Furthermore, the service providers in the IMCI intervention facilities are accustomed to regular monthly supervision which includes observations of case management, in the comparison facilities, supervision is less frequent and does not usually involve observation of case management. Therefore, any observation bias towards better quality of care would be more likely to occur in the comparison facilities than in IMCI intervention facilities as providers in the intervention facilities are more accustomed to such observations. While it is possible that the addition of two new freshly trained (in IMCI) paramedics in the IMCI facilities after the baseline may have contributed towards the better quality-of-care estimates in the 2003 follow-up surveys, we doubt that the overall effect would be large from just two workers. The number of children assessed during the health facility surveys was particularly low in the comparison facilities and we did not achieve the desired sample size in any of the surveys. However, the reduced sample was adequate for our primary purpose to compare the IMCI and comparison facilities as the differences between them were so large after the intervention. The facilities are typical of government facilities across the country and the majority (20 out of 24) of the facilities in the sub-district had been included in the study. Similar inputs should produce similar effects in such facilities elsewhere in Bangladesh.

In response to persistent low IMCI training coverage in most countries—usually attributed to the duration and costs of the training (Mushi *et al.* 2011), a WHO consultation in 2007 recommended the reduction of the duration of IMCI training course (WHO 2007). Surveys suggest that shortened courses will be widely acceptable (Goga *et al.* 2009). Many countries were already implementing shortened courses as a way of significantly reducing training costs as well as pressures on health-worker time. In 2011, the IMCI training duration for physicians in Bangladesh was also shortened from 11 days to 8 days from the previous 11 days. The training duration for paramedics and nurses was kept at 11 days for the paramedics and nurses. In a recent systematic review, Rowe *et al.* (2012) and colleagues concluded that 'based on limited evidence, standard IMCI training seemed more effective than shortened training, although the difference might be small'. In Matlab, where this study was conducted, all health workers had received the 11-day course. Since the duration of the course remained unchanged for both MA/SACMO and FWV the results of this study is still valid in the context of Bangladesh. However, it would be useful to assess the effectiveness of the shortened course for doctors.

A review of interventions designed to maintain high performance among first-level health workers found that simple dissemination of guidelines is often ineffective, that supervision and audit with feedback are usually more effective, and that multifaceted interventions (e.g. training plus supervision) are better than single interventions (Rowe *et al.* 2005). The review gave special attention to 'supervision' as an intervention to improve health-worker performance. A recent systematic review of effectiveness of IMCI training recommended implementation of other supportive interventions to support health workers after training (Rowe *et al.* 2012). A recent study in Afghanistan also demonstrated the importance of supervision in the quality of paediatric care (Edward *et al.* 2012). There is evidence that supervision can improve performance, systems for supervision are usually available, and supervisors are often the only human link between the first-level health workers and the health system. The quality of supervision and the amount of time actually spent by supervisors with health workers are the main challenges for good supervision.

In this study, the IMCI facilities were visited monthly by trained supervisors who spent a substantial amount of time observing the health workers. While the recommended follow-up after IMCI training was also conducted, we believe that the regular good-quality supervision was all-important in sustaining good quality of care in the IMCI facilities. This is consistent with recommendations made to integrate follow-up after training into routine supervision (Goga and Muhe 2011) in response to general difficulties in institutionalizing follow-up after training. The concern that arises from the results of our study is whether a low-income country such as Bangladesh can actually scale up and maintain this intensity and quality of supervision. Supervision in the non-IMCI facilities was infrequent and almost never involved observation of the health worker. This is typical of the government health system, and probably not unique to Bangladesh. The problem does not appear to be due to a lack of human resources for supervision, at least in Bangladesh, because eight medical officers as well as several other technically qualified staff are posted in each sub-district, although vacancies are a common problem (Chaudhury and Hammer 2003). Difficulties with maintaining regular and high quality supervision of health workers has been demonstrated elsewhere (Rowe *et al.* 2010) and there is evidence to indicate that the lack of supervision has limited IMCI coverage and impact in most countries (Chopra *et al.* 2012). The GoB should examine the barriers to supportive supervision, and attempt to overcome them.

The Bangladesh Expanded Programme for Immunization (EPI) has benefited from using a 'third-party' monitoring and quality assurance (QA) system that is managed by the Ministry of Health, which works within the existing government health system but does not depend only on line managers as primary supervisors. Such a strategy could also be applied for ensuring adequate supervisory mechanisms are in place at primary-level health facilities. We also consider the need to focus on innovations to address the problems with IMCI supervision (Chopra *et al.* 2012), and are convinced that effective innovations will require resources.

To the best of our knowledge there was no programme in the comparison areas that could have explained the observed changes in the non-IMCI comparison facilities. In Bangladesh, IMCI is not included in the pre-service training curriculum for the paramedics. Service providers in the comparison facilities did not receive IMCI or any other relevant training. Comparison area facilities only received supplies of medicines through the routine government system, which often suffers from periodic shortages, and were visited by the project medical officers approximately once every 3 months. The most probable explanation for the observed changes in the comparison is because of the variability we would expect in the absence of any standardization of care, which is then exaggerated by the lower numbers observed—a consequence of the lower levels of utilization of comparison facilities.

We have observed the effect of dual interventions—good quality training (IMCI clinical case management) and strong supervision—and it is difficult to separate the individual effects of these interventions. These findings should therefore be generalized with care, especially to settings where supervisory systems are weak. However, as noted above, we believe that the supervision being conducted in the IMCI intervention facilities in Matlab may be scaled up in the government health system at levels of quality similar to that assessed in this study.

Conclusions

The study findings suggest that with good quality training and supportive supervision, adequate performance among IMCI-trained service providers can be sustained. The findings also suggest that task shifting is possible from paramedics with 4 years of pre-service training to a lower-level provider with only 18 months of pre-service training. Steps must be taken to ensure high quality of training, effective supervision including the observation of health workers managing sick children during supervisory visits, and a constant supply of essential drugs and job aids for successful implementation of IMCI in Bangladesh.

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Conflict of interest

None declared.

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