Testing Validity of ARI Diagnosis Made by Primary Healthcare Field Workers with and without a Checklist

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Abstract

Objective: To allow correct assessment of cases of acute respiratory infections (ARI), a checklist was developed based on the WHO guidelines for ARI case management. The checklist was tested to assess whether the validity of identifying cases of ARI by the primary healthcare field workers could be improved with its use.

Method: Twenty randomly selected Health Assistants (HA) initially examined 228 children aged less than five years without using any checklist and later examined 374 children using the ARI checklist. All the children examined, irrespective of the HAs' diagnosis, were sent to the Medical Officers for assessment and were treated based on their diagnosis. The validity of the HAs' diagnosis of ARI was measured by calculating the sensitivity and specificity of diagnosing ARI by the HAs with and without the use of the checklist.

Results: The sensitivity of identifying a case of ARI (i.e. identify a child having cough or difficult breathing) by the HAs was 58 percent before the introduction of the checklist and 64 percent after its introduction (p=0.3). Similarly, the specificity was 71 percent before the introduction of the checklist and 69 percent after its introduction, showing no significant difference. The ability of the HAs to correctly classify ARI cases as 'no pneumonia', 'pneumonia', or 'severe pneumonia/very severe disease' changed from 31 percent to 37 percent (p=0.3). Strikingly, in 56 cases (9%) diagnosed as ARI, the physicians did not count the respiratory rate or record any sign of severe pneumonia to support their diagnosis. Similarly, in 114 cases (88%) diagnosed by the HAs as ARI, the respiratory rate was not counted.

Conclusion: The study shows that the ability of the health workers to identify and classify ARI cases is low, and simple introduction of the checklist as a diagnostic aid did not help improve their skills.

Introduction

Acute respiratory tract infection (ARI), particularly pneumonia, is a major cause of morbidity and mortality in children aged less than five years. Not every child suffering from ARI becomes seriously ill and needs antibiotic, but a few may have pneumonia which can be fatal. In developing countries, most deaths due to pneumonia are caused by bacterial infections which could be treated by administering low-cost antibiotics [1]. Simplified case-management procedures have been designed for diagnosis and treatment of the disease by health workers with limited training, but without any laboratory and radiological facility [2]. Results of studies in nine developing countries have shown that considerable reduction in ARI-associated mortality could be achieved by implementing these standard procedures [1].

In Bangladesh, the prevalence of respiratory illness among children aged less than three years has declined from 24 percent in 1993-1994 to 15 percent in 1996-1997 [3]. This decline is in line with the decline in the prevalence of diarrhoea as well as in the overall mortality of children aged less than five years. Reasons for the decrease in the prevalence of respiratory illness are numerous. The contributing factors may be a large increase in vitamin A coverage from 49 percent of children aged less than three years in 1993-1994 to 68 percent in 1996-1997, and a slight increase in the coverage of all vaccines provided through the Expanded Programme on Immunization (EPI) except third dose of polio. However, with regard to treating children with cough and difficult breathing, only 36 percent of children aged less than three years were taken to a health facility in 1996-1997, an increase from 28 percent in 1993-1994 [1]. Whereas, 63 percent of children with diarrhoea were treated with some type of oral rehydration therapy [3].

Current national guidelines stipulate that any child suffering from cough and difficult breathing must be brought to a health facility or to a provider for proper diagnosis and decision about management strategy. The outcome may be management at home or at a health facility. Only over one-third of the children with cough and difficult breathing, indicating lower respiratory infection, particularly pneumonia, were taken to any health facility [3]. This appears to be related primarily to the health-seeking behaviour of the parents. This, in turn, relates to: (a) the parents' understanding of ARI symptoms/signs, the graveness of the child's condition, and the need to seek proper treatment [4,5,6], (b) access to healthcare services, and (c) appropriateness and quality of the available services.

In Bangladesh, treatment facilities for ARI cases have been made available through different tiers. At the grass-root level, there is a large workforce of government healthcare providers, particularly the Health Assistants (HA). Each HA serves a population of more than eight thousand, providing them the first level of contact with the

government health system. These HAs are primarily responsible for providing EPI vaccines, distribution of vitamin A, supply of oral rehydration solution (ORS) to diarrhoea patients, to identify, report and refer infectious disease cases, and to provide limited curative care and health education. Under the ARI programme, these health workers have been trained to identify different categories of ARI cases, provide an early treatment of pneumonia cases among children aged less than five years, and refer the cases of more severe degree of illness. However, of the members of the households in rural Bangladesh seeking healthcare mostly for illness in the 2 weeks preceding survey, only 0.8 percent visited a field worker [3]. This, in part, reflects that the quality of services provided by these health workers has always been of concern. Therefore, much needs to be done to strengthen the ARI programme.

Experiences in Bangladesh and other countries show that the health service providers do not always follow all the steps necessary to make a correct assessment of the case [7,8]. Although written guidelines, pocket books, and posters on different algorithms are available with the health workers, all the steps are, in fact, practically not followed. Such a tendency is seen not only in case of ARI management, but also in other services. One approach, tested in urban clinics of non-government voluntary organizations, addressed the issue by incorporating checklists in patient/client cards that provided a structured questionnaire for the service providers to walk through the essential steps of a proper client interview, diagnosis, treatment and follow-ups. Individual observations and review of the cards showed that the service providers used the screening/assessment checklists and completed the assessment procedures [9]. Nevertheless, this urban experience was mainly related to reproductive health issues.

The question was how could a similar system be introduced in the government health system that has a very large workforce of HAs providing services to mainly rural population in Bangladesh and how such a checklist, particularly on ARIs, can help the field-level government health workers in making correct case assessment.

The ARI programme in Bangladesh

In Bangladesh, the ARI programme started with the formation of a national committee in 1987, but was not fully launched until late 1992 when a separate project bureau was established with a full-time Project Director.

In the first phase, eight thanas (sub-districts of about 270,000-300,000 population) were selected for the implementation of the ARI programme. By 1998, 384 thanas were included in a phased manner, thereby covering about 83% of the total population of the country.

An early detection of cases of pneumonia and severe pneumonia and the timely application of appropriate therapy were taken as the main strategy to reduce mortality due to acute lower respiratory infections.

The ARI programme activities included adaptation of the WHO guidelines on ARI case management for different levels of healthcare delivery, training of field-level health workers and physicians at the thana-level hospital (Thana Health Complex - THC), and supply of respiratory count timer and of pediatric cotrimoxazole up to the field level.

The HAs received a 5-day basic training at the beginning of the programme in each thana. After a year, one-day refresher training was also organized for them.

The key features of the management guidelines for the field-level health workers are:

a. Young infants aged less than two months with suspected pneumonia should be referred to the thana hospital (THC).

b. Children aged two months to five years with cough or difficult breathing and showing signs of severe pneumonia or severe disease should be given first dose of antibiotic (cotrimoxazole) and referred to the thana hospital (THC).

c. Children aged two months to five years, who are suspected of having pneumonia, should be given cotrimoxazole (paediatric dose) for five days along with appropriate counselling on home management.

A separate information system for ARI case recording, reporting and referral was also introduced. The HAs have been provided with a format for keeping records of all the cases of ARI among children aged less than five years attended by them. They record the name, age, address of the children, the diagnosis/severity of the case, and the treatments given in these forms. The completed forms are sent to their thana-level supervisor, the Health Inspector (HI), who enters the data from the forms in a separate register on a monthly basis. A compiled report is sent from the thana to the central project bureau located in the capital city.

The HAs also use a formatted referral slip to refer cases of severe pneumonia or severe disease to the THC.

In this context, a checklist for assessing ARI cases for use by the HAs was tested in two thanas with established ARI programme activities.

The ARI checklist

The ARI checklist (Annexure 1) was developed based on the WHO guidelines for ARI case management. The purpose of the checklist was that the health workers would use a separate checklist for each child suspected to have ARI to record the presence of signs and symptoms necessary for diagnosing and classifying a case of ARI. This, in turn, would assist in making proper assessment case by case.

The checklist has a section to record the name, age and the registration number of a child. After the HAs had ascertained the presence of cough and/or difficult breathing, the child was required to be registered as a case of ARI, and the checklist would then be used for classifying the case. The next section had a list of signs and symptoms of severe pneumonia or very severe disease. If the presence of any one of these signs or symptoms was detected and recorded, the HA would skip the following section for recording the respiratory rate, and record his/her diagnosis. If no sign or symptom of severe pneumonia or very severe disease was present, the HA would count the respiratory rate, and make his/her diagnosis based on it.

Objective of the study

The study compared and evaluated the performance of the minimally trained Health Assistants in making a correct diagnosis of ARI using the checklist against that of a fully trained physician.

Materials and Methods

To assess the validity of diagnosis of ARI by the HAs, the required sample size as calculated was 246 in each phase (without the checklist and with the checklist) of the study (Annexure 2), i.e. the HAs were required to examine 246 children aged less than five years in each phase.

To ensure that the HAs attend the above number of children, two thanas were selected with the daily outpatient attendance of approximately over 50 children aged less than five years. In total, 20 HAs from these two thanas were then randomly selected by taking the following factors into consideration:

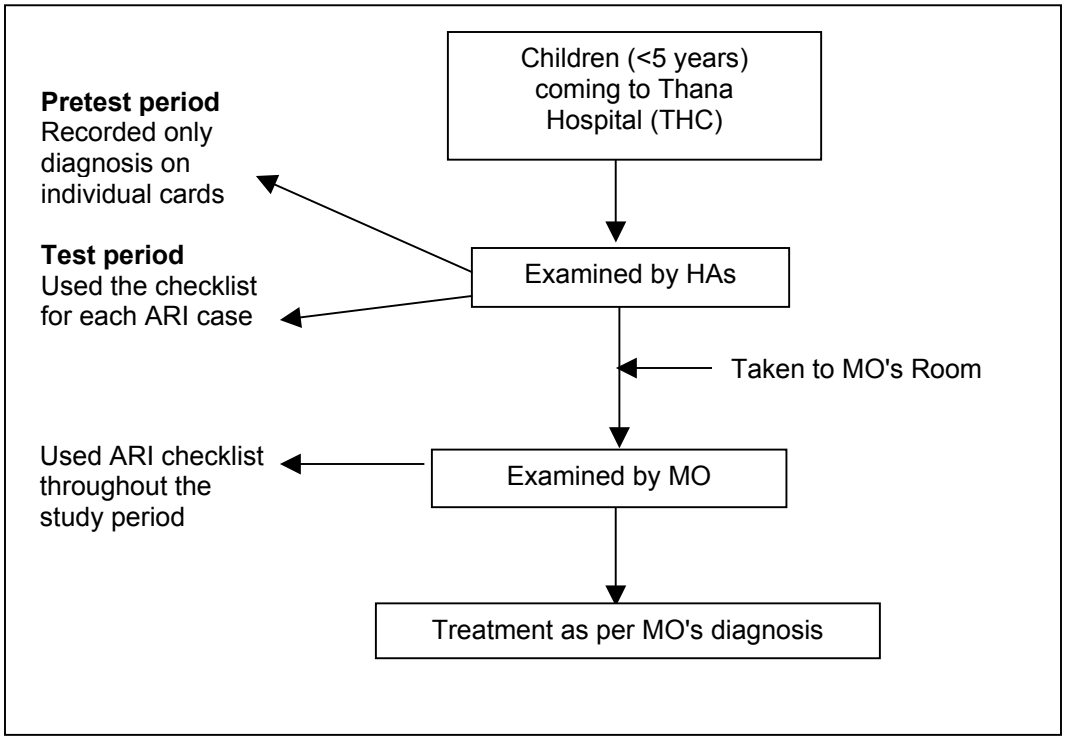
a. The HAs should examine all the children aged less than five years, coming to the hospital outpatient:
   - However, this should not add an extra waiting time for the patients to be seen by the HAs;
   - The study should not be done over a prolonged period, since it would hinder the normal flow of patients in the hospital, as well as the services given at the community level.

b. The usual work of the HAs, particularly holding immunization sessions at the community on pre-fixed days, should not be hampered. Nevertheless, the maximum number of HAs, who could be spared by the thana health manager, was involved in the study.

Two Medical Officers (MO)--one from each thana and both trained on ARI case management through the government ARI programme--comprised the comparison group.

The study was carried out at the outpatient department of the two thana hospitals (THCs) during July-August 1998. All the children, aged less than five years, who come to the hospital with any symptoms, were initially examined by the HAs, and were then taken to the MO for his assessment. The treatment was given based on the diagnosis made by the MO (Fig. 1).

Fig.1. Study protocol



Pretest period

Before the introduction of the checklist, all the children, aged less than five years, who came to the thana hospital (THC), were attended by the HAs for 4 working days in 2 weeks. The HAs were allowed to use any tools (timer, pocket guidelines, etc. provided to them during their previous training on ARI), except the checklist. The HAs recorded their diagnosis on a card provided to them during the pretesting period. One card was used for one child.

After being attended by the HA, each child was sent to the MO for his evaluation according to the ARI algorithm. The MO used the checklist for recording his findings.

Test period

After the pretest period, an orientation to introduce the checklist was organized for the HAs. Later on, all the children aged less than five years, who came to the thana hospital (THC) were attended by 10 HAs for 8 working days in 4 weeks.

The HAs were supposed to diagnose a case of ARI through taking the history of cough and/or difficult breathing. Once a child was diagnosed as a case of ARI, the HA would use the checklist to record their findings and classify the case as "pneumonia", "no pneumonia", or "severe pneumonia/very severe disease" based on the findings. One sheet of the checklist was used for each child.

All the children, irrespective of their diagnosis made by the HAs, were sent to the room of the MO who used a similar checklist and followed the ARI algorithm in making his diagnosis.

During the whole period, the staff members of the Operations Research Project (ORP) of the ICDDR,B: Centre for Health and Population Research supervised the flow of patients to the HAs and to the MO. The local thana health manager--Thana Health and Family Planning Officer (THFPO)-- monitored the activities of the HAs and the MO.

Data collection

A questionnaire at the beginning of the pretest period and after the orientation of the HAs on ARI checklist was administered to assess the knowledge of the HAs before and after the introduction of the checklist.

The cards (from pretest period) and the checklist sheets (from test period) were collected from the HAs at the end of each day. Data from these cards/sheets were entered into the computer and were analyzed using the EPI-Info package.

Medical Officer as a reference standard

In this analysis, the MOs of the two thanas were taken as the reference standard to compare the performance of the HAs. These two physicians had received training on ARI case management. During the pretest and test periods, the physicians were requested to use the ARI checklists and to use timers in addition to any tools (e.g. stethoscope) they may want to use. The activities of the physicians were neither closely supervised by the ORP staff nor were monitored by the local Thana Health and Family Planning Officer (THFPO). Nevertheless, the performance of the physicians as reference standard was reviewed based on the available records.

Table 1 shows that, in 96 cases (82%) (non-shaded cells), the respiratory count was either equal to or above the cut-off rate for the age for diagnosing the case as pneumonia. In 21 (18%) cases (shaded cells), the count was below the cut-off rate for the age to diagnose the child as having pneumonia. That is, if the ARI algorithm was followed, these 21 cases should have been diagnosed as cases of "no pneumonia." These 21 cases were re-diagnosed and included in the analysis as cases of “no pneumonia.” Similarly, two cases (age less than 2 months) whose respiratory counts were above 60 per minute and who were diagnosed as cases of pneumonia were reclassified as cases of severe pneumonia according to the ARI algorithm.

Table 1. Distribution by age and respiratory rate of cases (n=117) diagnosed as pneumonia by Medical Officers

Respiratory rate (per minute)	Age			Total (n=117)
	Up to 2 months (n=5)	2-12 months (n=59)	Above 12 months (n=53)	
Below 40	1	7	6	14
40–49	1	5	39	45
50–59	1	39	5	45
60 and above	2	8	3	13

Table 2 shows that, in 48 (37%) cases, the respiratory rate was not counted. In one case, the respiratory rate was above the cut-off rate for the age for classifying an ARI case as "no pneumonia, simple cough and cold." All the 48 cases for whom the respiratory rate was not recorded were excluded from the analysis; and the cases classified as "no pneumonia, simple cough and cold" but these cases having respiratory rates above the cut-off level were reclassified as cases of pneumonia and were included in the analysis.

Table 2. Distribution by age and respiratory rate of cases (n=131) diagnosed as "no pneumonia - simple cough and cold" by Medical Officers

Respiratory rate (per minute)	Age			Total (n=131)
	Up to 2 months (n=1)	2–12 months (n=56)	Above 12 months (n=74)	
Rate not counted	0	23	24	48
Below 40	1	19	30	49
40–49	0	13	20	33
50–59	0	0	0	0
60 and above	0	1	0	1

Table 3 shows that, in 8 (14%) cases of severe pneumonia, the MOs did not record any signs or symptoms of severe pneumonia in support of their diagnosis. These 8 cases were also excluded from the analysis.

Table 3. Distribution of cases (n=58) with severe pneumonia or disease by record of signs/symptoms by Medical Officers

Recording by MOs	No. of severe pneumonia cases
Any one of the signs recorded	50
No signs/symptoms recorded	8

In summary, 24 cases were re-diagnosed and included in the analysis, and 56 cases for whom the MOs did not record the relevant findings were excluded from the analysis.

Results

Number of observations

In total, 602 children were observed during the pre-test and test periods (Table 4).

Table 4. Number of children (n=602) observed

Study area	Before introduction of the checklist (n=228)	After introduction of the checklist (n=374)	Total (n=602)
Thana 1	112	234	346
Thana 2	116	140	256

Table 5 shows the distribution of the children included in the analysis by their diagnosis made by the MOs.

Table 5. Distribution of children (n=602) by diagnosis made by Medical Officers

Diagnosis	Before introduction of the checklist (n=228)	After introduction of the checklist (n=374)	Total (n=602)
No pneumonia (cough and cold)	55	28	83
Pneumonia	36	59	95
Severe pneumonia or very severe disease	14	36	50
No ARI	123	251	374

Validity of ARI case diagnosis by Health Assistants

The number of cases diagnosed by the HAs as ARI-positive or negative vis-a-vis the diagnosis of the MOs, both before and after the introduction of checklists, is shown in Table 6. The sensitivity, specificity and predictive values of the HAs' diagnosis of ARI before and after the introduction of checklist are shown in Table 7. No significant difference is apparent between the figures before and after the introduction of the checklist.

Data in Table 6 are arranged in the following pattern of 2x2 table:

Cases diagnosed by HAs	Cases diagnosed by Medical Officers (reference standard)		Total
	ARI +	ARI –	
ARI +	(a) Cases diagnosed as ARI by both MOs and HAs	(b) Cases diagnosed as not ARI by MOs, but diagnosed as ARI by HAs	(a + b)
ARI -	(c) Cases diagnosed as ARI by MOs, but diagnosed as not ARI by HAs	(d) Cases diagnosed as not ARI by both MOs and HAs	(c + d)
Total	(a + c)	(b +d)	

Table 6. Diagnosis of ARI cases by Health Assistants before and after the introduction of the checklist

Cases diagnosed by HAs	Cases diagnosed by Medical Officers (reference standard)					
	Before the introduction of the checklist			After the introduction of the checklist		
	ARI + (n=105)	ARI – (n=123)	Total (n=228)	ARI + (n=123)	ARI – (n=251)	Total (n=374)
ARI +	61	36	97	79	77	156
ARI -	44	87	131	44	174	218

The measures of association as shown in Table 7 have been calculated as follows:

- The sensitivity of the HA's diagnosis of ARI is equal to a/(a+c), the proportion diagnosed as ARI by the HA among cases diagnosed as ARI by the MOs.
- The specificity of the HA's diagnosis of ARI is equal to d/(b+d), the proportion diagnosed as not ARI cases among cases diagnosed as not ARI by the MOs.
- The positive predictive value of the HA's diagnosis of ARI is equal to a/(a+b), the proportion correctly diagnosed as ARI cases (i.e. the MO has also classified these cases as ARI) among cases diagnosed by the HA as ARI.

Table 7. Measures of association and 95% confidence interval

Measures of association	Before the introduction of the checklist		After the introduction of the checklists	
		95% CI		95% CI
Sensitivity	58%	48 - 68	64%	55 - 73
Specificity	71%	62 - 78	71%	65 - 76
Predictive value +	63%	52 - 72	51%	43 - 59
Predictive value -	66%	58 - 74	81%	75 - 86

p (for sensitivity, before and after) = 0.3

Pattern of classification of ARI cases diagnosed by Health Assistants

Once the HAs diagnosed a case of ARI based on history, they used the checklist to classify that case as having "no pneumonia", "pneumonia", or "severe pneumonia/very severe disease." Table 8 shows the distribution of cases correctly classified by the HAs compared to the case classification by the MOs. Before the introduction of the checklist, the HAs correctly diagnosed and classified 33 (31%) of the 105 ARI cases diagnosed by the MOs. After the introduction of the checklist, they correctly diagnosed and classified 46 (37%) of the 123 ARI cases diagnosed by the MOs, and the change was not statistically significant. Those ARI cases which were diagnosed as ARI, but were not correctly classified by the HAs, are shown as incorrectly diagnosed cases in Table 8.

Table 8. Distribution of ARI cases (n=228) by classification done by Medical Officers and Health Assistants

ARI case classification	Before the introduction of the checklist			After the introduction of the checklist		
	No. of cases as diagnosed by MOs (n=105)	Diagnosis by HAs (n=61)		No. of cases as diagnosed by MOs (n=123)	Diagnosis by HAs (n=97)	
		Correct	Incorrect		Correct	Incorrect
No pneumonia	55	20	9	28	10	19
Pneumonia	36	6	8	59	11	4
Severe pneumonia	14	7	11	36	25	10

p=0.3

Completeness of records maintained by Health Assistants

The completeness of records by the HAs on the ARI checklist was also reviewed. Table 9 shows that, in 84% of the cases, the HAs did not record the respiratory rate, but diagnosed the cases as pneumonia or no pneumonia.

Table 9. Recording of the respiratory rate diagnosed by Health Assistants

Diagnosis by HAs	Cases as diagnosed by Health Assistant				Total
	Resp. rate counted		Resp. rate not counted		
	No.	(%)	No.	(%)	
No pneumonia	3	(3.3)	88	(96.7)	91
Pneumonia	12	(31.6)	26	(68.4)	38
Total	15	(11.6)	114	(88.4)	129

In all the 63 cases diagnosed as severe pneumonia, the HAs recorded one or more than one signs/symptoms of severe pneumonia/very severe disease.

Discussion

The objective of the study was to test whether the checklist helped the HAs to follow the WHO algorithm for classifying a case of ARI and to make an appropriate diagnosis. The study was not meant to test the validity of the algorithm itself.

The basis of the diagnosis by the MOs was also the WHO algorithm. The MOs did not use any other aids--radiology or laboratory tests for instance--to confirm their diagnosis. Thus, both study group (Health Assistants) and comparison group (Medical Officers) used the same diagnostic criteria. The strengths and weaknesses of the algorithm were, therefore, applicable to both the groups. Nevertheless, a number of studies have shown the reliability of the WHO guidelines for ARI case management to predict the presence of pneumonia [10,11,12].

Performance of Health Assistants

The key findings of this study are that the HAs:

- Missed to detect ARI in 37 percent of the cases,
- Did not count the respiratory rate in 88 percent of the cases, and
- Correctly diagnosed pneumonia in 18 percent of the cases (17 cases of 95 cases diagnosed as ARI by the MOs--Table 8).

The confounding factor in this study could be the actual ability of the HAs to carry out the examinations, for instance, counting the respiratory rate or recognizing chest indrawing. If they were not well experienced, providing a checklist would not help them anyway. In our study, most HAs had received 3-days basic training and/or 1-day refresher training on ARI case management about a year ago. They were also provided with orientation on the checklist. Furthermore, as we see in the study, the HAs could correctly identify severe pneumonia in about 50 percent of the cases before the introduction of the checklist and in about 69 percent cases after the introduction of the checklist. In other words, the HAs were sufficiently trained to identify symptoms of severe pneumonia, and the checklist might have guided the workers in particularly looking for those symptoms.

The ORP staff supervising the study observed that the HAs did not meticulously ask the mothers whether their children have been suffering from cough and/or difficult breathing and did not count the respiratory rate in children they thought had ARI. During the orientation on the ARI checklist, the HAs were told about the criteria of enrolling a child as a case of ARI. There were posters on ARI in the room where the HAs sat and examined the children. Although they had pocket guidebooks on ARI given to them during their formal training on ARI, the HAs even then missed to detect ARI in about 37 percent of the cases. This performance is very poor compared to other studies [2,13,14].

Non-counting of the respiratory rate was a very common omission by the HAs. In almost 88 percent of the cases, they diagnosed as having ARI, but they did not count the respiratory rate. This practice may be explainable in cases diagnosed as 'no pneumonia – simple cough and cold' where they might not have seen any obvious fast breathing. However, in about 68 percent of the cases diagnosed as pneumonia, they did not also count the respiratory rate. They might have visual impression of fast breathing in these children. However, the HAs were able to correctly diagnose only about 18 percent of the pneumonia cases with or without the checklist. This means that the practice of diagnosing pneumonia through visual impression of fast breathing might not work well with the HAs. This is also in contrast to the results of an intervention in India where the Traditional Birth Attendants (TBAs), who were unable to count up to 50, were trained to detect pneumonia through the visual impression of fast breathing. The supervisors who visited the cases about 15 days later verified the correctness of the diagnosis made and treatment given by the TBAs and recorded the outcome of the treatment. This study shows that 95 percent of the pneumonia cases treated by the TBAs were cured [15].

In our study, there was no significant difference in the performance of the HAs before and after the introduction of the checklist for the detection of ARI. Although there was some improvement in the performance, even then if we ignore the application of the

checklist as a factor, the sensitivity and specificity for the detection of ARI by the HAs was low, irrespective of the use of the checklist. The clue may be found in the Indian study [12]. In this intervention, special training methods for the Voluntary Health Workers (VHW) and the TBAs, educative supervision, and continued training ensured a gradual reduced in error rate. In our study, the HAs, who work mostly at the household level, received a formal training on ARI management about a year ago. Since then, their actual performance in correctly diagnosing a case of ARI in field conditions has never been supervised. They did not receive any sort of on-the-job training from their supervisors. All these might have contributed to gradual deterioration in their knowledge and skills to detect ARI cases.

At the time the checklist was introduced to the HAs, they were oriented on it. Their pre-orientation and post-orientation knowledge was assessed using a questionnaire (Annexure 3). Their pre-orientation knowledge on definition, diagnostic criteria and management ranged from 28 percent to 88 percent points (average 59%) and the post-orientation knowledge from 56 percent to 92 percent points (average 77%). This finding indicates a deficiency in the HAs' knowledge of ARI case management which deficiency might have been reduced due to the orientation, but some degree of lack of knowledge still remained.

Based on the findings, it may be concluded that simply introducing a diagnostic aid, such as the checklist, could not help improve the performance of the HAs.

Relevance to integrated management of sick children

This study also points out an important lesson for future programmes. From a single programme focus on ARI or diarrhoea separately, the present emphasis is on an integrated approach to important childhood illnesses, such as pneumonia, diarrhoea, malaria, measles, and malnutrition which are responsible for almost three-quarters of deaths in children aged less than five years. The integrated management of childhood illness (IMCI) approach is considered one of the most cost-effective health interventions in both low and middle-income countries where it is likely to have the greatest impact in reducing the global burden of disease [16]. A simplified algorithm on IMCI has been designed. The algorithm incorporates the current WHO case-management guidelines for pneumonia, diarrhoea with dehydration, dysentery, persistent diarrhoea, and malaria [17]. The lesson learned from the present study is that when the programme on IMCI is introduced at the field level, it should not stop at providing the workers a one-time training and asking them to report. Educative supervision and continued training should also be the part and parcel of that programme. The checklist can then become a tool for guiding the health workers through the management algorithm, and help the supervisors to monitor the quality of care and identify the training needs of the health workers. Objective training can then be arranged suited to the need of the individual worker and workers as a group.

Performance of Medical Officers

The performance of the MOs merits some discussion. The study was not designed to verify the validity of their diagnoses. They were trained on ARI case management, and the checklist was also given to them to ensure that all the necessary procedures are followed while diagnosing a case. In our study, one of the MOs did not record either the respiratory rate in cases diagnosed as pneumonia or the symptoms in support of his diagnosis of severe pneumonia in 56 cases. Review of the records of the MOs showed that in one thana the MO performed all the required steps in case assessment. All the cases excluded from the study were from the other thana. The findings of the study were shared with the MO who said that if he had known that the findings would be shared with him and his supervisors he would have been more careful. This depicts a lack of concern or motivation on the part of that MO. This issue needs further investigation and broader discussion. Acceptance of the WHO algorithm as a guideline among the physicians also needs to be studied.

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Annexure 1

ARI checklist

ARI
(Child with cough and/or difficult breathing)

<table>
<tr><td colspan="3">Name of the child:</td></tr>
<tr><td colspan="2">Age:</td><td>Registration #</td></tr>
<tr><td colspan="3">Sign/symptoms of severe pneumonia or very severe disease</td></tr>
<tr><td rowspan="6">Put U mark if any of the sign(s)/symptom(s) of severe pneumonia or very severe disease is present</td><td>1. Chest indrawing</td><td></td></tr>
<tr><td>2. Not able to eat or drink</td><td></td></tr>
<tr><td>3. Unusually sleepy</td><td></td></tr>
<tr><td>4. Convulsion</td><td></td></tr>
<tr><td>5. Abnormal sound (wheeze) during respiration</td><td></td></tr>
<tr><td>6. Severely malnourished</td><td></td></tr>
<tr><td colspan="2">Respiratory rate</td><td></td></tr>
<tr><td colspan="2">Temperature</td><td></td></tr>
<tr><td rowspan="3">Diagnosis
(Put U mark in the appropriate box)</td><td>Simple cough and cold (no pneumonia)</td><td></td></tr>
<tr><td>Pneumonia</td><td></td></tr>
<tr><td>Severe pneumonia or very severe disease</td><td></td></tr>
<tr><td colspan="2">Treatment/management</td><td></td></tr>
</table>

Name of the service provider:_____

Date:_____

Annexure 2

Calculation of the sample size

To determine the sample size for the study, that is the number of times the checklist should be applied by the HAs for the assessment of sick child, the following formula was used:

$$n = \frac{(Z\alpha)^2 \times pq}{d^2}$$

Where, n = sample size

$Z\alpha$ = 1.96 when α = 0.05

p = expected sensitivity of diagnosis of ARI by HAs

q = 1 – p

d = acceptable error, taken as 5%

Based on a study in Gambia, the expected sensitivity was taken as 80%. Therefore, the required sample size is:

$$n = \frac{(1.96)^2 \times 0.8 \times 0.2}{(0.05)^2} = 246$$

Similarly, based on the same study, for an expected specificity of 90%, the required sample size is:

$$n = \frac{(1.96)^2 \times 0.9 \times 0.1}{(0.05)^2} = 138$$

So, the necessary sample size for the study was taken as 246, i.e. the HAs should examine 246 children aged less than five years.

Annexure 3

Pretest/post-test questionnaire

1. Which of the following signs and symptoms if present indicate that the child is suffering from ARI?
   a. Chest pain
   b. Common cold
   c. Abnormal sound (wheeze) during respiration
   d. Fever
   e. Breathing rate faster than normal
   f. Sever body ache

2. Which of the followings are types of ARI?
   a. Severe ARI
   b. Ear infection
   c. Pneumonia
   d. Red eye
   e. Common cold and cough

3. Classify the following cases of children with ARI having the given signs/symptoms? How will you manage each case?

Sign/symptom	**ARI classification**
a. The child has chest indrawing:	The child is suffering from_____
b. The child is unusually sleepy	The child is suffering from_____
c. The child has only cough and fever	The child is suffering from_____

Management

In case of case “a”:_____

In case of case “b”:_____

In case of case “c”:_____