

Original Research Article

Evaluation of the WHO/UNICEF algorithm for integrated management of childhood illness

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ABSTRACT

Background: The present study was designed to evaluate the feasibility and utility of the integrated management of the childhood illness (IMCI) algorithm to diagnose the illnesses in children under the age of 2 months to 5 years.

Methods: The study was conducted on 300 children, aged 2 months to 5 years, who presented with a fresh episode of any illness to the out-patient Department of the SMGS Hospital over a period of 9 months. Within these initial selection criteria, the WHO/UNICEF algorithm for management of the sick child was referred to, children were assessed and classified as per "IMCI" algorithm and treatments required were identified. The final diagnosis was made and appropriate therapy instituted served as the "Gold standard". The diagnostic and therapeutic agreements between the 'gold standard' and the IMCI and vertical (on the basis of primary presenting complaint) algorithms were computed.

Results: Among all 300 subjects, more than one illness was present in 207 (69%) of subjects as per Gold standard diagnosis. The corresponding, figures for IMCI module were 141 (47%) and 222 (74%) for low and high malaria algorithms respectively. The mean illnesses per child were 2.12, 1.82 and 2.21, respectively. The subjects who would have been referred as per IMCI module had a greater co-existence of illnesses than those who would not have been referred (mean 2.5 versus 1.5 illnesses per child respectively). The specificity for general danger signs was 66% while the sensitivity was 71%.

Conclusions: In conclusion, the performance of the IMCI algorithm is significantly better than the vertical disease specific algorithm. In addition, the IMCI algorithm incorporates an element of preventive care in the form of immunization and feeding advice.

Keywords: Children, Gold standard, IMCI, WHO/UNICEF algorithm

INTRODUCTION

On an average, under-five child mortality in developing countries is about 5-15 times higher than that in developed countries. Its reduction has become a global priority area 30. Every year some 12.9 million children die before they reach their fifth birthday; many of them die during the first year of life. Majority 46 (70%) of these deaths and visits to health facilities are due to

diarrhea, pneumonia, measles, malaria or malnutrition and often due to combination of more than one conditions. At least three out of four sick-children seeking health care are suffering from one of the five conditions referred to above.¹⁻³

Over the recent decades, a number of disease-specific control programmes (vertical programmes) like RCH and diarrheal disease control programmes have remained in

operation for meeting the child health needs. Nevertheless, the success in reducing the childhood morbidity and mortality by these disease-specific programmes in the developing world has not been up to the mark.⁴⁻⁶ More recently, there has been a growing appreciation of the fact that children in the developing countries are comparable to the camelback i.e. they suffer from more than one ailment.⁷

The present study was designed to evaluate the IMCI algorithm for children between the age of 2 months to 5 years, to determine the deficiency, if any, in the IMCI algorithm, to suggest any modifications in the current IMCI algorithm, keeping in mind the regional morbidity profile.

METHODS

The study was conducted in the Department of Pediatrics, SMGS Hospital, Govt. Medical College, Jammu over a period of 9 months from 1st January 2001 to 30th September 2002.

Fresh subjects of either sex between 2 months and 5 years from the pediatric OPD were eligible for enrolment in the study. For objectivity and convenience attempt was made to include every third subject earmarked for a particular chamber on a particular OPD days in this study, the first recruited subject was selected by draw of lots from three numbers (namely 1, 2, 3). Subsequently, every third child for fitting the entry criteria was selected. The rationale for randomizing every third child was based on the morbidity load of the pediatric services.

For the children recruited in the study, the WHO/UNICEF algorithms for integrated management of the IMCI were referred to. Every study child was assessed and classified according to the guidelines in the same order prescribed by these algorithms. The treatment steps were also identified as according to assess and classify module of IMCI and recorded in the proforma. These diagnoses and treatments were only hypothetical according to IMCI algorithms while the actual diagnosis and treatments were determined by the "Gold Standard" as described below.

After filling the proforma for study subject, overall assessment was made by a qualified pediatrician based on detailed clinical evaluation and relevant investigation(s) which served as gold standard and/ or, in case of the child being hospitalized, overall assessment was made by the paediatric team.

A detailed history was taken for each subject and a clinical examination was performed. All relevant investigations (including blood counts, Hb, urine examination, stool examination, chest radiograph, blood cultures, lumbar puncture etc.) were performed based on the history and detailed examination. A thin "peripheral smear" was made for each patient presenting with a

history of fever or an axillary temperature of 37°C or more and examined for the presence of malarial parasite in addition to morphology and differential leucocyte counts. A chest X-ray was taken for every patient with a history of difficult breathing or findings of respiratory distress (tachypnea or chest in drawing) Based on the detailed clinical evaluation and relevant investigations, final diagnosis was made, and the therapy instituted. These diagnosis and treatment were considered as the "gold standard" and thus a diagnostic comparison was made between the gold standard and IMCI algorithm.

The study children were either admitted or sent home after initial evaluation, depending upon the nature and severity of the illness. Hospitalized children were discharged only on recovery for the condition. Each immunized or incompletely immunized child was immunized, and therapy/advice were given to every malnourished child. All children including, hospitalized one and those sent back after initial evaluation were asked to report for routine follow-up (3 to 7 days) to determine the final outcome and to decide about any further investigation or therapy. A total of 300 subjects fulfilling these criteria were analysed.

Analytic design

Two categories of possible diagnosis and treatments were available for each recruited study subject namely Gold standard and IMCI algorithm.

The diagnostic and therapeutic agreement between the Gold standard and the IMCI algorithm was made. Sensitivity, specificity, positive predictive value and negative predictive values were calculated.

Statistical analysis

The data was expressed in number and percentages and analysed using MS excel. Statistical significance was set at $p < 0.05$.

RESULTS

A total of 300 children, aged 2 months to 5 years and of either sex, who fulfilled the study criteria were evaluated. As per the 'Gold Standard' management, decided by the qualified pediatrician, 100 (33.3%) children were hospitalized and 200 (66.6%) were sent back on an outpatient basis after evaluation. Males (56%) outnumbered females (44%). 60% of the cases were below 2 years of age. Roughly 20% of them were infants.

Table 1 summarizes the co-existence illness in both admitted ($n=100$) and non-admitted cases ($n=200$). In admitted cases, a greater number of children had co-existence of 3 illnesses. As per Gold standard 37% children had 3 common illnesses and as per IMCI 38% from low malaria risk zone and 40% from high malaria risk zone had 3 illnesses. The percentage of children in

non-admitted cases had more than one illness as per the Gold standard was 47% and for IMCI assuming malaria

low and high-risk zones was 33.5% and 72% respectively.

Table 1: Comparison of co-existing number of illnesses between Gold standard and IMCI (n=300).

No. of illnesses documented	Admitted cases (n=100)			Non admitted cases (n=200)		
	Gold standard N (%)	Integrated management		Gold standard N (%)	Integrated management	
		Malaria low risk N (%)	Malaria high risk N (%)		Malaria low risk N (%)	Malaria high risk N (%)
0*	NA	5 (5)	6 (6)	NA	11 (5.5)	10 (5)
1	20 (20)	24 (24)	10 (10)	106 (53)	122 (61)	46 (23)
2	25 (25)	20 (20)	25 (25)	74 (37)	56 (28)	112 (56)
3	37 (37)	38 (38)	40 (40)	16 (8)	11 (5.5)	26 (13)
≥4	18 (18)	13 (13)	19 (19)	4 (2)	0 (0)	6 (3)
Mean±SD	2.5±1.2	2.5±1.2	2.6±1.0	1.59±0.72	1.33±0.67	1.86±0.81

*Refers to illnesses/complaints not covered by the IMCI module; NA- not applicable

Table 2: Comparison of morbidities between Gold standard and IMCI (n=300).

Illnesses	Gold standard (N)	Integrated management	
		Malaria low risk (N)	Malaria high risk (N)
Respiratory illnesses			
Pneumonia	43	49	49
Severe pneumonia		53	53
Cough/cold (URTI)	57	43	43
Bronchial asthma	12	-	-
Bronchiolitis	12	-	-
Tuberculosis	3	-	-
Empyema	1	-	-
ALTB	1	-	-
ASOM	5	3	3
CSOM	3	1	1
Whooping cough	2	-	-
Consolidation	5	-	-
Diarrhoeal disease			
Ac. diarrhea	53	53	53
Dysentery	7	7	7
Persistent diarrhea	5	5	5
No dehydration	43	40	40
Some dehydration	17	15	15
Severe dehydration	5	10	10
Malnutrition			
Very low weight	63	63	63
Marasmus	10	10	10
Maramic Kwashiorkar	12	12	12
Anaemia-fever			
Malaria	13	7	81
Very severe febrile	-	39	39
Meningitis	3	-	-
Septicemia	2	-	-
Measles	3	5	5
Enteric fever	9	-	-
Viral fever	6	-	-
Ricketts	61	-	-
Others	65	-	-
Mean±SD	2.12±1.07	1.82±1.18	2.21±1.14

The children requiring referral as per IMCI algorithm had significantly greater co-existence of morbidities. Thus, the co-existence of morbidities was significantly higher in those children who had been assessed to have a relatively severe condition. Mean values of both the groups were compared for gold standard ($p < 0.05$) and IMCI ($p < 0.001$ for both zones) found to be significant statistically.

The morbidity profile observed in 300 children as per the Gold standard and IMCI was given in Table 2. The total number of illnesses exceeds the number of patients. It is apparent that majority of the recorded illnesses are covered by the IMCI algorithms.

It is very important to analyze the broad diagnostic agreement between the Gold standard and the IMCI module. Since the IMCI algorithm is essentially management oriented, referral as a component of management was considered as a diagnostic match because the patient is being referred to higher level of health care for the treatment and/or investigation. Table 3 summarizes the diagnostic agreement between IMCI with the Gold standard assuming both low and high malaria risk. Considering low malaria risk, there was a total agreement on all diagnosis in a single patient in 67% subjects. The mismatch was more commonly of an under-diagnosis (24%) rather than over diagnosis (12.3%) the under diagnosis as well as over diagnosis were invariably restricted to a single diagnosis. On considering malaria as high risk, the mismatch increased by nearly 11%. Although there was a marginal improvement in under-diagnosis, the over-diagnosis increased substantially.

It may be argued that those cases referred by IMCI which were not hospitalized should be considered as a diagnostic mismatch since they may constitute an unnecessary referral on the already overburdened health system. Table 4 summarizes the diagnostic agreement in this manner, namely taking 16 such cases as diagnostic mismatch (over diagnosis). Even then, for low malaria risk, there was total agreement on all diagnosis in about two thirds of subjects. Differences outlined are again evident between high and low malaria risk zones.

Table 5: Utility of general danger signs and referral criteria as a predictor of hospital admission/observation.

Parameter	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)	OR
Admission	71	66	51.4	82.09	4.8

DISCUSSION

The major rationale for propagating the IMCI approach is that a single diagnosis for a sick child is often inappropriate because it identifies only the most apparent

clinical problem i.e. many children present with more than one condition and can lead to an associated and potentially life-threatening condition being overlooked. The current study reaffirms that co-existence illnesses is rule rather an exception, with two-thirds of children

Table 3: Summary of diagnostic agreement between Gold standard and IMCI.

Type of mismatch	Malaria risk			
	Low		High	
	N	%	N	%
No mismatch*	201	67	177	59
Any mismatch	99	33	123	41
Underdiagnosis by IMCI	72	24	63	21
Single diagnosis	61	20.3	52	17.3
Two diagnoses	11	3.6	11	3.6
Over diagnosis by IMCI**	37	12.3	66	22
Single diagnosis	31	10.3	60	20
Two diagnoses	6	2	6	2

Significantly different between low and high malaria risk ($p < 0.005$); **($p < 0.005$).

Table 4: Summary of diagnostic agreement between Gold standard and IMCI not considering all referral as a match.

Type of mismatch	Malaria risk			
	Low		High	
	N	%	N	%
No mismatch*	185	61.6	161	53.6
Any mismatch	115	38.3	139	46.3
Underdiagnosis by IMCI	72	24	63	21
Single diagnosis	61	20.3	52	17.3
Two diagnoses	11	3.6	11	3.6
Over diagnosis by IMCI**	53	17.6	82	27.3
Single diagnosis	47	15.6	76	25.3
Two diagnosis	6	2	6	2

*Significantly different between low and high malaria risk ($p < 0.02$); **($p < 0.001$).

having more than one illness as per the Gold standard assessment. There is a paucity of similar data quantifying the co-existence of illnesses. A study of 250 children presenting to an outpatient facility in the Gambia revealed that 70% of children have more than one disease present. A very large proportion had different combination of fever, diarrhea, pneumonia and malnutrition. Often ARI does not occur alone but in association with other infections or conditions such as malnutrition, diarrhea and chronic conditions, measles can be complicated by pneumonia, diarrhoea, laryngotracheo-bronchitis or otitis media.^{2,5,6,8}

In the present study, majority of subjects had two morbidities. However, nearly one-fifth had three or four co-existing illnesses. The number of morbidities was higher in those children who had been assessed to have a relatively severe condition (means 2.5 vs.1.5 illnesses/child).

For co-existence of illnesses in children, co-prescription of treatment is necessary. In the current study, in non-referred subjects, co-prescription of treatment was evident (mean 1.9 prescribed treatment/case as per Gold standard and 1.6 prescribed treatment/case as per IMCI). More than one treatment was prescribed in approximately 70% and 47% as per Gold standard and IMCI respectively.

These observations were in accordance with the findings of Shah et al. In his study, mean number of morbidities as per the Gold standard and IMCI (low and high malaria risks) were 2.1, 1.8 and 2.2, respectively. Subjects with any referral criteria as per IMCI module had a greater co-existence of illnesses (mean 2.6 vs. 1.6 illnesses per child, respectively).⁹

In the current study, the proposed referral criteria of the IMCI algorithm have acceptable levels of sensitivity (71%) and specificity (66%). The performance (diagnosis and treatment) of IMCI algorithm is significantly better than the vertical disease-specific algorithms. In comparison to the Gold standard, with the IMCI algorithm, there is total agreement in a majority of the cases (67%) and total disagreement in only a minority of cases. This was in agreement with the findings of Shah et al.⁸ The sensitivity and specificity for utility of referral criteria was 69% and 89% respectively. In another study by Simoes et al, the sensitivity and specificity for referral criteria was greater (84% and 97% respectively) than the present study.¹⁰

In the present study, it was seen that with IMCI approach, considering low malaria risk zone, there was a total agreement with Gold standard in all diagnosis and prescribed broad categories of treatments in a single patient in approximately two-third of subjects if referral was considered a diagnostic match. On considering malaria as high risk, the mismatch increased by nearly

10%. Thus a high malaria risk IMCI algorithm appears to be inappropriate for this geographic area.

It is thus evident that with a primary health worker with training, the IMCI algorithm performs satisfactorily in comparison to the Gold standard and offer considerable advantage over the vertical disease - specific- algorithm. However, most of the clinicians in routine practice employ the integrated approach only for diagnostic and therapeutic practice.

The IMCI algorithms also focus on the provision of preventive services like immunization and feeding advice, for every child which tend to get ignored with disease-specific vertical-algorithms. In the current study, there was a possibility of missed opportunities for immunization which were effectively covered by the IMCI in 11%. Concern over missed opportunities for immunization in developing countries has been expressed globally.

CONCLUSION

In conclusion, co-existence of illnesses and co-prescription of treatments is the rule rather than an exception for sick under-five children. There is, thus, a strong fundamental basis for adopting an integrated approach for sick children which actually most clinician are doing in routine practice. The performance of the IMCI algorithm is proved to be significantly better than the vertical disease specific algorithm. In addition, the IMCI algorithm incorporates an element of preventive care in the form of immunization and feeding advice. The proposed IMCI algorithm appears to be a promising, feasible and useful intervention strategy to promote wellbeing of children in India and other developing countries with scarce resources. However, further studies in diverse morbidity setting at different level of health care are required to validate these conclusions.

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