EVALUATION OF THE WHO/UNICEF ALGORITHM FOR INTEGRATED MANAGEMENT OF CHILDHOOD ILLNESS BETWEEN THE AGES OF ONE WEEK TO TWO MONTHS

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Manuscript received: May 31, 1999; Initial review completed: July 15, 1999; Revision accepted: August 23, 1999.

Objective: To evaluate the utility of the WHO/UNICEF algorithm for integrated management of childhood illness (MCI) between the ages of 1 week to 2 months. Design: Prospective observational. Setting: The Outpatient Department and Emergency Room of a medical college hospital. Methods: 129 infants presenting to Outpatient Department (n = 70) or Emergency Room (n = 59) were assessed and classified as per 'IMCI' algorithm and treatment required was identified. A detailed evaluation with all relevant investigations was also done for these subjects. The final diagnoses made and therapies instituted on this basis served as "gold standard". The diagnostic and therapeutic agreement between the 'gold standard' and the 'IMCI' was computed. Results: More than one illness was present in 97 (75.2%) of subjects as per 'gold standard' (mean 2.1). Subjects having any referral criteria as per 'IMCI' algorithm had a greater (p = 0.002) co-existence of illnesses (mean 2.3 vs. 1.8 illnesses per child, respectively). IMCI algorithm covered majority (81-84%) of the recorded diagnoses either partly (40-44%) or fully (40-44%). The referral criteria proved quite sensitive (86-87%) in predicting hospitalization but had a lower specificity (53-58%). A total agreement with IMCI was found in 60-66% cases. The mismatch (34-40%) was more commonly of an overdiagnosis (21-23%) rather than underdiagnosis (15-21%). The sensitivity of the algorithm to identify serious bacterial infection was high (96.1-96.5%) while the specificity was relatively low (51.8-59.7%). Upper respiratory infection (URI) emerged as an important cause resulting in unnecessary referrals (13 out of 21 cases). Of the 43 cases identified as diarrhea by the algorithm, 6 had breast fed stools, which do not require any therapy. The 'IMCI' algorithm had a provision for preventive services of immunization and breastfeeding counseling (18% possibility of availing missed opportunities in both). Conclusion: There is a sound scientific basis for adopting IMCI approach even in young infants as co-existence of morbidities is frequent and severe illnesses are assessed with good sensitivity. However, there is a need to improve the specificity of referral criteria. Two important conditions identified for possible refinement are URI and breast fed stools.

Key words: Infant mortality, Integrated management of childhood illness, Neonatal mortality.

INFANT mortality remains unacceptably high in developing countries, with about 8 million deaths occurring annually in infants, 5 million during the neonatal period(1). Overall for India, infant mortality comprises nearly 70% of under-five mortality(2). The neonatal component of infant mortality is fairly high ranging between 60% to 77% for all but four states(2). It is obvious that programs to reduce under five and infant mortality must now urgently address neonates and young infants.

Formulation of simplified programmatic
guidelines for the management of sick young infants offers a formidable challenge since the clinical presentation of diseases in young infants is often non-specific; feeding difficulty, lethargy, irritability and respiratory distress are common denominators of a group of diseases, some of which may be of serious nature. In an attempt to overcome this limitation and to improve health-workers' performance in managing sick young infants, World Health Organization (WHO) and United Nations Children's Fund (UNICEF) have devised a separate algorithm for age group of one week up to two months in the Integrated Management of Childhood Illness (IMCI) approach(3,4). India is currently in the process of introducing the IMCI strategy. However, before it's widespread implementation, the generic 'IMCI' algorithms require careful adaptation to reflect the epidemiological and cultural characteristics of the country.

The published experience for the 'IMCI' algorithms in India pertains to older children(5). Further, there is scarce quantification of the upper range of expectations from this approach in young infants, namely the agreement between the 'gold standard' and a pediatric resident following the algorithm. The present study was therefore designed to generate relevant information in this context for the proposed algorithm for children between the ages of one week up to two months.

**Subjects and Methods**

The study was performed in the Outpatient Department and Emergency Room between May 1997 to February 1998. Both Outpatient Department and Emergency Room settings were utilized so that illnesses of various types and severity could be evaluated. The study period was deliberately extended to ten months to minimize the effect of seasonal clustering of common morbidities. All subjects aged between 1 week to 2 months, who presented to the Outpatient Department or Emergency Room of the hospital for a fresh episode of an illness, were eligible for enrolment in the study. The recruited subjects were selected from the eligible cases in a randomized manner.

For the children recruited in the study, the WHO/UNICEF algorithm for 'Integrated Management of Childhood Illness' was referred to. Every study infant was assessed and classified according to these guidelines, treatment steps identified and information was recorded in a proforma. A pediatric post-graduate trainee (RGI) performed this assessment during the second year of the residency program. The study subjects were then assessed, examined and managed according to the protocol of the treating unit under the supervision of faculty and/or pediatric senior residents. All relevant investigations (including blood counts, chest radiograph, stool examination, blood cultures, lumbar puncture, etc.) were performed on the basis of history and detailed clinical examination. Based on this detailed clinical evaluation and relevant investigations, final diagnoses were made and therapies instituted. These diagnoses and treatments were considered as the 'gold standard'.

The study children were either admitted or sent home after initial evaluation, depending upon the nature and severity of illness. The hospitalized subjects were followed up till discharge or death. Other children were called for follow up one week later to determine the final outcome. Each unimmunized or incompletely immunized sick child was immunized and dietary therapy/advice was given to every child with low birth weight or one with a feeding problem.

Two categories of possible diagnoses and treatments were therefore available for each recruited study subject, namely, 'gold standard' and 'IMCI algorithm'. A sample size of 117 was
Infants requiring referral as per 'IMCI' algorithm had significantly greater co-existence of morbidities (2.3 ± 0.8 vs 1.8 ± 0.8, p = 0.002) thereby implying a greater magnitude of multiplicity of illnesses in infants who had been assessed to have a relatively severe condition.

The utility of the 'Referral Criteria' outlined in 'IMCI' algorithm in predicting hospitalization was computed. The sensitivity of these criteria in total patients (n = 129) and follow-up certain subjects (n = 105) was 87% and 86% whereas the specificity was 58% and 53%, respectively. The positive predictive value, negative predictive value and odds ratio (95% CI) for the same were 75% and 78%, 76% and 66% and 9.3 (3.7-24.3) and 6.6 (2.4-18.9), respectively.

The diagnostic agreement was calculated between 'gold standard' and the 'IMCI' algorithm. A 'total agreement' was considered if the case required referral as per 'IMCI' algorithm and was actually admitted or if all the diagnoses made by algorithm matched the 'gold standard'. Cases not fitting in the above category were defined as a mismatch. Table II summarizes the diagnostic agreement of the 'IMCI' with the 'gold standard'. There was a total agreement on all diagnoses in a single patient in 60% to 66% of subjects. The mismatch was more commonly of an overdiagnosis (23% and 21%) rather than underdiagnosis (21% and 15%). If all referrals were considered a diagnostic match, the total agreement was 76% to 81%.

Three fourths (75%) of the children had two or more co-existent morbidities as per the gold standard diagnoses. In comparison to the 'gold standard', the 'IMCI' module documented a slightly lower number of co-existent morbidities (mean 2.1 vs 1.8, respectively, p = 0.001).
### Table I—‘Gold Standard’ Morbidities Recorded

<table>
<thead>
<tr>
<th>Illness</th>
<th>Total subjects (n = 129)</th>
<th>Outcome Certain (n = 105)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Feeding Problem and/or Low Birth weight and/or Oral Thrush*</td>
<td>97 (75.2)</td>
<td>81 (77.1)</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>97 (75.2)</td>
<td>81 (77.1)</td>
</tr>
<tr>
<td>Breastfed stools*</td>
<td>36 (27.9)</td>
<td>31 (29.5)</td>
</tr>
<tr>
<td>Dysentery</td>
<td>6 (4.6)</td>
<td>5 (4.7)</td>
</tr>
<tr>
<td>Upper respiratory infection</td>
<td>34 (23.6)</td>
<td>20 (19.0)</td>
</tr>
<tr>
<td>Serious Bacterial Infections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Septicaemia</td>
<td>28 (21.7)</td>
<td>21 (20.0)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>17 (13.1)</td>
<td>16 (15.2)</td>
</tr>
<tr>
<td>Meningitis</td>
<td>11 (8.5)</td>
<td>10 (9.5)</td>
</tr>
<tr>
<td>Tetanus</td>
<td>4 (3.1)</td>
<td>4 (3.8)</td>
</tr>
<tr>
<td>Abscess</td>
<td>2 (1.5)</td>
<td>2 (1.9)</td>
</tr>
<tr>
<td>Congenital heart disease</td>
<td>8 (6.2)</td>
<td>8 (7.6)</td>
</tr>
<tr>
<td>Local bacterial infection</td>
<td>7 (5.4)</td>
<td>7 (6.7)</td>
</tr>
<tr>
<td>Conjunctivitis</td>
<td>6 (4.6)</td>
<td>6 (5.7)</td>
</tr>
<tr>
<td>Jaundice</td>
<td>5 (3.8)</td>
<td>5 (4.8)</td>
</tr>
<tr>
<td>Bronchiolitis</td>
<td>5 (3.8)</td>
<td>5 (4.8)</td>
</tr>
<tr>
<td>Others†</td>
<td>13 (10)</td>
<td>9 (8.6)</td>
</tr>
</tbody>
</table>

* If any of these morbidities were present alone or in combination, it was considered as a single morbidity to avoid duplication of a single illness category (feeding difficulty).
* Not counted as morbidity as per gold standard.
† Others included acute otitis media, hypocalcemia, umbilical granuloma, umbilical hernia and cleft palate (all n=2); and meningomyelocele, neuralaxial duct block and congenital absence of facial muscle (all n=1).

The total number of illnesses exceeded the number of subjects because of co-existence of morbidities.

complaints of cases in which there was a diagnostic mismatch. The presenting complaints of these 52 and 36 cases are given in Table III. It is evident that cough, fever, coryza and diarrhea were the important presenting symptoms for diagnostic mismatch. Upper respiratory infections were diagnosed in 63.4% and 52.7% of these patients and breastfed stools in 9.6% and 11.1%.

The sensitivity of algorithm to identify a serious (n = 57) or any (n = 64) bacterial infection was 96.5% and 96.8%, respectively while the specificity was relatively low (59.7% and 58.5%, respectively). The corresponding figures for the outcome certain subset (serious bacterial infection in 51 and any bacterial infection in 58) were 96.1% and 96.5% for sensitivity and 51.8% and 51.1% for specificity. Of the 43 cases identified as diarrhea, 6 (14%) had breastfed stools without diarrhea which did not need any therapeutic intervention. The algorithm performed well for detecting dehydration status (35/35) although it tended to overestimate the severity of dehydration in a few (6/35, 17%) subjects.
TABLE II—Summary of Diagnostic Agreement Between 'Gold Standard and IMCI'

<table>
<thead>
<tr>
<th>Type of mismatch</th>
<th>Total subjects (n = 129) n (%)</th>
<th>Outcome certain (n = 105) n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No mismatch (Total agreement)</td>
<td>77 (55.7)</td>
<td>69 (65.7)</td>
</tr>
<tr>
<td>Any mismatch</td>
<td>52 (40.3)</td>
<td>36 (34.3)</td>
</tr>
<tr>
<td>Underdiagnosis by 'IMCI'</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single diagnosis</td>
<td>27 (20.9)</td>
<td>16 (15.2)</td>
</tr>
<tr>
<td>Two Diagnoses</td>
<td>24 (18.6)</td>
<td>13 (12.4)</td>
</tr>
<tr>
<td>Overdiagnosis by 'IMCI'</td>
<td>3 (2.3)</td>
<td>3 (2.8)</td>
</tr>
<tr>
<td>Single diagnosis</td>
<td>29 (22.5)</td>
<td>22 (21.0)</td>
</tr>
</tbody>
</table>

TABLE III—Presenting Complaints in Cases with Any Diagnostic Mismatch

<table>
<thead>
<tr>
<th>Presenting Complaint</th>
<th>Total subjects (n = 52) n (%)</th>
<th>Outcome certain (n = 36) n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough</td>
<td>34 (65.3)</td>
<td>21 (58.3)</td>
</tr>
<tr>
<td>Fever</td>
<td>28 (53.8)</td>
<td>20 (55.5)</td>
</tr>
<tr>
<td>Coryza</td>
<td>21 (40.3)</td>
<td>11 (30.5)</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>9 (17.3)</td>
<td>8 (22.2)</td>
</tr>
<tr>
<td>Respiratory distress</td>
<td>5 (9.6)</td>
<td>4 (11.1)</td>
</tr>
<tr>
<td>Vomiting</td>
<td>5 (9.6)</td>
<td>4 (11.1)</td>
</tr>
<tr>
<td>Jaundice</td>
<td>3 (5.7)</td>
<td>3 (8.3)</td>
</tr>
<tr>
<td>Constipation</td>
<td>2 (3.8)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Umbilical redness</td>
<td>2 (3.8)</td>
<td>2 (5.5)</td>
</tr>
<tr>
<td>Others*</td>
<td>9 (17.3)</td>
<td>8 (7.6)</td>
</tr>
</tbody>
</table>

Others included deviation of mouth, excessive crying, feeding difficulty, increasing head size, nasal block, rash, refusal of feeds, regurgitation of feeds and swelling back (all n = 1).

With the IMCI algorithm, 55% of the non-referred subjects (17.8% of the total sample of 129 cases) would have received immunization. These subjects would have theoretically constituted a missed opportunity for immunization if a solitary vertical program approach had been adopted. Also 55% of the non-referred cases (17.8% of the total sample of 129 cases) required counseling for appropriate breastfeeding practices. These children would also have represented a missed opportunity for counseling for appropriate breastfeeding with a solitary vertical program approach.

Discussion

The current study reaffirms that co-existence of illnesses is a rule rather than exception even in young infants with three fourths of children having more than one illness. Similar observations in this age group were recorded in an earlier report(6). Another important finding was that the number of morbidities was higher...
in those children who had been assessed to have a relatively severe condition (means of 2.3 vs.
1.8 illness/child). Earlier data from Bangla-
desh(6) in younger infants and from India and
Bangladesh(5,6) in older children also showed
similar results.

An important component of IMCI algorithm is the early recognition of severe
morbidity requiring referral to a higher level of
health facility for appropriate management.
Problems in this area can easily undermine the
confidence of the paramedical personnel and the
community for this proposed health interven-
tion. The IMCI guidelines are designed to be
highly sensitive for the referral of patients
with a possible severe illness, thus it inevitably
leads to some children being referred un-
necessarily(7). We compared the IMCI recom-
mandation for referral with the judgement of
senior pediatrician on the need for hospital-
ization and found a reasonably good sensitivity
(86-87%) but a lower specificity (53-58%). An
earlier study from Bangladesh(6) in 234 young
infants had also documented a higher sensitivity
(84%) and a lower specificity (54%). Thus,
there is a need to improve the specificity of
the referral criteria. One possible area for
improvement of excessive referral would be
refinement to define upper respiratory infection
since 13 of 21 unnecessary referrals (62%) in
our study had this morbidity. The need for
referrals for these 13 patients as per IMCI
algorithm was primarily fever. The Bangladesh
study(6) also revealed that most frequent
provisional diagnoses in patients unnecessarily
referred were pneumonia as per WHO criteria
(68%) and upper respiratory tract infections
(13%). The addition of intercostal or suprasternal retraction to lower chest wall indrawing increased the sensitivity of IMCI referral from
54% to 69% in young infants (27% increase,
95% CI: 8%-49%), while maintaining
sensitivity.

Regarding overall performance of this
algorithm, the clinical experience is limited in
young infants. In the present study with IMCI
approach, there was a total agreement with 'gold
standard' in all diagnoses and prescribed broad
categories of treatments in a single patient in 59-
66 per cent of subjects, if appropriate referral
was considered a diagnostic match and in 76-
81 per cent of subjects if all referrals were
considered a diagnostic match. Thus, an impor-
tant reason for mismatch was excessive referral
of the children who subsequently were not
hospitalized. The algorithm does not have any
provision for diagnosis of breastfed stools,
which is a common occurrence in exclusively
breastfed neonates. In the current study 14% of
cases identified as diarrhea by IMCI (6/43 cases)
had breastfed stools which would have resulted
in unnecessary treatment for diarrhea. The IMCI
algorithm also focuses on the provision of
preventive services like immunization and
feeding advice for every child, which tend to get
ignored with disease specific vertical algo-
rithms. In the current study, there was a possi-
bility of missed opportunities for immunization
and breastfeeding counseling, which were
effectively covered by the IMCI in 18% of
subjects for both.

The algorithm had a high sensitivity (96.1-
96.5%) but a lower specificity (51.8-59.7%) for
identifying a serious bacterial infection. A recent
multicentric trial(8) has attempted to generate
more accurate clinical predictors of serious
bacterial illness in young infants. This study
compared the accuracy of the generated 14 item
simplified three-level model with that of the 12
clinical signs in the WHO guidelines for the
management of the sick young infants. In
detecting infants under 60 days of age with any
outcome abnormality, the WHO sick child
criteria had an ROC area of 0.656 as compared
to 0.838 for the three-level model, signifying
greater accuracy of the latter. This research may
Key Messages

- There is a sound scientific basis for adopting the Integrated Management of Childhood Illness (IMCI) approach.
- Coexistence of morbidities is a rule rather than exception for sick young infants.
- IMCI algorithm for young infants provides good sensitivity but lower specificity for assessing severe illness.
- Two conditions identified for possible refinement of the algorithm are upper respiratory tract infection and breastfed stools.

Contributors: HPSS coordinated the study (particularly its design and interpretation) and drafted the paper, he will act as guarantor for the paper. RG participated in the data collection, and also helped in drafting the paper. DS participated in analysis and drafting.

Funding: None.

Competing interest: None stated.

REFERENCES


NOTES AND NEWS

ANNUAL CONFERENCE OF INDIAN ASSOCIATION OF PEDIATRIC SURGEONS

This event is to be held from November 2-5, 2000 at Post Graduate Institute of Medical Education and Research, Chandigarh 160 012. For further details please contact Prof. K.L.N. Rao, Head of Department of Pediatric Surgery, Post Graduate Institute of Medical Education and Research, Chandigarh 160 012. Tel. 0172-744555 (O), 715314 (R); Fax 744401, 745078; E-mail: klnrao@hotmail.com.

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