Child Health Research Project

Synopsis: Validation of Outpatient IMCI Guidelines

January 1998 Number 2

Every year some 12 million children die before they reach their fifth birthday, many of them during the first year of life. Seventy percent of these child deaths are due to diarrhea, pneumonia, measles, malaria, or malnutrition—and often to a combination of these conditions (Figure 1). Because there is considerable overlap in the signs and symptoms of several of the major childhood diseases (Table 1), a single diagnosis for a sick child is often inappropriate. Focusing on the most apparent problem may lead to an associated, and potentially life-threatening, condition being overlooked. The WHO/UNICEF Integrated Management of Childhood Illness (IMCI) guidelines lead to more accurate identification of illnesses in outpatient settings, ensure more appropriate and combined treatment of all major illnesses, and speed referral of severely ill children. In addition, the strategy improves the counseling of caregivers and the provision of preventive services, and aims to improve the quality of care of sick children at the referral level. In the home setting, it promotes improved nutrition and preventive care, appropriate care-seeking behaviors, and the correct implementation of prescribed care.

The IMCI guidelines are a simplified system of diagnosis and treatment that is designed for use by health workers with limited training and little or no laboratory support. According to the guidelines, the health worker first assesses the child, asking questions and examining the child and checking immunization status. Then, he or she classifies the child's illness and identifies the treatment: urgent referral, specific medical treatment and advice, or simple advice on home management, based on a color-coded triage system. If the child is being referred urgently, health workers give only initial treatment before departure. Practical treatment instructions are provided, including how to teach the mother to administer oral drugs, to

Figure 1. Distribution of 11.6 million worldwide under-five deaths in 1995 by cause.
Source: World Health Organization (References 1, 2)

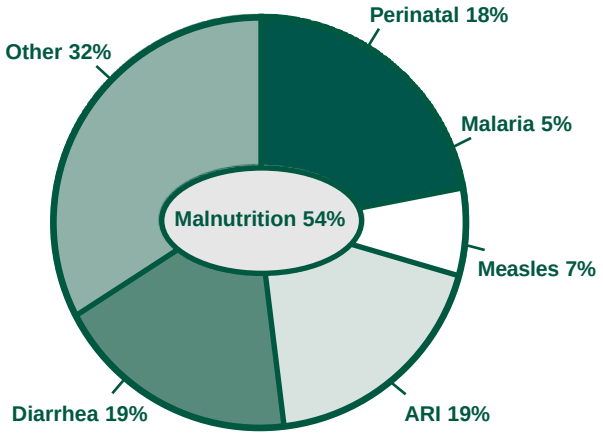


Table 1. For many sick children a single diagnosis may not be appropriate.

Presenting complaint	Possible diagnosis
Cough and/or fast breathing	Pneumonia Severe anemia P. falciparum malaria
Lethargy or unconsciousness	Cerebral malaria Meningitis Severe dehydration Very severe pneumonia
Measles rash	Pneumonia Diarrhea Ear infection
Severely ill young infant	Pneumonia Meningitis Sepsis

increase fluids during diarrhea, and to treat illnesses at home. The mother is advised on how to recognize when the child should immediately be brought back to the clinic and when to return for routine follow-up. Feeding is assessed (in children less than two years old and in those who are malnourished), and counseling on feeding problems is provided.

The IMCI guidelines have been refined through research and field tests that were fully reported in a recent edition of the *Bulletin of the World Health Organization*[3-10]. The projects covered in this issue of *Synopsis* were sponsored by Child Health Research Project members: the WHO Division of Child Health and Development (Kenya, Gambia, United Republic of Tanzania) and Johns Hopkins Family Health and Child Survival (Uganda, Bangladesh).

Kenya

This study compared the ability of health workers with two years of clinical training to make a correct diagnosis using a draft version of the IMCI guidelines with that of a fully trained pediatrician who had laboratory and radiological support. Research was conducted at the Siaya District Hospital in Nyanza Province in western Kenya—an area of high malaria transmission. 1795 children between the ages of two months and five years (median age = 13 months) were recruited for the study. The most common complaints presented were fever in 51%, cough in 22%, and diarrhea in 11% of the children. All children were initially evaluated by the health workers who classified the children using the IMCI guidelines, and then evaluated by a physician who had no knowledge of the health worker's assessment. After the physician's history was completed, all children underwent laboratory evaluation for hemoglobin levels, malarial parasite density, and serology for HIV-1. Chest radiographs were done if a child was classified as having severe pneumonia or pneumonia by the health worker in the first year of the study, and in the second year, only when required by the physician. Blood cultures were obtained if the child's oral temperature was greater than 37.5 degrees C., if a chest x-ray showed pneumonia, or if a lumbar puncture was indicated.

A total of 67% of children had *Plasmodium falciparum* infection, 80% were anemic (less than 11g/dl hemoglobin), and 9.6% tested positive for HIV-1. 49% of children had both pneumonia and malaria, and 45% of children presented with both malaria and malnutrition. Sensitivities (number of cases diagnosed as positive by the health worker using IMCI guidelines/number positive by physician) and specificities (number negative by health worker/number negative by physician) for components of the IMCI guidelines calculated were pneumonia 97% sensitive and 49% specific; dehydration in children with diarrhea (51%, 98%); malaria of any degree (100%, 0%); ear infection (98%, 2%); nutritional status (96%, 66%), and need for referral (42%, 94%) (Table 2). Detection of fever by laying a hand on the forehead was both sensitive and specific (91%, 77%). The low specificity in IMCI guidelines' detection of malaria is based on using any fever or history of fever for the empirical treatment of the disease. Refinements were subsequently made to the IMCI guidelines to increase their sensitivity and specificity for certain diseases.

Table 2. Sensitivities and Specificities of the IMCI Guidelines for Pneumonia, Diarrhea, Malnutrition and the Need for Referral.

Site/Disease	Sensitivity % (n/N)	Specificity % (n/N)
Kenya		
Pneumonia	97	49
Dehydration from Diarrhea	51	98
Malnutrition	96	66
Need for Referral	42	94
The Gambia		
Pneumonia	81	89
Dehydration from Diarrhea	67	96
Malnutrition	89	90
Measles	100	99
Need for Referral	45	93
Uganda		
Pneumonia	76	60
Diarrhea	91	88
Malnutrition	19	97
Need for Referral	41 (111/268)	91 (870/958)
Bangladesh*		
Need for Referral		
Young Infants		
All	84	54
With Pneumonia	100	5
Children		
All	86	64
With Pneumonia	97	25

*** IMCI and reference standard data were collected by physicians. At other research sites, IMCI data were collected by other health workers.**

The Gambia

In The Gambia, 440 children between the ages of two and five months were enrolled from the outpatient department of the Medical Research Council Laboratories in Fajara. All children were first examined according to IMCI guidelines by field assistants, and then seen by a physician who examined the child without referring to the field assistant's findings. Later, temperature, hemoglobin concentration, heart rate, and a blood film for malaria parasites were obtained. Chest roentgenograms were taken if the respiratory rate was counted by either the field assistant or the physician as greater than 40 for children older than one year, or greater than 50 for infants under age one. 21% of children were seen from August to December —the malaria season—and 79% were seen from January to July. The most common complaints were fever (66%), cough (36%), diarrhea (29%), chest pain (28%), vomiting (24%), skin problems (15%), abdominal pain (13%), difficulties in feeding (8%), headache (5%), and eye problems (5%). After evaluation of the laboratory findings, the physician made his final diagnosis.

Compared with the pediatrician's diagnosis, the sensitivity and specificity of the IMCI guidelines were 81% and 89% for the detection of pneumonia; 67% and 96% for dehydration; 87% and 8% for malaria parasitemia (any level); 100% and 9% for severe malaria; 100% and 99% for measles; 30% and 97% for ear infection; and 89% and 90% for malnutrition. The guidelines clearly helped the field workers correctly diagnose most of the illnesses presented to them. However, in this study, the IMCI guidelines would have resulted in considerable overtreatment for malaria during the low-malaria risk season due to relying on the history of fever for diagnosis. Several research efforts were subsequently launched to try to raise the specificity of malaria diagnoses.

Uganda

In Uganda, 1226 children aged two to 59 months were first seen by a medical assistant using a version of the IMCI guidelines that had been revised by WHO after initial studies and then evaluated by medical officers in Kabarole District Hospital in Fort Portal. 75% had cough or difficulty breathing, 72% had a fever, 28% had diarrhea, and 4% had an ear infection. Chest films were taken if children showed signs of chest indrawing, intercostal retractions, or rapid respiration, or if the physician suspected pneumonia. Blood films for malaria were ordered for a history of fever in the preceding 24 hours or an axillary temperature above 37.5 degrees C. Hematocrit was determined in children with pallor and for a systematic 20% sample of all children. The most common physician diagnoses were anemia (38%) and non-pneumonia respiratory disease (36%); 69% of children were classified into more than one symptom category.

A total of 16% were classified into a severe category for which the guidelines recommend urgent referral to a hospital. Medical officers, in contrast, referred 22% of children for admission. Sensitivity of IMCI guidelines relative to the physician's reference diagnosis was 97% - 98% for fever and non-severe or severe malaria. Sensitivity and specificity were 91% and 88% for diarrhea; 77% and 99% for ear infections; 76% and 98% for persistent diarrhea, and 76% and 60% for severe pneumonia. Low sensitivities were noted for the detection of severe anemia (24%) and severe malnutrition (16%). It should be pointed out that the physician diagnosis of severe malnutrition was based on weight-for-age Z score less than -3 (which includes both severely wasted children and children who are only stunted or stunted with mild wasting) or kwashiorkor; whereas the IMCI guidelines used visible severe wasting or edema. It would thus be expected that fewer children would be classified as severely malnourished given the difference in definition. Many would argue that those identified by the IMCI guidelines as severely malnourished are those requiring acute attention and referral. This study concluded that the IMCI approach was an important advance in the treatment of children at primary health care facilities in Uganda.

Bangladesh

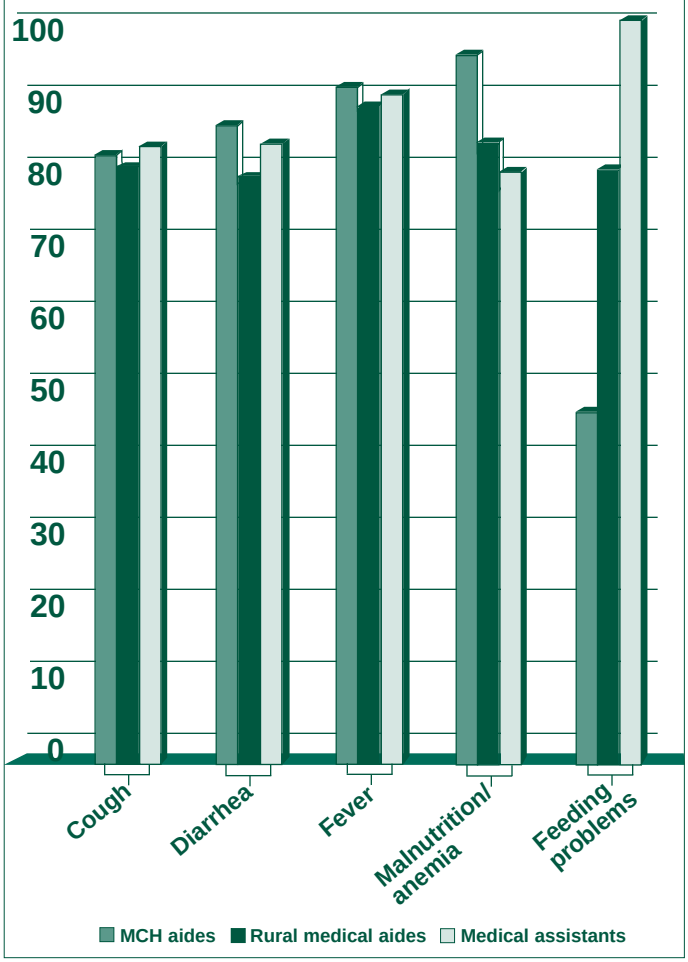
This prospective study in Bangladesh sought to validate the content of the IMCI referral guidelines (rather than the ability of health workers to use them) for children under five years old who came for medical care at the outpatient or emergency department of Dhaka Shishu (Children's) Hospital. Two experienced Bangladeshi pediatricians evaluated 234 young infants (ages one week to two months) and 668 children (ages two months to five years)

using a standard format incorporating all the IMCI signs as well as several other signs and symptoms commonly assessed by physicians. Pneumonia was the most common provisional physician diagnosis in both age groups, with multiple diagnoses (pneumonia and diarrhea or local bacterial infection) more common in the young infants. Severe malnutrition was evident in 12% of infants and 29% of children who had weight for age Z-scores of <-3.

The physicians diagnosed 45% of the young infants and 34% of the children as needing hospital admission. IMCI referral signs had good sensitivity (84% in young infants, 86% in children) when compared with the physicians' assessment but only moderate specificity (54% in young infants and 64% in children). The referral decisions made by health workers trained in IMCI might be quite different from those based on the computer application of the algorithm, since health workers will also take other factors into consideration when deciding about referral. Even if patients do not receive a severe classification, health workers are instructed to "assess other problems" and to use other training/guidelines to decide what to do for those problems not included in IMCI. The high prevalence of severe malnutrition in Bangladesh and the physicians' tendency not to admit these patients due to the presence of community treatment programs also contributed to the guidelines' low specificity for the need for referral.

The guidelines for referral had a sensitivity of 100% for young infants and 97% for children with a physician's diagnosis of provisional pneumonia, but specificity was only 5% and 25%, respectively, in children without this diagnosis. Possible modifications to the IMCI guidelines were also tested to attempt to increase specificity. Requiring intercostal or suprasternal retractions to accompany lower chest wall indrawing increased the specificity of referral from 54% to 69% in all young infants and from 64% to 74% in all children, while maintaining sensitivity in both groups. This also increased the specificity of pneumonia referral from 5% to 43% in young infants and from 25% to 63% in children. These modifications, however, yielded only a small increase in positive predictive value.

Figure 2. Number and percentage of sick children correctly classified by the three categories of health workers.



Anemia Guidelines in Uganda and Bangladesh

This analysis included the 835 and 483 children aged two months to five years also reported on in the Ugandan and Bangladeshi studies, respectively. The object of this study was to assess the ability of pallor of the palms (included in the IMCI guidelines) as well as other clinical signs to identify anemia in country settings with and without malaria. In Uganda, conjunctival, palmar, nailbed, and tongue pallor were rated by the study and blood films for malaria, and hematocrits were obtained as described above. In Bangladesh, only the conjunctivae and palms were examined. In addition to the criteria used in Uganda, hemoglobin was also measured for children who had a weight for age Z-score of <-3, or who were having blood drawn for another reason.

In Uganda, 65% of the children had at least mild conjunctival or palmar pallor. After assessing hematocrit levels, 2% were found to have severe anemia, 13% had moderate anemia, and 42% had mild anemia. In Bangladesh, 57% of children were diagnosed with pallor, and after blood work, 2% were found to be severely anemic, 17% moderately anemic, and 62% mildly anemic. In Bangladesh the sensitivity of conjunctival pallor approached acceptable levels, but the sensitivity of palmar pallor was very low, suggesting that conjunctival pallor should be added to the guidelines, or should be locally adaptable in regions where palmar pigment may be increased. In Uganda the sensitivities for both anatomical sites were low to moderate. The addition of grunting to pallor with an "or" statement identified more cases of severe anemia—in Uganda it raised the sensitivity to 37%; in Bangladesh to 80%. The specificity of the signs for severe anemia was high in both study locations, but was low for moderate or mild anemia in Uganda and moderate for this level in Bangladesh. Combining conjunctival and palmar pallor lowered specificity but improved the overall diagnosis of both moderate and mild anemia in Bangladesh. The performance of the signs in detecting severe anemia was not appreciably different in children with and without malaria.

This work confirms a high prevalence of anemia in two developing countries, and shows that careful evaluation of clinical signs can correctly classify half or more of young children with anemia. Also included in the *Bulletin of the World Health Organization* supplement is a study on IMCI anemia guidelines tested in The Gambia.

United Republic of Tanzania

At the invitation of the Tanzanian Ministry of Health, the IMCI training course was field-tested in Arusha from February through March 1995, with three types of first-level facility health workers—medical assistants, rural medical aides—and maternal and child health (MCH) aides to see if the materials were effective in preparing the course participants to correctly manage sick children. The results of this study also enabled researchers to suggest improvements in the course materials and teaching procedures. Ability of the health workers to correctly assess, classify, counsel, and treat according to IMCI guidelines was measured both together and by professional background, which permitted an examination of the differences between the groups of health workers. Medical assistants were more proficient in reading English, compared to the rural medical aides and the MCH aides.

Overall the rate of correct assessment of signs was very high at 93% (range 85% - 97%), with medical assistants consistently scoring higher than MCH aides. When assessment was categorized by the degree of severity of the classification, the total across all symptoms showed only 81% correct in the severe group, compared with 91% in both the non-severe and no-symptom groups. The proportion of children correctly classified on the basis of the assessment of main symptoms, nutritional status, and feeding problems was 88% (range 77% - 100%) (Figure 2). When grouped by severity of cases, the number correctly classified was again lower in the severe category (64%) than in the non-severe categories (>90%). The proportion of cases correctly classified varied by health worker assessment, with MCH aides having the highest rate (90%), rural medical aides the lowest (86%), and medical assistants in between (88%).

Overall, 86% of cases were correctly counseled, but this varied by type of health worker. Rural medical aides had the most problems with counseling, particularly in their ability to use checking questions and to convey critical information. The proportion of cases given the correct treatment was 91%. These results show that the participants of the IMCI course were able to assess, classify, and treat most sick children correctly by the end of the course, and most were able to provide adequate counseling to the mother. Improvements in the guidelines suggested by the field test included some reduction of the technical content and simplification of the English of some of the training modules. Subsequent experience training rural medical aides with modules translated into Swahili indicates that this remedied problems noted in the field test in reading the modules and doing the written exercises.

Summary

The IMCI guidelines were designed to maximize detection and appropriate treatment of illnesses due to the most common causes of child deaths and related conditions in developing countries—pneumonia, diarrhea, malaria, measles, severe and local bacterial infections in young infants, malnutrition, anemia, and ear problems. The studies presented in this issue of *Synopsis* show that the guidelines can be expected to succeed in assisting health workers at first-level health facilities to identify most of these conditions with high sensitivity. Health workers using the guidelines performed well when compared to physicians who had access to laboratory and radiographic findings, and health workers trained in full case management (Arusha, Tanzania) did well in counseling mothers and teaching them to deliver treatments at home. An identified problem, requiring further refinement of the guidelines, is the improved detection of severe anemia.

A potentially more serious problem is the low to moderate specificity of the guidelines for several clinical conditions and for the need for urgent referral to hospital. This could lead to overdiagnosis in some disease classifications, with the accompanying problems of possibly contributing to the development of antibiotic resistance and overburdening hospitals with unnecessary referrals. Previous studies of case management guidelines suggest that, despite their low specificity, when compared to current practices they can improve treatment at first-level health facilities[10] and reduce unnecessary referrals[12]. Nevertheless, the studies reported here reveal some problems and suggest some possible solutions that warrant further investigation in other locations. Several of these issues have already been incorporated into the World Health Organization's latest IMCI research priorities including:

- Determining health workers' ability to learn to detect lower chest wall indrawing;
- Identifying clinical signs, in addition to or instead of lower chest wall indrawing, to increase the specificity of referral for severe pneumonia;
- Identifying other clinical signs to increase the specificity of hospital referrals overall, thereby reducing unnecessary referrals.
- Investigating how clinical care for severely ill children could be expanded in areas where referral is not feasible;
- Finding ways to increase the specificity of the diagnosis of malaria, and
- Recognizing clinical signs to increase the sensitivity of the diagnosis of severe anemia and the specificity of the diagnosis of moderate or mild anemia, and the possible need for regional adaptation of the anemia guidelines.

Adaptations of the IMCI guidelines to the circumstances of individual countries is crucial to the success of the approach[13]. Certain adaptations must be done in all countries. These include selecting first and second line oral antimalarials and antibiotics for pneumonia, dysentery, and cholera as well as identifying complementary foods that are locally available and culturally acceptable for children of different age groups. Individual countries should not seek to expand the guidelines to assess and treat all pediatric conditions, as this would make the training course too long and implementation of the guidelines too cumbersome. Only if patterns of serious illnesses vary significantly from those assumed in the course materials should a problem be added. For example, dengue hemorrhagic fever has been added in several countries where it accounts for a significant amount of morbidity and mortality.

Although only introduced three years ago, by May 1997, 17 countries (Bolivia, Brazil, Dominican Republic, Ecuador, El Salvador, Ethiopia, Indonesia, Madagascar, Morocco, Nepal, Niger, Peru, the Philippines, Sudan, United Republic of Tanzania, Vietnam, and Zambia) had introduced IMCI and moved on to early implementation. In addition, 16 countries were in the process of introduction, and nine had expressed strong interest. One country (Uganda) was already in the expansion phase. The IMCI strategy encompasses interventions in the home and the health facility which aim to prevent and respond to illness, and will aid in the reduction of morbidity and mortality in the developing world. It overlaps with and does not intend to replace existing programs on immunization, nutrition, safe motherhood, essential drugs, and malaria. According to the *World Development Report 1993*[14], IMCI is one of the most cost-effective health interventions in both low- and middle-income countries, and was assessed to be the intervention likely to have the greatest impact in reducing the global burden of disease.

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