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Potential implications of the integrated management of childhood illness (IMCI) for hospital referral and pharmaceutical usage in western Uganda

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Summary The integrated management of childhood illness approach (IMCI) is currently being implemented by a number of countries worldwide. This is the second report from a study in western Uganda comparing the assessment and classification of disease by medical assistants using the IMCI algorithm with that of hospital-based general medical officers, who used their clinical judgement to assess and provide treatment. Treatment prescribed by the hospital medical officers was compared to that indicated by IMCI disease classifications. The study population comprised 1226 children aged 2–59 months. Medical assistants had some difficulty in completing the IMCI assessment, leading to incorrect classification of findings in 138 of 1086 completed forms (13%). If their classifications had been used to decide on hospital referral, 37 children who met IMCI criteria for referral would have been sent home. Consultations took on average 7.2 min, longer than usual for several African countries. Use of the IMCI guidelines would have referred 16.2% of children to hospital, compared with 22% referred by the medical officers. Use of IMCI could have reduced the cost of medication to US$0.17 per child compared to the treatment cost of US$0.82 as prescribed by medical officers. Medical officers prescribed both a greater number and a greater variety of drugs than indicated by the IMCI algorithm. Compared to the present management of sick children by medical officers at Kabarole district hospital, using the IMCI algorithm would bring major changes in pharmaceutical use and referral practices. However, there is concern about the difficulty medical assistants had in using it, and the potential for longer consultation times.

keywords Integrated management of childhood illness, IMCI, Uganda, pharmaceuticals

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Introduction

In developing countries diarrhoea, pneumonia, measles, malaria and malnutrition account for both 70% of visits to health facilities and deaths of children under five. The WHO, UNICEF and others have developed the Integrated Management of Childhood Illness (IMCI) approach, which combines case management algorithms and preventive measures to target major causes of death (WHO 1995). The IMCI algorithm starts with an *Assess and Classify* section where the health worker enquires about danger signs which would require immediate hospital referral: lethargy or unconsciousness, recent convulsions, inability to drink or vomiting everything. This is followed by questions about cough or difficulty breathing, diarrhoea, fever or ear problems. If the caregiver indicates one of these is present, additional questions are to be asked and an examination has to be conducted before continuing with the sequence. The child is then assessed for anaemia and malnutrition and his or her immunization status is checked. Findings are then classified and the *Treat the Child* section indicates appropriate clinical management. In the *Counsel the Mother* section which follows, information is provided to the caregiver on the cause of the illness, caring for the child at home, and when to bring the child back to the clinic. The visit concludes with an enquiry about other conditions which the child or mother may have.

In a prospective study previously reported, the *Assess and Classify* component of the IMCI was used by medical assistants in an outpatient department of Kabarole district hospital in western Uganda (Kolstad *et al.* 1997). The intent of the study was not to validate IMCI classifications against the 'gold standard' of an expert paediatric assessment, but rather to compare IMCI classifications by medical assistants with the prevailing standard of care provided by general medical officers in a typical Uganda district hospital.

Children aged 2–59 months were first seen by a medical assistant who assessed and classified the child's illness according to IMCI guidelines. The children then saw a hospital physician who, after his examination, ordered appropriate laboratory tests and prescribed treatment based on his clinical judgement. The study design was a comparison of IMCI classifications by medical assistants and the district hospital medical officer's diagnosis using a standard history, physical examination and treatment approach. This was not a study to validate the IMCI algorithm.

Of the 1226 children included, 93% were classified by the medical assistants into one or more of the IMCI categories. Danger signs were present in 8% of children, 69% had one or more IMCI diagnoses, and 16% were classified as severely ill, requiring referral to hospital. The findings of the hospital-based medical officers and of the laboratory tests they ordered were used as reference standards for comparison with IMCI classification. In this study, IMCI classifications generally had a high specificity, but variable sensitivity and positive predictive value compared to classifications of the medical officers.

In this paper we examine the medical assistants' use of the IMCI algorithm, and compare how treatment following IMCI guidelines would differ from that which was prescribed by the hospital medical officers.

Methods

The outpatient department of Kaborale district hospital is the principal clinic for Fort Portal, the largest town in the district, and for the surrounding rural areas. Each day the hospital's outpatient department attends to 15–25 children under five years of age. From 15 August 1994 to 27 January 1995, a systematic sample of children aged 2–59 months (variously 67%, 75% or 80% of all children based upon anticipated daily attendance) were selected. Verbal informed consent was obtained from the child's caregiver.

The children were first seen by one of two Ugandan medical assistants who had been trained in an intensive 5-day course to use the *Assess and Classify* section of the June 1994 version of the IMCI guidelines immediately before commencement of the study. A complete history and physical examination using a standard medical format was then carried out by one of the hospital's four medical officers, who were unaware of the IMCI classification made by the medical assistant. Medical officers prescribed treatment and referred children for hospital admission based on their clinical judgement and the laboratory and X-ray examinations they requested. Supervision of both medical assistants and medical officers was maintained throughout the study. As part of the supervision, a sample of medical assistant encounters were timed, measuring the time from the start of the IMCI assessment to its completion. This time included counting of the respiratory rate, taking the temperature and weighing the child. The medical assistants were secondary school graduates with three years of medical assistant training and 18–36 months of clinical experience. Continuous supervision was provided to monitor their work and resolve difficulties as they arose. The four Ugandan medical officers had 7–13 years of clinical experience after medical school. Regular meetings were held with them to address problems encountered.

No attempt was made to verify accuracy of either the medical assistants' observations or their recording. However, during computer analysis it was possible to assess the internal validity of the IMCI classifications by the medical assistant. Classifications were done by computer analysis of signs and symptoms recorded, and compared with the classifications of the medical assistant at the end of each consultation. Hospital referrals which would have been made using IMCI guidelines were compared with referrals by medical officers.

The IMCI classifications assigned through computer analysis of the medical assistants' assessment were used to determine what drugs would have been prescribed if treatment had followed the guidelines. This information was then compared with what medical officers prescribed following their evaluation. IMCI recommendations for children referred to hospital include only the first dose of antibiotics or paracetamol for high fever. These initial doses of antibiotics were costed as injectables and included costs for syringes and needles. Information on drugs prescribed by the medical officers was taken directly from the data collection forms.

The medical officers prescribed drugs for a range of conditions not addressed by IMCI guidelines: abscess, glomerulonephritis, syphilis, oral candidiasis, stomatitis, scabies, furunculosis, tonsillitis, tinea capitis, urinary tract infection and intestinal helminths. The cost of treatments for these conditions was excluded.

Pharmaceutical prices for both the IMCI recommendations and medical officer prescriptions were taken from the 1995 International Drug Price Indicator Guide (Drug Management Program 1995), using the average price quote from all vendors for each item. Preparations not appearing in the Price Indicator Guide were excluded from the overall price calculation. These prices represent a hypothetical reference price for use solely in comparisons between the two prescribing patterns, and are not a reflection of wholesale prices in developing countries. The study protocol was approved by the Fort Portal Hospital Ethical Review Committee and the Committee on Human Research at the Johns Hopkins School of Hygiene and Public Health.

Results

The 1226 children included represent an estimated 62% of all children presenting at the outpatient department during the study period. On average, 22 children a day came to the clinic, about 14% of the total outpatient attendance. The medical assistant's consultation using the IMCI algorithm was timed in 29 instances. The average duration, which included weighing and temperature measurement, was 7.2 min (range 3–11 min).

In making IMCI classifications based on the signs and symptoms they recorded, medical assistants misclassified 138 or 13% of children compared to the computer classification of these findings (Table 1), which would have resulted in 37 children being denied referral to a higher-level health facility. This represents 26% all children who would have been referred to hospital by the IMCI algorithm if signs and symptoms had been correctly classified.

Error rates varied by IMCI section. For respiratory illness, 50 of 900 children (6%) with a cough or difficult breathing were classified incorrectly. More than half of these were incorrect classifications of the recorded respiratory rate, while 30% were failures to incorporate presence of a danger sign in the classification. Of the 287 children with a respiratory rate between 40 and 50 breaths per minute, 9% had an error in IMCI classification. In the diarrhoea section, 10% of children were misclassified in one of the three possible categories, 50% of whom had incorrect classifications of dehydration. For persistent diarrhoea, 35% were incorrectly classified, for dysentery, 7%. In the fever section, the medical assistant failed to correctly incorporate a danger sign into the IMCI classification of 12 children, 2% of the children presenting with fever.

Using computer-corrected disease classifications, the IMCI guidelines recommended referral for 199 children (16% of those seen), while the medical officers recommended admission to hospital for 268 (22%). The two agreed on 111 children (9%). Rates of recommended admission by the medical officers and the IMCI guidelines are compared in Table 2. For children with 'severe' reference standard diagnoses, both the IMCI guidelines and the physicians

Table 1 Classification errors made by medical assistants*

IMCI section and types of errors	Number of cases
Respiratory section	50/900 (6%)
incorrect respiratory rate classification	27
(errors involved the age-dependent determination of rapid respiration)	
failure to incorporate danger sign	15
Diarrhoea section	32/333 (10%)
Dehydration (dehydration overestimated in all cases)	13
Persistent diarrhoea (8 cases reported diarrhoea lasting 30 or more days)	20
Dysentery (bloody diarrhoea not classified as dysentery)	3
Fever section	15/843(2%)
failure to incorporate danger sign	12
Ear problem section	15/39(38%)
acute infections classified as chronic	12
Malnutrition and anaemia section	68/1212(6%)
physical findings of anaemia not classified as anaemia	18
physical findings of severe malnutrition classified as malnutrition	32
Overall, one or more errors made by the MAs	138/10 386**(13%)
error led to fewer severe classifications	42
error led to more severe classifications	4
error led to failure to refer	37

*Errors determined by comparing IMCI classifications assigned by medical assistants to the classifications assigned during analysis, based on recorded signs and symptoms recorded by the medical assistants. **Includes only children who had every classification complete (140 children had one or more classifications not indicated). When all 1226 children are counted, 163 had one or more errors made, leading to 51 children missing proper referral.

Table 2 Comparison of referral rates between IMCI algorithm and medical officers

		Referral recommended by			
		IMCI	MO	Both	
Medical officer diagnosis	Cases	*n* (%)	*n* (%)	*n* (%)	*P*-value
Overall	1226	199 (16)	268 (22)	111 (9)	0.000*
Any severe reference standard diagnosis	292	98 (34)	145 (50)	70 (24)	0.000*
No severe reference standard diagnosis	934	101 (11)	123 (13)	41 (4)	ns*
Severe diagnosis					
Severe pneumonia	45	24 (53)	45 (100)	24 (53)	0.000†
Severe malaria	81	35 (43)	51 (63)	24 (30)	0.015*
Severe dehydration	1	1 (100)	1 (100)	1 (100)	…
Mastoiditis	11	2 (18)	2 (18)	1 (9)	ns†
Meningitis	1	0 (0)	1 (100)	0 (0)	…
Severe anaemia	21	7 (33)	13 (62)	5 (24)	ns†
Severe malnutrition	181	55 (30)	73 (40)	38 (21)	0.018*
Non-severe diagnosis (excluding cases with any severe diagnoses)					
Pneumonia	210	20 (9)	64 (31)	15 (7)	0.000*
Non-pneumonia respiratory disease	385	36 (9)	19 (5)	7 (2)	0.013*
Some dehydration	9	6 (67)	6 (67)	5 (56)	ns†
Dysentery	26	1 (3)	2 (8)	0 (0)	ns†
Persistent diarrhoea	24	3 (17)	3 (13)	1 (4)	ns†
Malaria	226	24 (11)	27 (12)	6 (3)	ns*
Measles	2	1 (50)	1 (50)	1 (50)	ns†
Otitis media	23	3 (13)	4 (17)	1 (4)	ns†
Malnutrition	215	40 (19)	36 (17)	13 (6)	ns*
Anaemia	337	41 (12)	54 (16)	12 (4)	ns*

*McNemar test; †probability from binomial distribution.

Medical officer standards: for ‘severe’ disease

1. **Severe pneumonia:** medical officer diagnosis of severe pneumonia, or diagnosis of pneumonia plus grunting respiration at rest and subcostal retractions.
2. **Severe dehydration:** medical officer diagnosis of severe dehydration.
3. **Severe malaria:** fever within the previous 24 hours reported to medical officer and a blood film finding of one or more malaria parasites, plus history of convulsions, observed altered level of consciousness, or history of altered level of consciousness.
4. **Mastoiditis:** medical officer diagnosis of mastoiditis.
5. **Meningitis:** medical officer diagnosis of meningitis.
6. **Severe malnutrition:** weight-for-age Z score (WAZ) of -3 or worse or medical officer diagnosis of kwashiorkor.
7. **Severe anaemia:** haematocrit less than 15%.

Medical officer standards for ‘non-severe’ conditions

1. **Pneumonia:** medical officer diagnosis of pneumonia, or WHO radiographic findings of pneumonia, and not severe pneumonia.
2. **Non-pneumonia respiratory disease:** medical officer diagnosis of upper respiratory tract infection, common cold, pharyngitis, laryngitis, bronchiolitis, tonsillitis, coryza with no radiographic evidence of pneumonia (if chest film was obtained).
3. **Dehydration:** medical officer diagnosis by assessment of skin turgor.
4. **Persistent diarrhoea:** care giver report of diarrhoea with a duration of 14 days or longer.
5. **Dysentery:** care giver report of diarrhoea with three or more stools per day with blood in the stool reported to medical officer.
6. **Malaria:** fever within the previous 24 hours reported to medical officer and a blood film finding of one or more malaria parasites.
7. **Measles:** medical officer diagnosis of measles.
8. **Otitis media:** medical officer diagnosis of acute or chronic Otitis media
9. **Malnutrition:** WAZ between -2 and -3, and not severe malnutrition.
10. **Anaemia:** haematocrit between 15% and 33%.

recommended further care more frequently than for children without a severe diagnosis. In 39 instances caregivers refused admission outright. Most of these (80%) were cases where the medical officer recommended admission while the IMCI guidelines did not. The average length of stay on the paediatric ward was 8.5 days and this did not differ between children recommended for admission by the medical officers or the IMCI guidelines. Based on the number of patients seen in the outpatient department each day, the daily census for the paediatric ward would have been an estimated 25 children if the IMCI admissions criteria had been followed compared with 34 based on medical officer criteria for admission. Most, but not all, paediatric admissions came through the outpatient department.

The IMCI prescribing recommendations were limited to 11 drugs mostly in tablet form, while the medical officers used more than 50 encompassing a wide range of preparations (Tables 3 and 4). Fifty-six percent of the children had an antibiotic recommended by the IMCI guidelines, while 77% had an antibiotic prescribed by the medical officers. Injections were recommended by IMCI for 11% of the children, medical officers prescribed injections for 28%. Physicians prescribed oral rehydration salts only for 48% of the children with diarrhoea. IMCI guidelines would have not prescribed any drug to 7.6% of children, a single drug to 39.4% and more than one drug to 53%. By contrast the medical officers prescribed no drug to 0.4% of children, one drug only to 4.7% and more than one drug to 94.9% of children.

Table 3 Cost of treatment using IMCI guidelines

	Times prescribed	% of children	Reference price (US$)*
Preparation			
Chloroquine tablets	621	51	16.91
Cotrimoxazole tablets	506	41	48.20
Oral rehydration salts	344	28	32.92
Paracetamol tablets	186	15	5.05
Chloramphenicol injection	141	11	74.80
Quinine injection	112	9	11.97
Vitamin A tablets	78	6	0.11
Mebendazole tablets	45	4	1.61
Metronidazole tablets	40	3	4.95
Gentian violet	31	3	1.18
Tetracycline eye ointment	22	2	7.03
Total			204.73
Category			
Antimalarials	700	57	
Antibiotics	684	56	
Injectables	141	11	

*International Drug Price Indicator Guide, Management Sciences for Health, Arlington, Virginia

The differences in price between the IMCI-indicated drugs and what the medical officers prescribed are set out in Tables 3 and 4. The IMCI guidelines would have dispensed drugs to 1133 children at a total cost of US$ 204.73 or US$0.17 per child. However, for the same children medical officers prescribed drugs costing US$1003.68, or US$0.82 per child, a difference of 390%. This included the costs of drugs only for conditions which would have been treated using the IMCI algorithm. When drugs prescribed by medical officers for all conditions in these children (not just IMCI conditions) were included, the price was $1110.63, an additional 10%.

Fully 42% of the cost of drugs prescribed by medical officers were accounted for by syrup formulations of three drugs: erythromycin, cotrimoxazole and paracetamol. For each a less expensive tablet formulation was available. If medical officers had prescribed the tablets, costs would dropped to US$687.83, or US$0.56 per child. The calculated reference prices for the IMCI guidelines are based on the least expensive tablet formulation available. However, IMCI guidelines do not exclude the use of syrups. If syrup preparations of the drugs indicated by IMCI guidelines were dispensed in the same proportion as the medical officers prescribed (52%), then the costs for drugs would have risen to $374.12, an increase of 83% over the tablet-only IMCI reference price.

Discussion

Adopting the IMCI approach to treatment of childhood illness involves a major change in the health worker approach to sick children. Although IMCI validation studies are now being reported, these have not focused on the potential impact of IMCI on health services (WHO 1997). In this study in western Uganda we found that use of IMCI guidelines could achieve a substantial saving in drug costs, reduce hospital referrals and potentially the use of hospital inpatient resources. But at the same time, the results raise several concerns about IMCI use.

Errors

Despite daily supervision, the medical assistants had difficulty throughout the study in correctly classifying the signs and symptoms they observed. Errors in classifying signs and symptoms recorded were made in the cases of 138 children, or 13% of those seen. Classification errors mostly reduced the apparent severity of illness, thus lowering IMCI operational sensitivity. The exception was for children with

Table 4 Cost of treatment prescribed by medical officers

Medical officer prescriptions	Times prescribed	% of children	Total reference price (US$)	IMCI-comparable reference price (US$)
Preparation				
Chloroquine tablets	522	43	14.10	14.10
Paracetamol syrup	411	34	227.34	227.34
Mebendazole tablets	262	22	9.05	3.17
Paracetamol tablets	212	18	6.83	6.83
Chloroquine injection	207	17	23.26	23.26
Chloramphenicol syrup	196	16	219.45	216.30
Oral rehydration salts	155	13	29.28	29.28
Phenoxymethyl penicillin (PenV) tablets	152	12	46.78	46.78
Junior cotrimoxazole tablets	144	12	14.22	14.10
Erythromycin syrup	108	9	184.68	172.71
Crystalline penicillin (Xpen) injection	103	9	30.19	29.65
Ferrous sulphate tablets	95	8	6.72	6.72
Aspirin tablets	87	7	2.29	2.29
Cough syrup	82	7	14.63	14.63
Cotrimoxazole tablets	64	5	9.03	8.96
Cotrimoxazole syrup	59	5	29.70	29.70
Procaine penicillin fortified (ppf) injection	59	5	79.65	39.45
Quinine syrup	58	5	n/a	n/a
Benzyl benzoate cream	43	4	13.53	1.98
Metronidazole tablets	36	3	1.93	1.93
Multivitamin syrup	34	2	25.28	25.28
Whitfield's ointment	34	3	5.94	2.88
Ampicillin syrup	32	3	25.60	24.80
Chlorepheniramine tablets	30	2	0.61	0.39
Multivitamin tablets	28	2	1.82	1.82
Tetracycline ointment	27	2	8.08	8.08
Amodiaquine tablets	22	2	0.68	0.68
Sulphadoxine & pyrimethamine tablets	22	2	0.89	0.89
Nystatin syrup	13	1	15.84	0.00
Chloramphenicol drops	13	1	5.06	5.06
Other preparations*	...	...	58.17	49.44
Total			1110.63	1008.54
Category				
Antimalarials	744	62		
Antibiotics	926	77		
Skin preparations	135	11		
Injectables	341	28		
% with diarrhoea given ORS	...	48		

*__Drugs prescribed to less than 1 percent of children:__ 12 cases: neomycin cream; 11 cases: junior aspirin; 10 cases: folic acid tablets, chlorhexidine, promethazine tablets, calamine lotion; 9 cases: hydrocortisone ointment, diazepam tablets; 8 cases: gentian violet; 6 cases: chloramphenicol injection, erythromycin tablets, cotrimoxazole ointment, metronidazole syrup, salbutamol tablets, furosemide tablets; 5 cases: quinine injection, chloramphenicol ointment; 4 cases: glycerin in borax, phenobarbitol tablets, salicyclic acid cream; 3 cases: gentamycin tablets, nystatin tablets, dexamethasone cream, digoxin tablets, bisacodyl tablets, betamethasone cream, TH300 tablets; 2 cases: sulphadimidine tablets, streptomycin injection, griseofulvin tablets, vitamin C tablets, propanalol tablets, ephedrine nasal drops; 1 case: nystatin cream, tetracycline tablets, hydrocortisone drops, junior cotrimoxazole syrup, ampicillin injection, chlorpromazine syrup, permethasone cream, ampliclox syrup, Vitamin B tablets, Vitamin K injection, probantheline tablets, Mg trisilicate syrup, clotrimazole cream, cloxacillin syrup, ephedrine tablets.

diarrhoea and dehydration: the diarrhoea classification assigned by medical assistants overestimated dehydration in half of the children. This could lower IMCI specificity and increase hospital diarrhoea referrals.

These errors meant that although the signs and symptoms recorded should have resulted in classifications which referred 16.2% of children to hospital, in fact the misclassifications made by medical assistants would have resulted in only 12.3% being referred. This would represent a 24% under-referral through failure to classify observations correctly. The consequences of under-referral could be delay in appropriate treatment, unnecessary complications or death. Over-referral, on the other hand, could add substantial financial strain to families having to provide transportation to hospital for the child and one or more guardians, as well as extra strain on hospital resources. It is important to consider how the classification process can be made less error-prone.

Referrals

In this study 199 of 1226 children seen (16%) would have been referred to hospital. This compares with 7% in Ethiopia (Simoes 1997), and 14% both in Kenya (Perkins *et al.* 1997) and The Gambia (Weber *et al.* 1997). Based on computerized assessment of paediatrician records in Bangladesh, the IMCI referral rate in an urban hospital would have been 36% (Kalter *et al.* 1997)

Applied correctly, IMCI guidelines would refer significantly fewer children to hospital than medical officers did. This study did not look at outcomes among those referred or not referred. This is an important question which deserves attention. Assuming that children who would not have been referred by IMCI guidelines indeed did not need hospitalization, the resulting reduction in referrals by 26% from medical officer rates would be of real economic benefit to hospitals as well as the children's families. Fewer caregivers would have to seek transportation to higher-level facilities, reducing out-of-pocket costs and time away from subsistence or income-generating activities. Fewer referrals would also have a substantial economic benefit for the hospitals involved. For six district hospitals in Malawi, Mills *et al.* (1993) calculated that a single inpatient cost hospitals 34–55 times more than an outpatient. In Uganda, medical officers admitted 6% more children than IMCI guidelines would have indicated. This compares with 8% more admissions by medical officers in Kenya (Perkins *et al.* 1997) and 4% in The Gambia (Weber *et al.* 1997). The similarity of these figures also suggests that the overall referral rate by paediatricians (in Kenya and The Gambia) differed little from that of general medical officers in Uganda, although the nature of those referred could differ.

Pharmaceutical use

This study focused on two aspects of pharmaceutical use and IMCI: rational use of pharmaceuticals and the price of the pharmaceuticals prescribed. In our study sample medical officers prescribed an antibiotic to 77% of the children. This high proportion may be explained partly by the large proportion of children presenting with respiratory complaints. However, on analysis, physicians prescribed more antibiotics than recommended by either IMCI or Ugandan National Standard Treatment Guidelines (1993).

There are few reports of antibiotic prescription patterns in paediatric populations. In Sri Lanka, Tomson *et al.* (1990) reported that 49% of paediatric outpatients were prescribed antibiotics or sulphonamides, and Agunawela *et al.* (1990) noted a figure of 45%. In Guinea 55% of children under age 15 with acute respiratory infections received antibiotics (Sow *et al.* 1995). Costs in Guinea were US$0.45 per child for those treated in a rural health centre and US$9.70 per child for those treated in an urban children's hospital. Apart from the potential for reducing antibiotic prescriptions in this study, the use of IMCI would have reduced the numbers of drugs given to each child: 47% of children would have received one or no drugs, compared with 5.1% for those seen by the medical officers.

In addition to benefits to patients of rational drug use, the savings on costs of pharmaceuticals for a developing country health system can be substantial. At the national level it is estimated that approximately 30–40% of the health system budget goes toward the purchase of pharmaceuticals (Barnett *et al.* 1980; Lauridsen 1984). At the district level, Mills *et al.* (1993) found that between 24% and 37% of district hospital recurrent costs were attributable to medical supplies.

If IMCI treatments were prescribed in the same syrup-tablet proportion as the physicians in this study prescribed, actual drug costs would still have been only 34% of medical officer drug costs, even with adjustment for treatment of non-IMCI conditions. Our results indicate that adoption of the IMCI guidelines could reduce pharmaceutical costs for children by more than half, even if the more expensive syrups or suspensions were included. If providers prescribed mainly the less expensive tablet formulations, savings would be even greater.

Consultation time

The 7.2 min the medical assistant required for the *Assess and Classify* portion of the IMCI consultation was longer than traditional consultations, both in Uganda and other locations. Evaluations of consultation time using the International Network for the Rational Use of Drugs (INRUD) methodology have found consultation times ranging from 1 minute in Bangladesh to 2.3 min in Malawi, 3.0 min in Tanzania, and 6.3 min in Nigeria (Hogerzeil *et al.* 1993). Other INRUD-style evaluations reported consultation times from 2.8 to 4.6 min in Nepal (Kafle *et al.* 1993) to 3.7

min in Mozambique (Folkedal *et al.* 1994). A large study in Uganda reported an average consultation time of 4.6 min (Kafuko *et al.* 1996).

Consultation time could be reduced if immunization status, temperature and weight were assessed at registration, before seeing the health worker. However, when the time taken to complete the *Treat the Child* and *Counsel the Mother* sections were added, it is likely that an average consultation could last longer than the 7.5 min in our study context. Using the Ugandan data from Kafuko as a comparison, the IMCI guidelines would increase consultation times by 57%. It is possible that the additional time needed for IMCI consultation may not be available in many health facilities already stretched by patient numbers and facing severe resource constraints. This would likely pose a serious obstacle to widespread use of IMCI. In busy outpatient facilities with multiple health workers, experience with IMCI in Zambia indicates that reorganization of clinic services could create additional capacity for treatment of children (Drs G Burnham & B Pond, personal observations). The use of ORT corners to provide fluids and instruct the mothers, and separate nutrition counsellors, could further reduce consultation time in busy clinics.

Conclusions

The findings of this study indicate that use of IMCI guidelines would substantially reduce the number of children referred to hospital from an outpatient facility. In comparison with other studies, the reduction in referrals would be of a similar order regardless of whether the referral practices of specialist paediatricians or general medical officers were used as a comparison. Reduction in referrals could conserve resources, both in the health system and at the household level. IMCI use offers the potential to substantially improve drug prescribing by decreasing the prescription of multiple drugs, and the unnecessary prescription of antibiotics. Further, in the setting of this study, following IMCI treatment guidelines would have greatly reduced drug costs. At the same time, our findings raise concerns about the number of errors made by medical assistants in classifying their observations. The tendency to underestimate the severity of illness and the need for hospitalization was particularly alarming. This would suggest a need for making the algorithm more user-friendly. The length of time required to complete a consultation using IMCI is another concern that, unless addressed, may limits its use in many busy settings.

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