Assessment of inpatient paediatric care in first referral level hospitals in 13 districts in Kenya

Mike English, Fabian Esamai, Aggrey Wasunna, Fred Were, Bernhard Ogutu, Annah Wamae, Robert W Snow, Norbert Peshu

Summary

Background The district hospital is considered essential for delivering basic, cost-effective health care to children in resource poor countries. We aimed to investigate the performance of these facilities in Kenya.

Methods Government hospitals providing first referral level care were prospectively sampled from 13 Kenyan districts. Workload statistics and data documenting the management and care of admitted children were obtained by specially trained health workers.

Findings Data from 14 hospitals were surveyed with routine statistics showing considerable variation in inpatient paediatric mortality (range 4–15%) and specific case fatality rates (e.g., anaemia 3–46%). The value of these routine data is undermined by missing data, apparent avoidance of a diagnosis of HIV/AIDS, and absence of standard definitions. Case management practices are often not in line with national or international guidelines. For malaria, signs defining severity such as the level of consciousness and degree of respiratory distress are often not documented (range per hospital 0–100% and 9–77%, respectively), loading doses of quinine are rarely given (3% of cases) and dose errors are not uncommon. Resource constraints such as a lack of nutritional supplements for malnourished children also restrict the provision of basic, effective care.

Interpretation Even crude performance measures suggest there is a great need to improve care and data quality, and to identify and tackle key health system constraints at the first referral level in Kenya. Appropriate intervention might lead to more effective use of health workers’ efforts in such hospitals.

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Introduction

Reducing child mortality in developing countries has again become the focus of some attention and increasingly, the critical role of functional health systems in delivering effective interventions is acknowledged. The delivery of several interventions, especially case management, assumes a pyramidal structure of primary health care, with the district hospital and associated district health administration at the system’s apex. Clinically, such centers should provide appropriate local expertise for referral care and supervision of peripheral units, and should contribute vital morbidity and mortality data to national health information systems, in theory allowing distribution of resources according to need. Care in district hospitals might therefore be expected to have a large effect on the overall performance of health systems. However, little is known about the effectiveness of such facilities in sub-Saharan Africa, although broad based assessments for international benchmarking have been optimistically proposed. In view of the potential leadership, supportive, and advocacy roles of district hospitals in reducing child mortality we aimed to assess child health-care practices at this level in Kenya. Moreover, if improving the health system is an objective in its own right, then developing an understanding of where interventions need to be targeted and how to measure their effect is essential, especially if donor funds are to be used efficiently. Since methods to assess hospital performance are poorly defined, we undertook a baseline survey in Kenya as a first step in this process.

Methods

We surveyed inpatient paediatric care in district hospital between July 8, and Oct 4, 2002. Data were obtained by three teams of three to four people working in parallel at separate hospitals. All survey staff were skilled Kenyan health workers trained for 3 weeks in survey procedures including pilot exercises in one district and one provincial hospital.

Survey procedures

Most survey instruments were adapted from ones that had been previously developed. However, since no suitable methods were identified for collection of longitudinal case-based data, a specific data recording form was developed and piloted between April, and June, 2002 (available on request from the authors). Annual hospital workload data were collected with the assistance of hospital records officers and cross-checked against primary sources. When annual summary data were not available, estimates were derived from ward admission and discharge registers. In these cases, survey staff chose the most recent, continuous period of 3 months for which data were complete as the basis for annual estimates. For data about pregnancy outcomes in

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stillbirth or early neonatal death, and that one in
14 children admitted (range: one in seven to one in 20) are likely to die in hospital (table 1). However, these figures might represent an underestimate because in half the hospitals data for the outcome of premature or very low birthweight infants were incomplete or missing. When data were available, prematurity or low birthweight was the most common cause of inpatient paediatric death in four hospitals. Excluding this category, malaria and anaemia were recorded as the most frequent cause of paediatric admission and death in ten and nine hospitals, respectively, with pneumonia the most frequent cause of admission and death in the remaining hospitals. Classification of cause of admission and death was not straightforward. Malaria was diagnose and treated on admission in 386 (60%) of 639 inpatients. In 59 (15%) of these cases, the diagnosis was made without laboratory confirmation and in 72 (19%) it was made despite a negative test. In 81 (21%) cases, in whom malaria was recorded as the reason for hospital admission, only a negative malaria test result was common, the order of recording diagnoses could therefore have greatly affected the reported prevalence and case fatality of disease (table 1). This theory seems particularly true for malaria with or without anaemia and malaria with or without pneumonia but is less relevant for easily identifiable diseases such as measles. The difficulty in using hospital data is further emphasised in the case of HIV/AIDS. Despite having survey sites in several areas with expected HIV seroprevalence in adults of more than 15%,14 HIV/AIDS was rarely reported as a cause of admission or death in children although all hospitals reported offering testing.

**Case management**

**Malaria and anaemia**

Key clinical signs that form part of national8 and international guidelines for classification of the severity of malaria, and that are recommended to guide decisions on transfusion in anaemic children with malaria9,11,12 were rarely documented (table 2). Although a loading dose of quinine in the treatment of severe malaria is recommended worldwide,9,10 only ten (3%) of 362 children given quinine were prescribed a loading dose and nine of these were treated in the same hospital. 74 children with anaemia or malaria, or both, had transfusion; in 11 (15%), haemoglobin was not measured. Of 63 children, haemoglobin values before transfusion were between 50 and 60 g/L in 17 (27%), and more than 60 g/L in six (10%). In those with haemoglobin higher than 60 g/L, no rationale for this departure from international guidelines was documented.

**Pneumonia**

Pneumonia was diagnosed in 206 (32%) of 639 cases. Nationally and internationally recommended signs for classifying disease severity and choosing treatment13,14 were infrequently documented (table 2). Respiratory rates were recorded in 84 (41%) of 206 pneumonia cases but were 40 beats per minute or higher in only 11% of these. Overall, an odd numbered respiratory rate was recorded on only one of 225 occasions, and often a restricted range of rates were documented in any one hospital. In 147 (71%) cases antibiotics appropriate for very severe pneumonia were prescribed although only 16% of pneumonia admissions to one well characterised district hospital in Kenya15 were recorded to be very severe (English M, unpublished data). Oxygen use is described in table 3.

**Meningitis**

Only 13 children were diagnosed with meningitis on admission, but 46 were documented to have either a fever and a stiff neck, or, a fever and a history of convulsions and at least one indication of an abnormal mental state (e.g., irritability, lethargy). Lumbar puncture was not done in any child although 13 hospital laboratories said they could do CSF microscopy.

**Diarrhoea/malnutrition**

Of 117 children with an admission diagnosis of non-bloody diarrhoea, 66 (56%) were prescribed antibiotics, generally cotrimoxazole with metronidazole. Of these, 22 (19%) were not prescribed fluids at all whereas 76 (65%) were prescribed intravenous fluids. When intravenous fluids were used, prescriptions of only 39 (51%) included both volume and duration of fluid, and ten (26%) of these suggested an infusion rate that equated roughly to normal maintenance requirements only. A clinical diagnosis of severe malnutrition was made in 27 children on admission. Only four were prescribed frequent special milk feeds of appropriate volume for their weight. Often, feeding plans simply stated “special milk” and in three instances “high protein diet” (contraindicated in acute, severe malnutrition16). Other aspects of supportive care for children with malnutrition17 were rarely requested or available (table 3).

**Performance indicators with system organisation implications**

<table>
<thead>
<tr>
<th>Performance measure</th>
<th>Number</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site specific results</td>
<td>35% (0%–80%)</td>
<td>Four hospitals reported rarely or never having access to scales for children, weights were recorded in 15% of children in these hospitals compared with 43% in other hospitals</td>
</tr>
<tr>
<td>Pooled data</td>
<td>31/53 (58%)</td>
<td>All hospitals reported access to oxygen but paediatric wards often reported that demand outstripped supply and 3 of 14 hospitals had serious problems with flow meters. Only 2 of 12 hospitals had any oxygen saturation measuring device</td>
</tr>
<tr>
<td>Malnutrition: proportion without a specific written feeding plan</td>
<td>21/27 (78%)</td>
<td>Ten hospitals reported never having and one hospital reported rarely having appropriate formula milk feeds for severe malnutrition</td>
</tr>
<tr>
<td>Malnutrition: proportion prescribed multivitamins</td>
<td>27/27 (100%)</td>
<td>13 of 14 hospitals reported rarely or never having government stock</td>
</tr>
<tr>
<td>Malnutrition: proportion prescribed vitamin A</td>
<td>9/27 (33%)</td>
<td>11 hospitals reported always or usually having vitamin A available</td>
</tr>
<tr>
<td>Malnutrition: proportion prescribed mineral supplements or potassium</td>
<td>0/27 (0%)</td>
<td>13 of 14 hospitals reported rarely or never having mineral supplements or oral potassium supplements and no hospitals had Resomol*</td>
</tr>
<tr>
<td>Neonatal care: number of hospitals giving vitamin K prophylaxis</td>
<td>2/14 (14%)</td>
<td>11 of 14 hospitals reported rarely or never having vitamin K</td>
</tr>
<tr>
<td>Neonatal care: number of hospitals able to support feeding</td>
<td>14/14 (100%)</td>
<td>All hospitals were able to offer nasogastric or cup and spoon feeding but only one had supplies of neonatal formula milk for short term supplementation</td>
</tr>
</tbody>
</table>

*Specific WHO-recommended rehydration solution for malnourished children.

Table 3: Performance indicators with system organisation implications.
Table 4: Parenteral drug doses prescribed

<table>
<thead>
<tr>
<th>Drug</th>
<th>Daily dose recommended in national guidelines</th>
<th>Daily dose recommended in WHO guidelines</th>
<th>Median (20th–90th percentile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinine (n=282)</td>
<td>20 mg/kg/day</td>
<td>20 mg/kg/day</td>
<td>29 mg/kg/day (19–48)</td>
</tr>
<tr>
<td>Gentamicin* (n=188)</td>
<td>5–7·5 mg/kg/day</td>
<td>7·5 mg/kg/day†</td>
<td>4·6 mg/kg/day (2·5–8·6)</td>
</tr>
<tr>
<td>Penicillin* (n=304)</td>
<td>120–240 mg/kg/day</td>
<td>120–240 mg/kg/day</td>
<td>141 mg/kg/day (89–240)</td>
</tr>
<tr>
<td>Chloramphenicol (n=53)</td>
<td>50–100 mg/kg/day</td>
<td>75–100 mg/kg/day</td>
<td>79 mg/kg/day (43–159)</td>
</tr>
<tr>
<td>Diazepam (n=44)</td>
<td>0·3 mg/kg</td>
<td>0·2–0·3 mg/kg</td>
<td>0·41 mg/kg (0·31–0·85)</td>
</tr>
</tbody>
</table>

*Children older than 7 days only were included in this analysis. †National guidelines recommend a three times daily regimen; WHO guidelines recommend a once daily regimen.

**Drug doses**

Quinine, gentamicin, penicillin, and chloramphenicol were the most often prescribed parenteral antimicrobial drugs. Prescribed doses per kg bodyweight showed considerable variation with, not uncommonly, evidence of worrying degrees of overdosing for both quinine and chloramphenicol (table 4). Dose results calculated for quinine, penicillin, and gentamicin using only cases with a recorded weight differed insignificantly from those calculated after replacement of missing values (data not shown). By contrast with quinine and chloramphenicol, doses of gentamicin were low. Gentamicin was prescribed once daily in only 1% of cases, perhaps reflecting 1994 national guidelines11 advising a three times daily regimen. Diazepam was the most commonly prescribed emergency drug for the immediate treatment of seizures. Prescribed doses were high, 5 (10%) cases were prescribed almost three times the recommended dose (table 4). One child prescribed an excessive dose died, although whether the doses were given as prescribed or whether drug error contributed to the fatal outcome was uncertain.

**Discussion**

We have described in detail the technical aspects of paediatric care provided in 13 districts of Kenya focusing on the initial medical management of common serious conditions. Curative care of seriously ill children in the most critical phase of admission seems rarely to be provided by doctors and almost never by paediatricians. This finding has important implications for the current IMCI approach that aims to channel severely ill children to hospitals for referral care. Although IMCI includes guidelines for hospital based care,9 our data and the report of Nolan and colleagues17 suggest that appropriate assessment and treatment cannot be assumed. In cases of malaria, information about the level of consciousness or degree of respiratory distress—features that in the past decade have come to define severe malaria in African children14,15—were often not recorded. This absence of information might result in unnecessary use of parenteral drugs9 and prevent children being appropriately reviewed. Although blood transfusion for severe anaemia can be life-saving,20 inappropriate use of blood, possible in up to 40% of transfused cases in this survey, could expose children to significant risk of HIV and other infections19 and inappropriately deplete a vital commodity. In cases of diarrhoea, antibiotics and intravenous fluids were inappropriately or poorly used. Most children with malnutrition received little appropriate treatment and, despite reasonable indications for lumbar puncture in 46 children with possible meningitis, no lumbar punctures were done. For all these conditions, national11,12 and international evidence based guidelines exist.11,12

Of equal importance were inaccuracies in drug prescribing. Accidental drug errors are an uncommon but substantial concern in developed countries.22,23 Paediatric dosing often depends on a calculation based on the child’s weight, but in this study in almost two thirds of cases there was no recorded weight. For common drugs, dosage ranges per kg bodyweight in children with a recorded weight were clinically equivalent to the estimates generated after entering missing weights, and we felt justified in generalising this approach. Although this extrapolation of NCHS standards to a more malnourished Kenyan population is not ideal, any bias introduced is likely to underestimate the prevalence of overdosing and overestimate underdosing. In view of these caveats, our data suggest about one in ten doses of quinine and chloramphenicol were potentially dangerously high if sustained. Daily doses of gentamicin were often low and when given in three divided doses it is possible that the resultant low peak levels considerably reduced efficacy,24 especially in treatment of meningial or respiratory tract infections. The absence of monitoring or respiratory support facilities make the very high bolus doses of diazepam prescribed in the context of acute seizures also worrying.

For practical reasons there were drawbacks to our survey design. Hospitals were not randomly selected, no account was taken of the different levels at which data were related (eg, by hospital or clinician responsible for admission), we did not attempt to weight summary performance measures, and sampling took place over 3 months in a country where disease pattern can be highly seasonal. Furthermore, hospitals visited were informed about the survey in advance and survey workers undertook their tasks openly. However, the survey was national in scope, included representation from diverse settings, and was undertaken in partnership with district, provincial, and national administrative bodies. Thus, despite the limitations, and although this survey was unable to explore in detail the reasons for the problems encountered, our data provide useful insight into the process of paediatric care at the first referral level in Kenya. Since the disease burden in Kenyan children and the state of its health sector have much in common with several African countries our findings might also be of wider interest.

Effective health-care planning needs accurate information. Failure to include important groups of patients such as premature or very low birthweight infants, or children with HIV/AIDS, misclassification of illnesses, and failure to account for disease severity can result in misdirected policies. These failures might also prevent the effects of major health care interventions such as the vaccine against Haemophilus influenzae type b being recognised, and make it impossible to identify hospitals or communities in difficulty. For example, how should case fatality rate from anaemia that ranges between 3% and 46% be interpreted? Detailed examination of root causes could provide valuable insight. However, unless the severity of illness, presence of co-morbidity, and outcome are clearly and accurately defined, this approach and approaches modelling...
routine data might be of little value in explaining variations in hospital performance.

Our data suggest that there are considerable problems with first referral care of children with common, serious diseases. Interventions in many areas may be of benefit. Improving the technical component of care, targeting clinical officers in particular, through pre-service and in-service training, true, the development and implementation of appropriate guidelines, ongoing supervision, and a focus on quality improvement might help. System constraints such as staffing levels, skill mix, and the provision of appropriate equipment, adequate drugs, and consumables must also be tackled. Addressing problems could need local action, such as the use of hospital income to purchase appropriate feeds for malnourished children, or national action including amendments to the essential drugs list (for example, to include vitamin K) and strategic human resource planning. Some problems might need international approaches—for example, vital mineral supplements for severely malnourished children are not, as far as we know, available from any regular source. Understanding the factors affecting hospital performance and developing simple performance monitoring tools that allow the most effective use of interventions are also needed. Until these processes exist, our data indicate that simple instruments used by non-specialist staff might be valuable as advocacy tools, focusing attention on key illnesses and basic services.

Our data also have important implications for translation of new evidence into practice and the benefit of new treatments. The absence of quinine loading doses, the persistence with multiple daily doses of gentamicin, and the failure to administer vitamin A in malnutrition, suggest that major barriers to implementation of evidence exist at all levels. These problems do not seem to exist exclusively in paediatrics. During this survey, as an indicator condition, data were collected for the use of magnesium sulphate for eclampsia, a treatment supported by research in collecting for the use of magnesium sulphate for eclampsia, a treatment supported by research in the development and implementation of appropriate guidelines, ongoing supervision, and a focus on quality improvement might help. System constraints such as staffing levels, skill mix, and the provision of appropriate equipment, adequate drugs, and consumables must also be tackled. Addressing problems could need local action, such as the use of hospital income to purchase appropriate feeds for malnourished children, or national action including amendments to the essential drugs list (for example, to include vitamin K) and strategic human resource planning. Some problems might need international approaches—for example, vital mineral supplements for severely malnourished children are not, as far as we know, available from any regular source. Understanding the factors affecting hospital performance and developing simple performance monitoring tools that allow the most effective use of interventions are also needed. Until these processes exist, our data indicate that simple instruments used by non-specialist staff might be valuable as advocacy tools, focusing attention on key illnesses and basic services.

Inevitably, the focus of this report is on problems within the system. However, in most hospitals many basic supplies were available, including oxygen, antibiotics, antimarial, intravenous fluids, and vitamin A amongst others. Clinicians were diligent in recording some signs (eg, the presence of pallor), and it is probably unfair to conclude that absence of documentation indicates lack of assessment for other signs. The system of care is clearly therefore functioning which is a credit to the many health professionals at work in sometimes very difficult circumstances. The desire expressed by these personnel for further training and better information would, however, seem to suggest that there is considerable capacity for improving performance through interventions directed at both personnel and system needs. Improving such services might also be one way to improve referral patterns and overcome barriers to use of services, increasing the benefit that hospitals have on the surrounding population. Targeted improvements in district hospital based care might then benefit the entire pyramid of primary health care, provide accurate data to monitor health outcomes, and address issues of equity. Support for this sector seems an inescapable component of global health ambitions.28

Contributors
All investigators contributed to the design and implementation of the survey, reviewed the results, contributed to and approved the manuscript. M English co-ordinated survey design, trained the survey staff, supervised the fieldwork, and was responsible for the analysis and drafting of the manuscript.

Conflict of interest statement
M English, N Peshu, R W Snow, and B Ogutu worked for or with the Kenya Medical Research Institute, part of the Kenyan Ministry of Health. A Wamae works for the Kenyan Ministry of Health, and F Essaami, A Wasunna, and F Were worked for government-supported universities and in government hospitals. There are no other conflicts of interest.

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10 most wanted

In the stroke of time

March, 2004

1 Statins for stroke (March 6, 2004)
Heart Protection Study Collaborative Group. Effects of cholesterol-lowering with simvastatin on stroke and other major vascular events in 20 536 people with cerebrovascular disease or other high-risk conditions. DOI:10.1016/S0140-6736(04)15690-0. Lancet 2004; 363: 757–67

2 Drug combination for arthritis (Feb 28, 2004)

3 MAGIC effects (March 6, 2004)

4 Understanding hypothyroidism (March 6, 2004)

5 The future for myeloma research (March 13, 2004)

6 Management of pericarditis (Feb 28, 2004)

7 Exploiting RNA interference for therapy (Oct 25, 2003)

8 Complacency over public health (March 6, 2004)

9 Analysis of stroke trials (March 6, 2004)

10 MMR: time to look forward (March 6, 2004)