DIAGNOSTIC AND PRESCRIBING PRACTICES IN PERIPHERAL HEALTH FACILITIES IN RURAL WESTERN KENYA

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Abstract. Health facility ledgers of 11 rural health facilities in western Kenya were reviewed to evaluate diagnostic and prescribing practices. Clinics lacked laboratory facilities. Of 14,267 sick child visits (SCVs), 76% were diagnosed with malaria and/or upper respiratory infections. Other diagnoses were recorded in less than 5% of SCVs. Although two-thirds of malaria cases were diagnosed with co-infections, less than 3% were concomitantly diagnosed with anemia. Chloroquine and penicillin constituted 94% of prescriptions. Half of children given a sole diagnosis of measles or pneumonia were prescribed chloroquine, and 22% of children with a sole diagnosis of malaria were given penicillin. Antimalarials other than chloroquine were rarely prescribed. Only 12% of children diagnosed with anemia were prescribed iron supplementation, while 53% received folic acid. This study highlights limited diagnostic and prescribing practices and a lack of adherence to national treatment guidelines in rural western Kenya.

INTRODUCTION

Implementation of integrated management of childhood illness (IMCI) has been recommended to strengthen primary health care services in rural Africa. Measurement of the impact of IMCI or new drug policies depends on routine surveillance data through active and passive case finding. Data from routine health surveillance may best represent the local disease burden, and may thus be used to adapt local services to local needs. While national programs are attempting to strengthen district level surveillance systems, the quality of the data so generated is questionable. For more effective introduction of new interventions, a clear understanding of routine diagnostic and prescribing practices at peripheral health facilities is needed.

We examined health facility records for more than 14,000 sick child visits (SCVs) to rural health facilities in western Kenya in preparation for a randomized controlled trial of permethrin treated bed nets (ITNs). We present data on diagnoses made and prescriptions given. These diagnoses are compared with disease prevalence data generated contemporaneously through active morbidity surveillance at baseline for the ITN trial. We discuss diagnostic and prescribing practices, as revealed retrospectively through facility ledgers, at these peripheral facilities in the context of policies set at national level. The implications for malaria control are discussed, within the context of ITN implementation. The impact of ITNs on the incidence of SCVs to peripheral health facilities is described in an accompanying article.

MATERIALS AND METHODS

Study site and population. The health facility catchment population resides within the study area of the ITN trial. Asembo, with an area of 200 km², is in the Bondo (formerly Siaya) administrative district, northeast of Lake Victoria in Nyanza Province in western Kenya. The population of 55,000 consists mainly of ethnic Luo subsistence farmers and fishermen. Rain falls year round, but is usually heaviest between March and May, with a second smaller peak in October and November. Malaria transmission is holoendemic and perennial. Residents experience 60–300 infective bites per person each year, and 70–90% of children less than five years of age are infected with Plasmodium falciparum. Numerous studies have shown the failure of chloroquine in treating P. falciparum infections. By 1994, the incidence of moderate-to-high parasitologic resistance (RII + RIII responses) was estimated to be more than 70%, while clinical failures (by day 7) were recorded in 52% of the patients by 1996. Malaria accounts for nearly 50% of outpatient hospital visits, and was ascribed as the cause of half of all hospital deaths in young children. Malnutrition in children 3–18 months of age is common, especially before the harvest. More than half of all pregnant women surveyed had hemoglobin (Hb) levels less than 11.0 g/dL. In children less than five years old, 70–80% are anemic (Hb level <11.0 g/dL), and up to 20% have an Hb level <7.0 g/dL during peak malaria transmission. The seroprevalence of human immunodeficiency virus (HIV) in pregnant women was estimated to be 14% between 1994 and 1996 (Centers for Disease Control and Prevention, unpublished data). Cholera and bacillary dysentery are endemic. In 1996, Asembo had one mission hospital and 15 health facilities, three-fourths of which were government-supported. While private facilities charge for services, health care is free at government facilities, although some charge for medicines. Government-run district hospitals in Siaya and Kisumu towns are too far away (50 km) to be regularly used by children from Asembo.

Passive surveillance in peripheral health facilities. In early 1996, all health facilities in the study area were identified and records were examined to estimate the number of sick children seeking health care at each, prior to ITN distribution. A passive surveillance network was established in selected facilities. Laboratory diagnosis was not routinely available in any facilities. Diagnoses and treatment were based on clinical symptoms alone as assessed by community nurses, as reported in the facility ledgers. Thirteen of 15 facilities had registers available for review. The Kenya national treatment guideline was available in one of the 13 health facilities at the time of data collection. The ITN project staff conducted...
visits by children 2–5 years old, were calculated for the two younger (less than two years old) age groups with the rate of SCVs by age group, which compared the rate of visits by children less than five years old visiting health facilities was 12 per 1,000 (95% confidence interval [CI] = 11.08–12.92) compared to 9 per 1,000 (95% CI = 8.00–10.00) for children less than five years old. The frequency of SCVs and diagnosed malaria cases was highest 2–3 months after the peak rainfall (Figure 1). Peak SCVs corresponded with increases in malaria diagnosis. Diarrhea, dysentery, and respiratory diseases peaked during the drier seasons. The short rainy season (commonly occurring in October–November) did not occur in the latter half of 1996, and was characterized by a parallel decrease in the total number of SCVs and diagnosed malaria cases. The median age of children less than five years old visiting health facilities was 12 (interquartile range = 6–24) months. The frequency of SCVs was strongly correlated with age, with children less than two years old comprising 68.1% of the SCVs (Figure 2). Infants less than six months old, those 6–11 months old, and children 1–2 years old visited health facilities 3.17 (95% CI = 3.03–3.31), 2.89 (95% CI = 2.76–3.03), and 1.88 (95% CI = 1.80–1.97) times more often, respectively, than children 2–5 years old.

Statistical analysis. Analysis was performed using SPSS (SPSS, Inc., Chicago, IL) Microsoft Excel® (Microsoft, Redmond, WA) Epi-Info version 6.01 (Centers for Disease Control and Prevention, Atlanta, GA), and SAS release 8.1 (SAS Institute, Cary, NC) software packages. Relative risks (RRs) of SCVs by age group, which compared the rate of visits by children 2–5 years old, were calculated for the two-year period of 1995–1996. Children could contribute more than one visit to the numerator. Census data from the first quarter of 1997 were used for denominators. The RR by age group for diagnoses and prescriptions used the number of SCVs as the denominator. Ninety-five percent confidence limits (CLs) are reported, as well as P values associated with a summary chi-square statistic that tests the null hypothesis of no association between age and particular diagnoses or prescriptions. Two-sided P values <0.05 were considered statistically significant.

Ethical clearance. The study was reviewed and approved by the institutional review boards of the Kenya Medical Research Institute (Nairobi, Kenya) and the Centers for Disease Control and Prevention (Atlanta, GA).

RESULTS

Between January 1995 and December 1996, 14,267 SCVs by children less than five years old were made to 11 peripheral health facilities in Asembo for which data were available. The frequency of SCVs and diagnosed malaria cases was highest 2–3 months after the peak rainfall (Figure 1). Peak SCVs corresponded with increases in malaria diagnosis. Diarrhea, dysentery, and respiratory diseases peaked during the drier seasons. The short rainy season (commonly occurring in October–November) did not occur in the latter half of 1996, and was characterized by a parallel decrease in the total number of SCVs and diagnosed malaria cases. The median age of children less than five years old visiting health facilities was 12 (interquartile range = 6–24) months. The frequency of SCVs was strongly correlated with age, with children less than two years old comprising 68.1% of the SCVs (Figure 2). Infants less than six months old, those 6–11 months old, and children 1–2 years old visited health facilities 3.17 (95% CI = 3.03–3.31), 2.89 (95% CI = 2.76–3.03), and 1.88 (95% CI = 1.80–1.97) times more often, respectively, than children 2–5 years old.

Malaria and upper respiratory tract infection (URTI) were the most common diagnoses and represented 66% and 33% of SCVs (Figure 3). Overall, 76% of SCVs were diagnosed as either malaria or URTI. Diarrhea and helminth infections each accounted for 5% of the diagnoses and pneumonia accounted for 4%. All other illnesses each contributed 3% or fewer of the diagnoses. Anemia and malnutrition were recorded in 2% and 1% of SCVs. Cerebral malaria was diagnosed in 19 (0.1%) of SCVs while tuberculosis was diagnosed in 13 SCVs. Human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), vitamin A deficiency, and failure to thrive were diagnosed only once each during the two years of monitoring. Vaccine-preventable diseases included measles (448 cases; ranked as the sixth most common illness), hepatitis (34 cases), mumps (25), pertussis (10), meningitis (9), polio (8), and tetanus (3).

The median age of sick children differed by diagnosis. Illnesses such as malaria, URTI, diarrhea, pneumonia, anemia, and dehydration were more frequently diagnosed in children less than one year of age. Skin infections, otitis media, dysentery, trauma, malnutrition, and helminth infections were more common in older children. Infants less than six months old were three times as likely to be diagnosed with anemia, and twice as likely to be diagnosed with pneumonia, as 2–5-year-old children (Figure 2).


Sick children were commonly diagnosed with multiple illnesses. Measles was the only common disease predominantly diagnosed as a single illness (61%). Eighty-seven percent of SCVs diagnosed with helminthic infections and 59% of all malaria cases were given a second concomitant diagnosis. Malaria was the only common illness diagnosed in which multiple diagnoses were associated with age; children less than one year of age were significantly more likely to receive multiple diagnoses compared with children more than one year of age (RR = 1.07, 95% CL = 1.03–1.10). Malaria and URTI were most commonly diagnosed in combination. Of the 5,532 children diagnosed with malaria who were given additional diagnoses, 55.2% were in association with URTI, but only 2.6% were in association with anemia (Figure 4).

In the eight facilities that systematically recorded prescriptions, 22,568 medicines were prescribed for 9,318 SCVs (mean = 2.42 medicines per SCV). Age was not associated with the number of treatment received. Chloroquine, penicillin, and antipyretics were the most common medicines prescribed to 70%, 61%, and 59% of the SCVs, respectively (Figure 5). Overall, 94% of the prescriptions involved chloroquine (33%), penicillin (25%), or the combination of penicillin and chloroquine (36%). These drugs were usually administered by injection at the time of the SCV. Cotrimoxazole, oral rehydration salts, anthelmintics, and antihistamines were prescribed to less than 7% of the children, and all other medicines were prescribed to less than 5% of the children.

Medicines prescribed by diagnosis loosely adhered to standard treatment practices. Of the 2,488 children with malaria as a sole diagnosis, 22% received penicillin. Nearly half (49%) of all children with a sole diagnosis of measles received chloroquine in combination with other routine treatments, while 46% and 38% of the SCVs with a single diagnosis of pneumonia or diarrhea received a prescription of chloroquine (Table 1). Alternative antimalarials such as sulfadoxine-pyrimethamine or quinine were prescribed to 53 (0.8%) of the malaria cases. Iron supplementation was prescribed to just 12% of children diagnosed with anemia, while 53% received folic acid supplementation.

**DISCUSSION**

In this paper, we describe diagnostic and prescribing practices for sick children less than five years of age who visited peripheral health facilities in rural western Kenya, where malaria transmission is intense. We used data as recorded in the facility ledgers as a proxy for clinical practice. As is common for clinics in this area, no laboratory facilities were available. About two-thirds of the SCVs were for children less than two years old; approximately three-fourths of these visits were diagnosed as malaria, URTI, or both. Diarrhea and helminth infection were the only other two diagnoses commonly made. In the absence of laboratory facilities, it is unclear if these data suggest an indiscriminate diagnosis of malaria for many SCVs, or if they reflect the true proportion of sick children with acute malarial disease. Use of passive case detection has
not been recommended for monitoring of malaria control programs in areas of intense transmission because it is considered to be an insensitive indicator under these conditions.\(^2\) Nonetheless, a reduction of 27% in all SCVs and a reduction of 30% in malaria cases was detected via passive surveillance at these same clinics consequent to the introduction of ITNs.\(^7\)

Malaria is a main cause of severe anemia in this area, and malaria-associated anemia contributes substantially to child mortality.\(^27\) Despite this, anemia was diagnosed in only 2% of SCVs. Since facility registers lacked systematic records for symptoms, we do not know whether children diagnosed (or not) with anemia exhibited relevant clinical signs (palmar, nail, or conjunctival pallor).\(^28,29\) During prospective monitoring of SCVs at the same facilities during the ITN trial (1997–1998), only 36 (0.27%) of 13,176 sick children were noted by their caregivers to have *renato matin edel* (white blood), despite a 15% prevalence of moderate-severe (<7.0 g/dL) anemia and a 34% prevalence of pallor detected actively in children in the study area.\(^21\) While it was common for facilities to diagnose sick children with multiple illnesses, mostly in association with URTI, only 1.5% of children with malaria were also diagnosed with anemia. Improved understanding of the causes of anemia, coupled with improvements in its diagnosis through clinical algorithms (such as the IMCI), as well as introduction of laboratory facilities to determine hemoglobin concentrations in rural health clinics, is clearly a public health priority.

A single case of HIV/AIDS was diagnosed during the two-year study period. The seroprevalence of HIV among pregnant women in the study area was estimated to be 14% between 1992 and 1994; by 1998 this had increased to approximately 21% (Kenya Medical Research Institute/Centers for Disease Control and Prevention, unpublished data). Under these conditions, approximately 5–8% of the infants would be expected to be infected with HIV, assuming a 40% probability of mother-to-child transmission in the context of extended breastfeeding.\(^30\) Thus, it is highly likely that the staff at clinics in this area are treating co-infections associated with HIV/AIDS in children.\(^31\) Tools to diagnose HIV are required to identify children needing a package of supplementary measures. The IMCI algorithm may provide guidelines for a tentative diagnosis of HIV in this setting, and offer measures to improve the quality of life of HIV-infected children.

Lack of medicines, absence of updated guidelines and laboratory facilities, and inadequate training combine to produce a very limited scope of prescription practices. More than 94% of all prescriptions involved chloroquine and penicillin, either alone, or in combination. We presume that these drugs were often given as a safeguard treatment for undiagnosed malaria or bacterial infections. For example, half of all SCVs with a sole diagnosis of measles and pneumonia and one-third of SCVs with sole diagnosis of bronchitis or diarrhea were administered chloroquine. Twenty-two percent of SCVs with a sole diagnosis of malaria were given penicillin. Another possible reason for the administration of these drugs is the strong demand for parenteral medication in this community. Periodic observation at the health facilities showed that most doses of penicillin and the first dose of chloroquine are given by injection. Recognition of this entrenched prescribing habit is required if IMCI is to be successfully implemented. By 1994, *P. falciparum* was known to be highly resistant to chloroquine in this area,\(^13–15\) yet less than 1% of diagnosed malaria cases received antimalarials other than chloroquine. In the national clinical guideline (1994) for prescribing of drugs,\(^26\) sulfadoxine-pyrimethamine (SP) was recommended for treatment of malaria in areas with high levels of chloroquine resistance. However, only facilities that independently bought this drug had SP available. By 2000, SP had replaced chloroquine as first-line therapy. During 2001, chloroquine was banned by the Ministry of Health, although illegal importation and prescription continues. While SP is not easily available in the parenteral formulation in this area, it is likely that the practice of prescribing first-line antimalarials, oral or

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**TABLE 1**

Prescription of medicines by eight peripheral health facilities for children <5 years old diagnosed with a single disease only, 1995–1996, in Kenya*  

<table>
<thead>
<tr>
<th>Diagnosis (cases)</th>
<th>Top 5 medicines (% of cases) prescribed for cases with a single diagnosis only [Number missing prescription]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malaria (n = 2,488)</td>
<td>Chloroquine (89); antipyretics (67); penicillin (22); oral rehydration salts (7); anti-histamines (4) [110]</td>
</tr>
<tr>
<td>URTI (n = 540)</td>
<td>Penicillin (85); antipyretics (39); chloroquine (17); antihistamines (12); cotrimoxazole (5) [10]</td>
</tr>
<tr>
<td>Measles (n = 172)</td>
<td>Penicillin (91); antipyretics (78); chloroquine (49); cough syrup (34); cotrimoxazole (22) [3]</td>
</tr>
<tr>
<td>Pneumonia (n = 144)</td>
<td>Penicillin (79); antipyretics (50); chloroquine (46); cough syrup (25); ampicillin (10) [12]</td>
</tr>
<tr>
<td>Otitis media (n = 111)</td>
<td>Penicillin (91); antipyretics (45); chloroquine (16); antihistamines (8); nystatin (6) [7]</td>
</tr>
<tr>
<td>Bronchitis (n = 104)</td>
<td>Penicillin (88); antipyretics (68); chloroquine (30); cough syrup (16); cotrimoxazole (9) [8]</td>
</tr>
<tr>
<td>Diarrhea (n = 87)</td>
<td>Antipyretics (44); chloroquine (38); oral rehydration salts (32); cotrimoxazole (27); SP (17) Flagyl (metronizadole) (17) [6]</td>
</tr>
<tr>
<td>Helminths (n = 60)</td>
<td>Anti-helminthics (75); antipyretics (22); penicillin (18); chloroquine (17); anti-histamines (15) [0]</td>
</tr>
<tr>
<td>Anemia (n = 19)</td>
<td>Folate (53); chloroquine (47); penicillin (47); iron (12); other (12) [2]</td>
</tr>
</tbody>
</table>

URTI = upper respiratory tract infection; SP = sulfadoxine-pyrimethamine.
parenteral, to children with a single diagnosis unrelated to malaria will continue. This increased drug pressure may shorten its effective life. Studies on the coast of Kenya have demonstrated rapid spread of *P. falciparum* isolates with reduced sensitivity to SP due to point mutations in the dihydrofolate reductase gene.22,23

Analysis of the treatment of anemia revealed that only 53% and 12% of the small number of cases detected received folate and iron supplementation, respectively. The much lower use of iron compared with folate was likely due to the lack of availability of iron in these clinics and to the controversy surrounding the use of iron supplements in malaria-endemic areas.54 Availability and use of oral rehydration salts was less than that found in studies elsewhere,55 although the Ministry of Health rapidly provided oral rehydration salts for treatment of cholera during an outbreak in 1997.23

In Kenya, identical drug packs are distributed to areas with very different disease profiles.26 Furthermore, national treatment policies appear to percolate slowly down to the periphery. Overlap in the clinical presentation of malaria and respiratory illness, specifically pneumonia in studies in Malawi,27,28 resulted in the development of World Health Organization guidelines in 1993 that recommended the combined treatment of pneumonia and malaria with a sulfa drug, such as cotrimoxazole.39 Enactment of this policy requires renewed efforts as countries in Africa now adopt SP for first-line treatment of malaria. This study highlights the need for effective efforts to strengthen diagnostic and prescribing practices at peripheral levels of the health care system. It also reflects the need to implement, as an adjunct to effective treatment, interventions (such as ITNs) for the prevention of malaria to improve child survival in rural areas of sub-Saharan Africa.

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REFERENCES


19. ter Kuile FO, Terlouw DJ, Phillips-Howard PA, Hawley WA,


