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Melisa Shah Date

PEDIATRIC MALARIA AT A RURAL HEALTH CLINIC IN WESTERN KENYA,

JUNE 2006-JULY 2010

By

Melisa Shah

Master of Public Health

Epidemiology

_____

Dr. Kevin Sullivan
Committee Chair

PEDIATRIC MALARIA AT A RURAL HEALTH CLINIC IN WESTERN KENYA,

JULY 2006- JUNE 2010

By

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B.A.
Stanford University
2006

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An abstract of
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Rollins School of Public Health of Emory University
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Abstract

PEDIATRIC MALARIA AT A RURAL HEALTH CLINIC IN WESTERN KENYA, JULY 2006- JUNE 2010

By Melisa Shah

Background: Malaria is an important cause of morbidity and mortality, particularly in Africa which bears the majority of burden from the infection. Clinic-based surveillance of malaria is an important tool to track trends in malaria prevalence in rural Africa.

Objective: This study aims to describe trends and factors associated with malaria positivity among children under five at a rural clinic in Western Kenya from July 2006 to June 2010. The primary objective is to elucidate whether malaria positivity at the clinic varied during the four year study span.

Methods: The International Emerging Infections Program is a clinic-based morbidity surveillance in rural Western Kenya. Demographic and clinical data from this program was obtained for all children under five attending care at the Lwak Referral Center between July 2006 and June 2010. Logistic regression models were conducted to assess the relationship between malaria positivity and year of visit accounting for age, sex, bednet use, rainfall, and distance to clinic.

Results: From July 2006 to June 2010, 18,925 children under five attended Lwak Referral Center for a sick visit. Of all children seeking care, 47.7% were laboratory diagnosed with malaria. When age, sex, bednet use, rainfall, and distance to clinic are accounted for, year of visit was significantly associated with malaria positivity ($p<.0001$). Children visiting the clinic between July 2008 and June 2009 had the highest odds of malaria positivity of all four year categories when compared to the first year (OR 3.67, 95%CI: 3.21-4.19). Older children, children not sleeping under bednets, children travelling two kilometers or farther, and children visiting the clinic during times of rainfall of 164mm/month of greater, had increased odds of malaria positivity.

Conclusions: Clinic-based surveillance provides an important snapshot of pediatric malaria trends. In rural western Kenya between July 2006 and June 2010, malaria positivity among children under five at a clinic was associated with year of visit, age, bednet use, distance to clinic, and rainfall. In particular, heavy rainfall in the year between July 2008 and June 2009 contributed to increased pediatric malaria clinic diagnoses.

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TABLE OF CONTENTS

BACKGROUND

1.1 History of Malaria in Africa

More than two billion people are at risk of acquiring malaria, a disease caused by a parasite of the *Plasmodium* genus carried by *Anopheles* mosquitoes[1]. Today, malaria is an important cause of morbidity and mortality, particularly in Africa which bears 70% of the total global morbidity of malaria[1]. In 2000, malaria accounted for an estimated 18% of all child deaths in sub-Saharan Africa[2].

In 1955, the Global Malaria Eradication Programme was launched by the World Health Organization (WHO) armed with dichloro-diphenyl-trichloroethane (DDT) for vector control and chloroquine for clinical management. However, with the emergence of chloroquine and DDT-resistance, the goal of malaria eradication was soon abandoned. The 1970's and 1980's saw an alarming surge in chloroquine-resistant strains of *Plasmodium* which prompted the formation of a series of malaria initiatives focusing on Africa, including the WHO's Roll Back Malaria movement in 1998[3].

International advocacy and funding for malaria control has rapidly increased over the past decade. There has been an unprecedented increase in international funding commitments, which rose from 0.3 billion in 2003 to 1.7 billion in 2009[4]. This new funding has largely gone towards a set of priority interventions for African countries, including insecticide-treated nets (ITN), indoor residual spraying (IRS), reduction of pregnancy-related malaria sequelae, replacement of failing drugs with artemisinin-based combination therapy (ACT), and improvement of rapid point-of-care diagnostics[3].

Evidence from certain areas of Africa suggests reductions in malaria transmission and incidence during the past decade. Between 2000 and 2008, greater than 50% reductions in the number of reported malaria cases and deaths were seen in four high-burden countries including Eritrea, Rwanda, Sao Tome and Principe, and Zambia. In Zambia, child mortality rates also dropped 35% during this time. Reductions of over 50% were also seen in low transmission countries including Botswana, Cape Verde, Namibia, South Africa, and Swaziland.

While these reductions seem to be associated with intense malaria control activities, the relationship of such interventions to level of disease is complex. For example, although many reported reductions in malaria incidence span over five years and are unlikely to be entirely due to climate variation, the role of climate and other factors cannot be excluded. Additionally, these data must be used with caution as they stem largely from health facility data and may not be applicable at the community or population level. Finally, malaria reductions in certain regions of Africa may not reflect the situation in other communities and countries, and data is unavailable from many African countries with weak surveillance systems[4].

The goal of malaria eradication has been resurrected sporadically, particularly after dramatic success occurs in a few places[5]. For now, countries in Africa are continuing to focus on targeting the Millennium Development Goals for reducing childhood mortality with intense malaria control activities.

1.2 ***Malaria in Kenya***

In the entire African region, Kenya has received the largest percentage of external assistance – 11% which translates to 182 million dollars from 2000-2007. In 2008, Kenya had 71% coverage of long-lasting insecticidal nets, the highest coverage in the South-East sub-region of Africa[4]. In 2001 the Kenyan Government adopted a policy on ITNs to ensure 60% coverage by 2010. In 2006 the Ministry of Health, using Global Fund grants, launched a widespread distribution campaign of free ITNs to children under the age of five years, which rapidly increased ITN coverage nationwide[6]. A study of six clinical sites across Kenya showed an average ITN coverage of 20.3% in 2005 which increased to 41% by 2007[7].

Policies for malaria treatment have changed in Kenya over the past decade. A study in a highland area of Kenya found consultation of shopkeepers a very common method for initial malaria treatment which often leads to inappropriate and delayed treatment[8]. Between 2000 and April 2006, sulphadoxine-pyremethamine (SP) was the only drug available in most government clinics. However, the efficacy of SP declined rapidly over this period[9]. First line treatment was officially changed in April 2004 to the more efficacious artemether-lumefathrine (AL), and the new policy was implemented in Kenya during September of 2006. During the contentious presidential election on December 27, 2008, political instability caused stock-outs in malaria drugs across the country for several months. During this time, over 1,000 people were killed and 350,000 Kenyans were displaced from their homes[10].

While Kenya has taken intense malaria control measures, the relationship between reports of declining malaria incidence in Kenya and malaria control interventions remains circumstantial and complex. With the complex interplay of parasite biology, weather conditions, and resistance patterns, the effect of public health interventions on malaria burden is difficult to quantify with retrospective studies.

Several studies conducted in Kenya show that changes in malaria incidence over the past decade has differed in various parts of the country. A study published in 2010 by Okiro *et al.* indicates divergent temporal patterns of disease incidence across eight clinical sites in Kenya. When the 2006-2009 time period is compared to 2003-2006 levels, hospitalization from malaria showed a significant reduction in six sites. However, the authors show that the decline in four of these sites started prior to scaled interventions[7]. In an earlier study of 17 clinical sites across Western, Coastal, and high altitude regions of Kenya, little variation in malaria admission rates from 2000-2008 was found, although there was some evidence of rising rates in some western districts (Siaya and Bondo) during this time period[11]. Another study conducted in the highlands of Kenya, reports possible interruption of malaria transmission in two highland areas of Kenya as a result of widespread annual IRS insecticide treatment and use of ACT as first-line treatment for uncomplicated malaria[12]. A study in the coastal region of Kenya shows evidence of declining malaria transmission, with an increase in mean age of slide positive hospitalized patients and an increase in the proportion of severe disease presenting as cerebral malaria[13].

1.3 CDC-Kenya and the Emerging Infections Program in Rural Western, Kenya

Since late 2005, the Centers for Disease Control and Prevention's (CDC) International Emerging Infections program (IEIP) in collaboration with the Kenya Medical Research Institute (KEMRI), has conducted population-based, morbidity surveillance in rural Western Kenya and an urban, informal settlement in Nairobi. This surveillance system provides a unique method for close monitoring of disease burden in rural settings. The objectives of the surveillance are to define disease burden, describe epidemiologic patterns of disease, and evaluate the health impact of interventions over time in these populations. To achieve this, disease is characterized in a clinic setting as well as through home visits.

In Western Kenya, the IEIP study population is located in Asembo, part of Bondo District, Nyanza Province, off the shores of Lake Victoria[14]. The area comprises 100 square kilometers with an overall population density of 325 persons per square kilometer. The surveillance program covers approximately 25,000 individuals in 33 villages. Subsistence farming and fishing are the main sources of livelihood in the area, and the ethnicity of the population is largely Luo. Houses are widely dispersed around small fields for farming. The average estimated household wealth was 600-700 US dollars in 1998[15].

In Asembo, malaria is endemic and occurs year round. In 1999, free ITNs were provided for all children under five in Asembo. In 2003, 20% of the population of the Bondo District was less than five years old. The population had an estimated child mortality rate of 227 per 1000 live births in 2002 [14]. Asembo has a high prevalence of

HIV with 11% in men and 21% in women aged 13-34 in 2003 [16]. Rainfall is heaviest in March through May and October through November.

All participants in the IEIP program in Western Kenya must have resided permanently in the area for four calendar months and have been registered into the KEMRI/CDC Demographic Surveillance System (DSS). Field workers make home visits every two weeks to collect information about recent symptoms, exposures, and care-seeking behavior. The data is recorded with PDA's and then uploaded into a central database.

Participants can access free health care at a centrally located clinic called the Lwak Referral Center in Asembo which is staffed by physicians[17]. The Lwak Referral Center houses a laboratory with staff trained in malaria identification and diagnosis. The IEIP program can track sick child visits (SCVs) to Lwak Referral Center. Previous studies have indicated that SCVs are useful for documenting temporal changes in disease burden and the impact of healthcare interventions[18]. In this rural western region of Kenya, where walking is the main mode of travel and other transport options are limited, distance from a health facility partly determines attendance for sick visits[19]. During sick visits, data are gathered using a structured questionnaire administered to the child's caretakers asking about symptoms in the past two weeks and care seeking for the current illness. Between 2004 and 2006, Lwak had an increase in SCVs of 114%[18].

The purpose of this present study is to examine temporal changes in pediatric malaria prevalence at Lwak Referral Center from July 2006 to June 2010 as well as to

describe the demographic factors associated with malaria positivity among children under five years of age attending the clinic.

METHODS

This was a clinic-based study of malaria diagnoses among children under five years of age attending care at Lwak Referral Center from July 2006 to June 2010. This study stemmed from a surveillance program in Western Kenya led by the CDC and KEMRI. The main outcome of interest was malaria positivity, as determined by trained staff examining Giemsa-stained blood smears. The main predictor was year of sick visit over a four year time period. All pediatric sick visits to Lwak Clinic were included from July 2006 to June 2010. Patients with a reported or documented fever who did not receive a peripheral blood smear were excluded from the study. Patients were classified as negative for malaria if they had a negative blood smear or no blood smear done. The association of rainfall, gender, age, and distance to the clinic were also examined. Rainfall was calculated as the average monthly rainfall in the month prior to the sick visit.

Data were obtained from the CDC and KEMRI International Emerging Infections Program surveillance project based in Kisumu, Kenya. The surveillance project collects clinical, demographic, and laboratory data on each child visiting the Lwak Referral Center, where they receive free care. Data was gathered using a structured questionnaire asking about symptoms in the past two weeks, treatment history, care seeking for the current illness, and risk factors. Demographic data, height, weight, vital signs, and physical examination findings were also recorded on the questionnaire. Data on Giemsa blood smear results and parasite counts were recorded. The questionnaire was administered to the child's caretaker by paid clinicians and other non-clinician

recorders. The diagnosis, treatment, disposition, and hospital course for each sick child at Lwak was recorded. The questionnaires were scanned using TeleForm software and imported into SAS. Monthly rainfall data were obtained from the measurements taken at the Kisumu airport. Distance to clinic was obtained from GPS data collected at the household level as part of the larger surveillance project.

Descriptive statistics were conducted on 18,549 children attending Lwak Referral Center from July 2006 to June 2010. We excluded 371 visits due to the omission of Giemsa-stained blood smears in the setting of a documented fever of greater than or equal to 38.0 Celsius. Five sick visits were excluded because of implausible data on age and date of birth. In the main study analysis, 18,549 child sick visits were examined over a four-year period. In the bivariate analysis we compared demographic data on malaria positive and malaria negative pediatric patients using the chi-squared test for dichotomous variables and t-test for normally distributed continuous variables using an alpha level of 0.05. As risk factors for malaria positivity in the bivariate analysis, we included year of visit, age, sex, reported bednet use, distance to clinic and rainfall during the month prior to visit.

For the multivariate analysis, the dependent variable was whether the patient had malaria diagnosed by the criteria described above. Logistic regression analysis was conducted including in the multivariable model variables found to have a p-value of ≤ 0.2 in bivariate analysis. Dichotomous categories for distance to clinic and rainfall were created based on similar odds ratios in multi-level classification (Appendix A). Year of pediatric sick visit was the primary independent variable under consideration. The effect

of interaction was assessed among each predictor and the year of visit, the main predictor. Variables not found to be confounders using a greater than 10% change in estimates approach were considered for removal from the full model. All analyses were performed using SAS (version 9.2).

Logistic regression models were used to assess the relationship between malaria positivity and the four years under consideration. Backward elimination was conducted to assess the significance of first-order interactions between the exposure variable (year of sick visit) and other potential predictors of malaria positivity. Beginning with a full model including the exposure variable, all covariates, and all potential first-order interaction terms between the exposure variable and covariates, terms were eliminated until only statistically significant terms remained. Given the large sample size, interaction terms which did not have a meaningful effect on the relationship between year and malaria positivity were removed regardless of statistical significance. The final model consisted of all significant confounders and effect modifiers.

RESULTS

There were 18,925 sick visits of children under five years of age at Lwak Referral Center between July 1, 2006 and June 30, 2010. On average, there were approximately 13 visits per day across the four year time period. The average number of visits increased across the study period. There were 7,157 visits between July 2009 and June 2010 compared to 2,174 visits between July 2006 and June 2007.

Over the four year period, 9,018 children had laboratory diagnosed malaria via positive Giemsa-stained blood smears, 7,458 children had negative Giemsa-stained blood smears, and 2,073 children had no blood smear done or the smear was missing. The total number of malaria positive blood smears and percent malaria positive trends upwards over the four years and seasonal variation occurred during high-transmission and rainy months (Chart 1 and 2). Over one-third of children (35.5%) had a documented fever on presentation to the clinic. The most common parasite species was *Plasmodium falciparum*, followed by *Plasmodium malariae* and *Plasmodium ovale*. The mean parasite count was 37,317 per microliter of blood. The reported bednet usage on the night before coming to clinic was 93.3% during the four year period. Almost half of the children (49.6%) were given an anti-malarial drug at the time of visit, with Coartem being the most commonly used. About half of children (46.7%) visited elsewhere prior to coming to the clinic, with a chemist being the most common place visited. Almost half of the children had taken a medication prior to coming to the clinic. Only 0.43% of children had reported antiretroviral use. Danger signs for severe illness as defined by the Integrated Management of Childhood Illness (IMCI), including child not drinking or

breastfeeding, child vomiting everything, convulsions, lethargy or unconsciousness, was recorded in 17.4% of children. 14.7% of patients were admitted to the clinic as outpatients or referred to another facility. Among all children who visited the clinic, 34 (0.2%) ultimately died after admission. Female children made up 48.6% of visits while male children made up 51.4% of children which was not a statistically significant difference (p=0.8473). The mean age was 2.28 years with children ≥ 1 and <2 most likely to present at the clinic (Table 1).

In the bivariate analysis, each year of visit was significantly associated with malaria positivity compared to the first referent year (p<.0001). Compared to July 2006-June 2007, there was a 2.86 increased odds of malaria positivity in July 2007-June 2008, 3.83 times increased odds during July 2008-June 2009, and 3.75 times increased odds in July 2009-June 2010. Children older than one year were more likely to have malaria than children under the age of one (p < .0001). The age distribution of children with and without malaria differed (Chart 3). The mean age for children with laboratory confirmed malaria at the clinic was 2.56 years versus a mean of 2.01 years for children not diagnosed with malaria (p < .0001). There was not a significant association between gender and malaria positivity (p=0.8473). The odds of malaria among children without reported bednet use the previous night was greater than the odds of malaria among children using bednets (OR 1.24, 95%CI: 1.11-1.40). Children travelling less than two kilometers to reach the clinic were statistically less likely to have malaria than children travelling greater than two kilometers to reach the clinic (OR 1.30, 95%CI: 1.22-1.38). Children attending clinic with an average monthly rainfall of 164mm/month or greater

during the previous month were significantly more likely to have malaria than children visiting the clinic when previous monthly rainfall was less than 164 mm/month ($p<.0001$). Unadjusted odds ratios for rainfall stratified by year are shown in Appendix B.

Bednet use, rainfall, and distance to clinic were all statistically significant effect modifiers of the relationship between year and malaria positivity. However, after stratification, a meaningful interaction was not appreciated with bednet usage and distance to clinic. Lagged monthly rainfall did emerge as an important effect modifier and the interaction of rainfall and year of visit was included in the final model. The final model included year of visit, age, bednet use, rainfall, distance to clinic, and the interaction between rainfall and year. Gender of the child was the only factor not included in the multivariate model given the lack of association in bivariate analysis ($p=0.8473$). With respect to the covariates, year of child visit was a significant predictor of malaria positivity for all three time year categories when compared to the first referent year of July 2006-June 2007. The year period between July 2008 and June 2009 had the highest odds of malaria positivity of all the year categories (OR 3.67, 95% CI: 3.21-4.19). Children age three were the most likely to be positive for malaria compared to all other under five year age categories after adjustment (OR 3.2, 95% CI: 2.90-3.53). Bednet use overall was protective against malaria, with children not using a bednet during the night prior to their clinic visit having increased odds of malaria positivity (OR 1.20, 95% CI: 1.06-1.35). After adjustment for all covariates, children living greater than or equal to two kilometers from Lwak Referral Center had a 1.28 increased odds of malaria positivity (95% CI: 1.20-1.37) (Table 3).

When examined by rainfall only over the four year time period, children visiting during the month after rainfall of ≥ 164mm/month were not statistically more likely to have malaria than children visiting during a month of less average rainfall (OR 1.18, 95% CI: 0.90-1.54). However, when the interaction between rainfall and year was taken into consideration, there was a significant difference in malaria positivity by level of lagged monthly rainfall and year. Rainfall is a stronger predictor of malaria positivity during the later year categories compared to the first referent category. In July 2008-June 2009 in particular, there was a 19 times increased odds of malaria compared to the reference year with low rainfall (OR 18.96, 95%CI: 14.12-25.46) (Table 3).

DISCUSSION

In western Kenya, we examined demographic, clinical, and care-seeking behaviors among children under five attending an outpatient clinic (Lwak Referral Center) over a four year time period spanning July 2006 and June 2010. The data provided an opportunity to explore characteristics and factors associated with malaria positivity among a large sample size of children (n=18,549) attending a peripheral clinic in rural Kenya. The CDC in collaboration with KEMRI began offering free high-quality care to all children in Asembo (a part of Bondo District) enrolled in the International Emerging Infections Program (IEIP) in 2005, and data collection began in full during 2006. Since the launching of free health care services in Lwak, our data indicate a large increase in children seeking care at the Lwak Referral Center from 2006 to 2010. Since the first year of data collection (July 2006-June 2007), the likelihood of being diagnosed with malaria at this clinic has increased during the subsequent three years with the peak being between July 2008-June 2009. This general trend of increased visits may be partly due to increased knowledge and acceptance of the free program.

The clinic population of children under five years of age travelled a mean distance of 2.97 kilometers for their visit. A prior study in this region showed the presence of the distance-decay effect, which indicates that children's attendance to sick visits declines based on the distance to clinic[19]. In this clinic population, children travelling from two kilometers away or farther are more likely to be diagnosed with malaria compared to children living within a two kilometer radius of the clinic (OR 1.28,

95%CI:1.20-1.37). This data may suggest that children travelling from farther away come to the clinic with more serious illness due to the inconvenience and cost of travel.

In 1999, free insecticide treated bednets (ITNs) were provided to all children under five in Asembo and in 2002 large-scale social marketing of ITNs in Kenya began[18]. Our study reflects the widespread availability and use of bednets in this area of Western Kenya. The vast majority (93.3%) of all children receiving care at Lwak Referral Center reported using a bednet during the previous night over the four year study period with a slight trend of increasing bednet use by the fourth year. Between July 2009 and June 2010, only 4.8% of child did not report using a bednet while 9.01% of children visiting between July 2007 and June 2008 reported not using a bednet the previous night. While there was a statistically significant association between year and bednet use, upon further examination this association was not meaningful.

The age distribution of children visiting the clinic stratified by malaria positivity reveals a pattern where slightly older children are more likely to have have malaria than the youngest children. In this clinic population the mean age of children with malaria (2.56 years) was higher than the mean age of those without malaria (2.01 years). The highest risk group for malaria was children three years old who had 3.20 the odds of being diagnosed with malaria compared to children under one year after controlling for other factors.

Rainfall is a known risk factor for malaria as it promotes *Anopheles* mosquito breeding. In our population, monthly rainfall average lagged by one month was significantly associated with malaria positivity in the clinic setting. When rainfall was

greater than or equal to 164 mm the previous month, a child had an increased odds of having malaria (OR 1.6, 95% CI: 1.50-1.70) without adjustment for other factors. Interestingly, the effect of rainfall on malaria positivity differed by year of sick visit. In the year between July 2008 and June 2009, there was a particularly strong effect of rainfall on malaria positivity with higher levels of rainfall (≥ 164 mm/month) associated with a 19 fold increase in the odds of a malaria diagnosis. There were high levels of rainfall at the end of 2008 which likely contributed to the increased malaria positivity during that year.

After accounting for the age of the child, rainfall levels, distance to the clinic, and bednet use, year of visit was still a strong predictor of malaria positivity ($p<.0001$). This indicates the likely presence of other factors contributing to an increase in percent malaria positivity which were not available in this study. This study is limited by not including other environmental and biological factors which may predict malaria positivity, including temperature, humidity, household structure, and proliferation of larval habitats. Additionally, in this clinic-based population, the effect of repeat visits by the same child was not examined and may have been an independent predictor of malaria positivity. Sick visits increased throughout the study period and it is possible that during the first full year of surveillance (July 2006-June 2007) which is also the referent year, the free care service was new to both patients and staff limiting comparisons to subsequent years. Given the clinic-based design, the factors prompting children to attend the clinic cannot be controlled for and may introduce bias. Finally the

use of odds ratios instead of prevalence odds ratio slightly overestimates the associations.

In summary, this study demonstrates the effect of various factors on pediatric malaria at the clinic level. Rainfall was an important determinant of malaria positivity among children under five in rural Western Kenya, and rainfall varied over a four year time period. Bednet use, age, and distance to clinic were also important determinants of malaria positivity in this population. By understanding trends and predictors of malaria, interventions to decrease the burden of malaria in this region can be better implemented.

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TABLES AND CHARTS

Table 1: Characteristics of Children Under 5 at Lwak Referral Center in Western Kenya from July 2006 to June 2010

	All Visits (n=18.549)
Year of Visit	
July 2006-June 2007	2174 (11.7%)
July 2007-June 2008	4079 (22.0%)
July 2008-June 2009	5139 (27.7%)
July 2009-June 2010	7157 (38.6%)
Sex	
Male	9535 (51.4%)
Female	9004 (48.6%)
Mean Distance Travelled to Clinic (kilometers)	2.97
Mean Age in years	2.28
0-1 Years	4245 (22.9%)
1-2 Years	4618 (24.9%)
2-3 Years	3630 (19.6%)
3-4 Years	3224 (17.4%)
4-5 Years	2827 (15.2%)
Total Giemsa Smears Done	16476 (88.2%)
Positive Giemsa Smears (% of smears positive)*	9018 (54.7%)
Falciparum	8691
Malariae	310
Ovale	119
Vivax	0
Mean Parasite Count (per ul blood)	37,317
Bednet Use Previous Night	17, 116 (93.3%)
Fever ≥ 38.0C	6576 (35.5%)
Given Antimalarial at Visit	9190 (49.6%)
Coartem	7361
Quinine	1851
Amodiaquine	157
SP	54
Visited Elsewhere First	8656 (46.7%)
Chemist	4070
Shop/Duka	1480
Health Center	985
Nyamrerwa	758
Hospital	476
Family Friend	97
Traditional Healer	85
Bush Doctor	27
Community Health Worker	19
Private Clinic	12
Other	321
Taken Prior Medication	8818 (47.6%)
Children taking antiretroviral medications	44 (0.43%)
Has an IMCI Danger Sign+	3226 (17.4%)
Admitted^	2730 (14.7%)
Deaths after admission	34 (0.2%)

*Patients infected with multiple malaria parasites are represented in each species category applicable.
+Includes child not drinking/breastfeeding, vomiting everything, convulsions, lethargy, or unconsciousness
^This includes referral to PGH, Admission to Lwak, Referall to Bondo District Hospital, or refusal of admission.

Table 2: Characteristics of Children Under 5 with Laboratory-diagnosed Malaria at Lwak Referral Center in Western Kenya from July 2006 to June 2010

	Smear Positive (n=9018)	Smear Negative or No Smear (n=9531)∞	Crude Odds Ratio (95% CI)	p-value
Year				
July 2006-June 2007	510 (23.5%)	1664 (76.5%)	*Reference*	
July 2007-June 2008	1905 (46.7%)	2174 (53.3%)	2.86 (2.54-3.21)	<.0001
July 2008-June 2009	2775 (54.0%)	2364 (46.0%)	3.83 (3.42-4.29)	<.0001
July 2009-June 2010	3828 (53.5%)	3329 (46.5%)	3.75 (3.36-4.19)	<.0001
Age (years)				
< 1	1289 (30.4%)	2956 (69.6%)	*Reference*	
1	2141 (46.4%)	2477 (53.6)	1.98 (1.82-2.16)	<.0001
2	2073 (57.1%)	1557 (42.9%)	3.05 (2.78-3.35)	<.0001
3	1891 (58.7%)	1333 (41.4%)	3.25 (2.96-3.58)	<.0001
4	1624 (57.5%)	1203 (42.6%)	3.10 (2.80-3.42)	<.0001
Sex				
Female	4384 (48.7)	4621 (51.3%)	*Reference*	
Male	4628 (48.5%)	4907 (51.5%)	1.00 (0.94-1.05)	0.8473
Bednet Use Previous Night				
Yes	8295 (48.5%)	8821 (51.5%)	*Reference*	
No	666 (53.9%)	570 (46.1%)	1.24 (1.11-1.40)	<.0001
Mean Distance to Lwak				
< 2 Kilometers	2532 (44.2%)	3203 (55.9%)	*Reference*	
≥ 2 Kilometers	6486 (50.6%)	6328 (49.4%)	1.30 (1.22-1.38)	<.0001
Mean Rainfall				
< 164mm/month	5874 (45.2%)	7135 (54.9%)	*Reference*	
≥ 164 mm/month	3144 (56.8%)	2396 (43.3%)	1.60 (1.50-1.70)	<.0001

∞ Patients with documented fevers but no blood smear done (n=291) were excluded from the study.

Table 3: Association of Year of Visit to Malaria Positivity with respect to Covariates among Children Under 5 Attending Care at Lwak Referral Center in Western Kenya from July 2006-June 2010

		Adjusted Odds Ratio	**95% CI**	**p-value**
Year				<.0001
July 2006-June 2007		*Reference*		
July 2007-June 2008		2.68	2.34-3.07	
July 2008-June 2009		3.67	3.21-4.19	
July 2009-June 2010		3.44	3.02-3.93	
Age (Years)				<.0001
< 1		*Reference*		
1		1.83	1.67-2.00	
2		3.01	2.74-3.31	
3		3.20	2.90-3.53	
4		3.01	2.72-3.34	
Bednet Use Previous Night				0.0036
Yes		*Reference*		
No		1.20	1.06-1.35	
Mean Distance to Lwak				<.0001
< 2 Kilometers		*Reference*		
≥ 2 Kilometers		1.28	1.20-1.37	
Rainfall				
< 164 mm/month		*Reference*		
≥ 164 mm/month		1.18	0.90-1.54	.2414
Year	**Rainfall**			
July 2006-June 2007	*< 164 mm/month*	*Reference*		
July 2006-June 2007	*≥ 164 mm/month*	1.18	0.90-1.54	.2414
July 2007-June 2008	*< 164 mm/month*	2.68	2.34-3.07	<.0001
July 2007-June 2008	*≥ 164 mm/month*	5.51	4.48-6.77	<.0001
July 2008-June 2009	*< 164 mm/month*	3.67	3.21-4.19	<.0001
July 2008-June 2009	*≥ 164 mm/month*	18.96	14.12-25.46	<.0001
July 2009-June 2010	*< 164 mm/month*	3.44	3.02-3.93	<.0001
July 2009-June 2010	*≥ 164 mm/month*	7.07	5.63-8.88	<.0001

Chart 1: Total Malaria Cases and % Malaria Positive in Children Under Five Visiting Lwak Referral Center in Western Kenya from July 2006 – June 2010

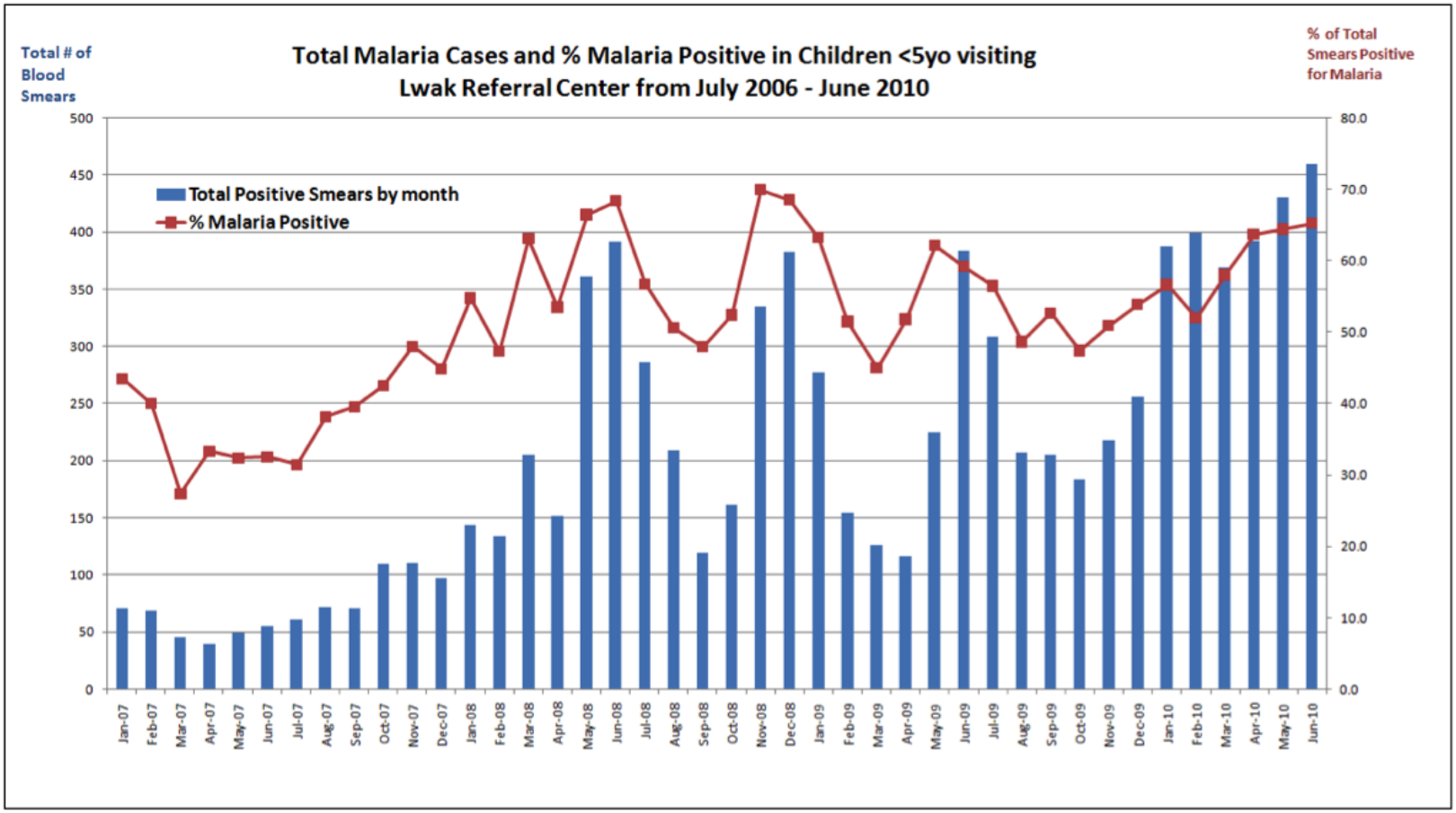


Chart 2: Monthly Rainfall and % Malaria Positive in Children Under Five Visiting Lwak Referral Center in Western Kenya from July 2006 – June 2010

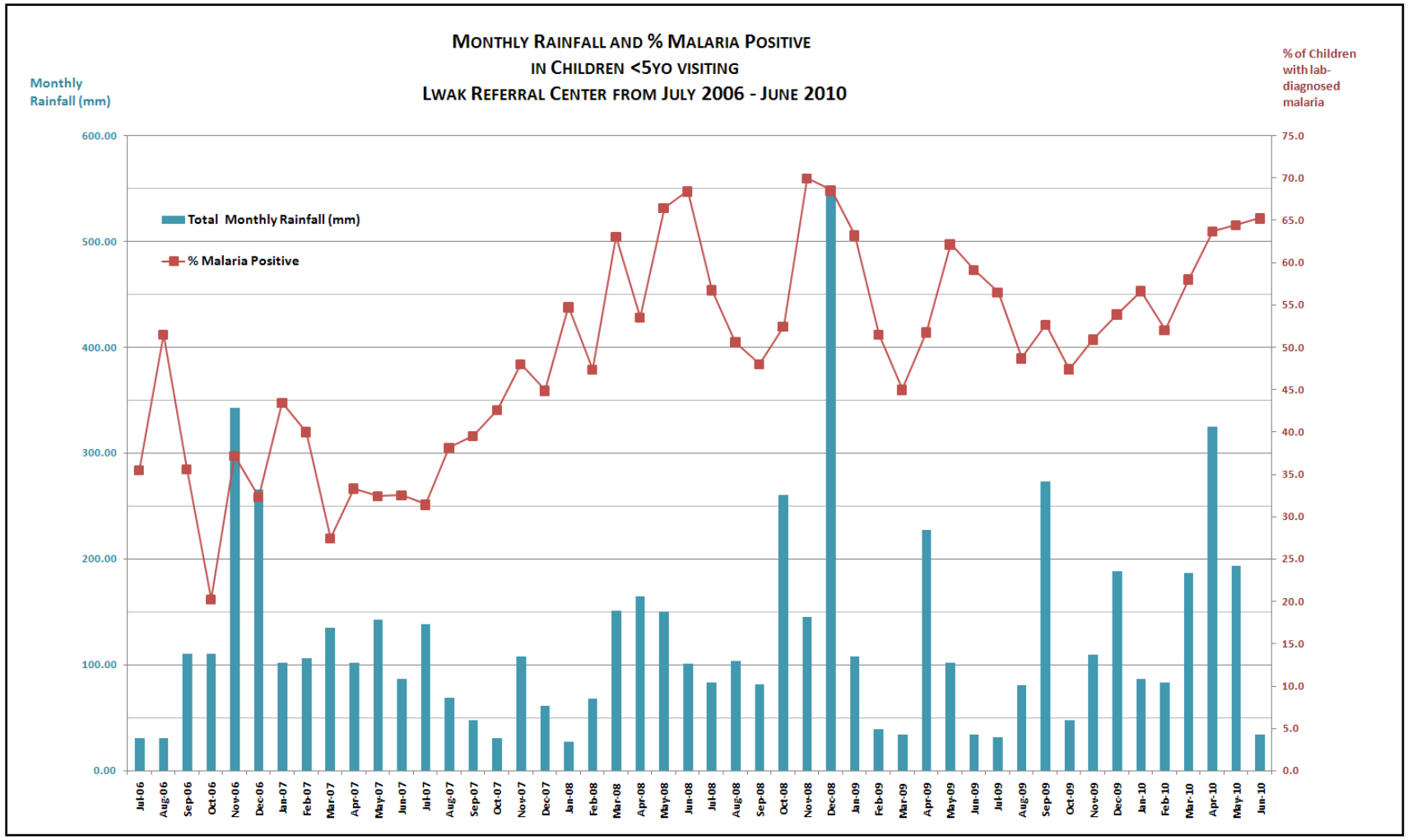
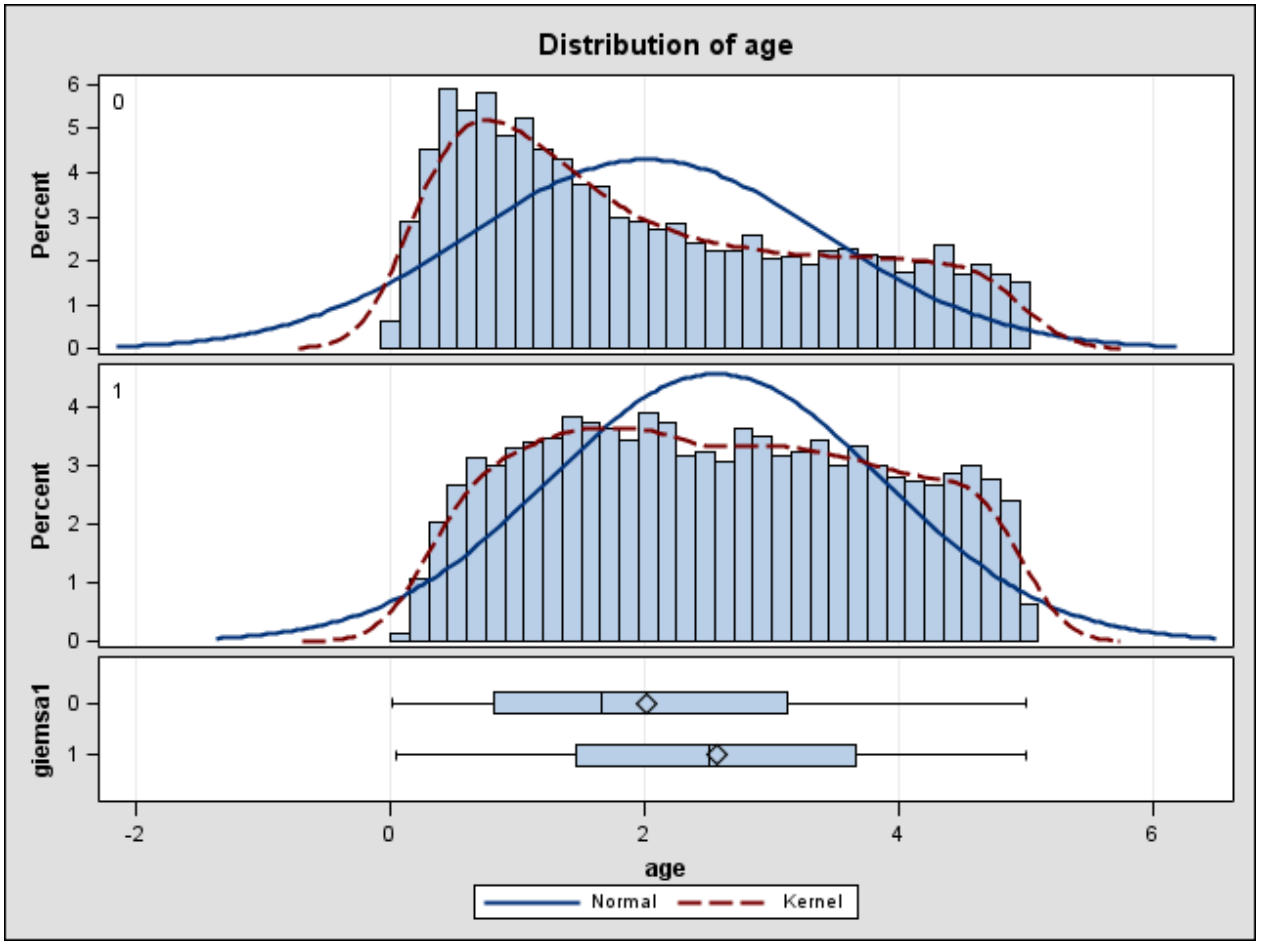


Chart 3: Age Distribution in Children Under Five with and without Confirmed Malaria Diagnoses Visiting Lwak Referral Center in Western Kenya from July 2006 – June 2010



The top chart represents patients with negative giemsa-stained smears or no smears done at all. The bottom chart represents the age distribution of patients with laboratory confirmed malaria.

APPENDICES

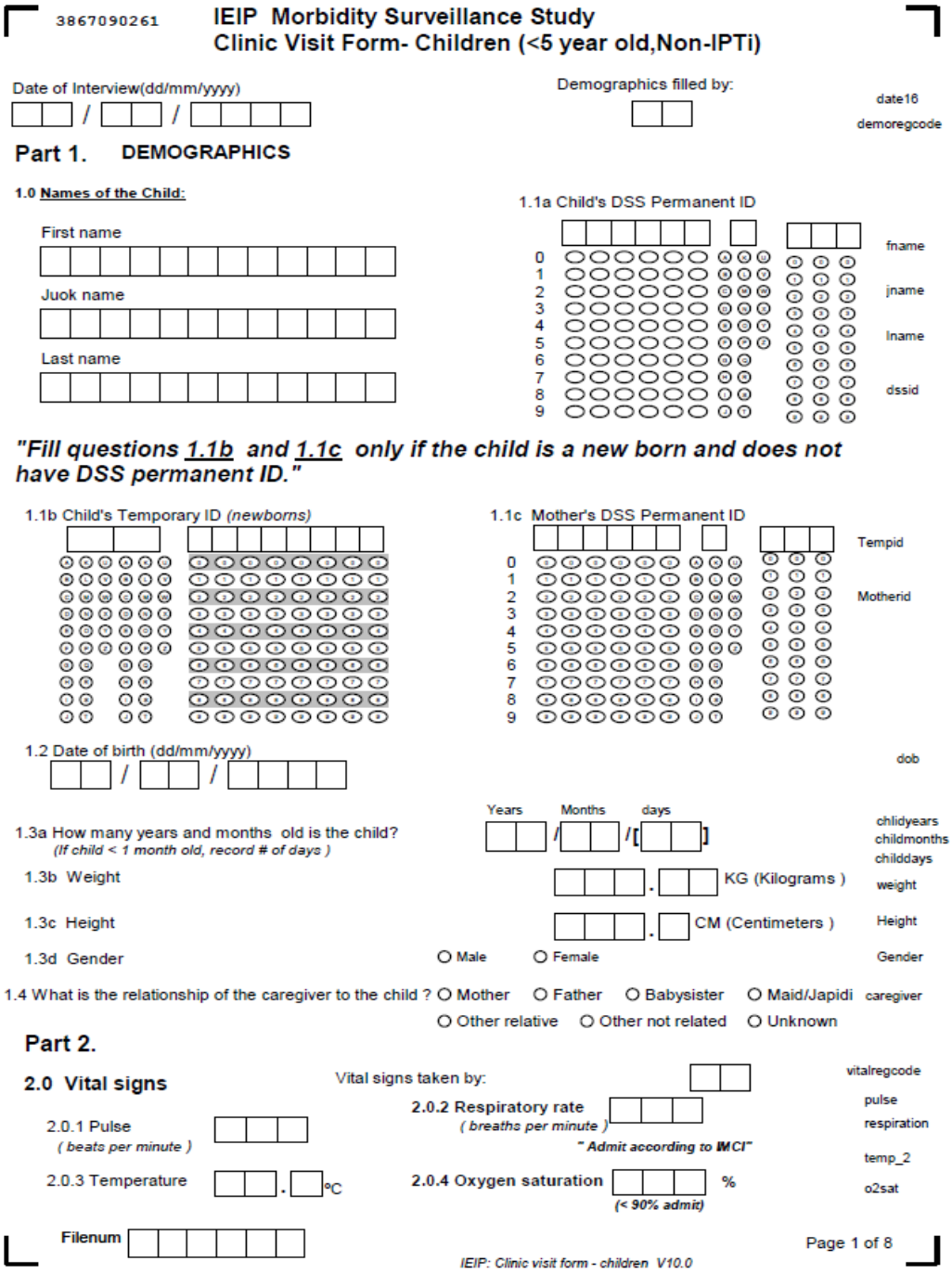
Appendix A: Bivariate Analysis with Increased Levels for Two Covariates - Distance to Lwak and Lagged Monthly Rainfall

	Smear Positive (n=9018)	**Smear Negative or No Smear (n=9531)∞**	**Crude Odds Ratio (95% CI)**
Mean Distance to Lwak			
< 1 Kilometer	1212 (42.1%)	1666 (57.9%)	*Reference*
≥ 1 and < 2 Kilometers	1320 (46.2%)	1537 (53.8%)	1.18 (1.06-1.31)
≥ 2 and < 3 Kilometers	2361 (52.3%)	2153 (47.7%)	1.51 (1.37-1.66)
≥ 3 and < 4 Kilometers	1974 (51.1%)	1888 (48.9%)	1.44 (1.30-1.58)
≥ 4 and < 5 Kilometers	1566 (49.6%)	1591 (50.4%)	1.35 (1.22-1.50)
≥ 5 Kilometers	585 (45.6%)	696 (54.3%)	1.16 (1.01-1.32)
Mean Rainfall			
< 68 mm/month	1549 (43.9%)	1977 (56.1)	*Reference*
≥ 68 and < 101 mm/month	2008 (47.1%)	2253 (52.9)	1.14 (1.04-1.24)
≥ 101 and < 164 mm/month	2317 (44.4%)	2905 (55.6%)	1.02 (0.93-1.11)
≥ 164 mm/month	3144 (56.8%)	2396 (43.3%)	1.68 (1.54-1.82)

Appendix B: Unadjusted Odds Ratios for Interaction of Year Categories and Lagged Monthly Rainfall

Year	**Rainfall**		
July 2006-June 2007	< 164 mm/month	1.0	Reference
July 2006-June 2007	≥ *164 mm/month*	1.18	0.91-1.54
July 2007-June 2008	< 164 mm/month	2.65	2.34-3.02
July 2007-June 2008	≥ *164 mm/month*	5.45	4.47-6.66
July 2008-June 2009	< 164 mm/month	3.57	3.15-4.05
July 2008-June 2009	≥ *164 mm/month*	18.43	13.91-24.44
July 2009-June 2010	< 164 mm/month	3.38	2.98-3.83
July 2009-June 2010	≥ *164 mm/month*	6.95	5.58-8.65

Appendix C: Lwak Referral Center Visit Form Children Under Five Years



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IEIP Morbidity Surveillance Study
Clinic Visit Form- Children (<5 year old,Non-IPTi)

Date of Interview(dd/mm/yyyy) ☐☐ / ☐☐ / ☐☐☐☐

Demographics filled by: ☐☐ date16 demoregcode

Part 1. DEMOGRAPHICS

1.0 Names of the Child:

First name ☐☐☐☐☐☐☐☐☐☐☐☐

Juok name ☐☐☐☐☐☐☐☐☐☐☐☐

Last name ☐☐☐☐☐☐☐☐☐☐☐☐

1.1a Child's DSS Permanent ID ☐☐☐☐☐☐ ☐ ☐☐☐ fname jname lname dssid

"Fill questions 1.1b and 1.1c only if the child is a new born and does not have DSS permanent ID."

1.1b Child's Temporary ID *(newborns)* ☐☐ ☐☐☐☐☐☐ Tempid

1.1c Mother's DSS Permanent ID ☐☐☐☐☐☐ ☐ ☐☐☐ Motherid

1.2 Date of birth (dd/mm/yyyy) ☐☐ / ☐☐ / ☐☐☐☐ dob

1.3a How many years and months old is the child? *(If child < 1 month old, record # of days)* Years ☐☐ / Months ☐☐ / days [☐☐] chlidyears childmonths childdays

1.3b Weight ☐☐☐.☐☐ KG (Kilograms) weight

1.3c Height ☐☐☐.☐ CM (Centimeters) Height

1.3d Gender ○ Male ○ Female Gender

1.4 What is the relationship of the caregiver to the child ? ○ Mother ○ Father ○ Babysister ○ Maid/Japidi ○ Other relative ○ Other not related ○ Unknown caregiver

Part 2.

2.0 Vital signs

Vital signs taken by: ☐☐ vitalregcode

2.0.1 Pulse ☐☐☐ *(beats per minute)* pulse

2.0.2 Respiratory rate ☐☐☐ *(breaths per minute)* respiration

" Admit according to IMCI"

2.0.3 Temperature ☐☐.☐ °C temp_2

2.0.4 Oxygen saturation ☐☐☐ % *(< 90% admit)* o2sat

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5941090266 **Treatment History**

History and symptoms taken by: ☐☐ histregcode

2.1 What is the reason for today's visit ? *(Ango momiyo ikelo nyathi e ospital kawuono)* opdwhy

- ○ 1. need to consult since child is sick
- ○ 2. return for further treatment (new/worse illness)
- ○ 3. return after weekend consultation
- ○ 4. immunization (child is also ill)
- ○ 5. immunization (child is not ill)
- ○ 10. Other: _____

2.1.1 Did the sick child visit anyone for health care before coming here? ------ ○ Yes ○ No ○ Unknown ipdhcb

2.1.1.a If yes, which? (*Do not probe. Mark all that apply*) visit

- ○ Family friend ○ Traditional healer ○ Nyamrerwa ○ Community health worker
- ○ Bush doctor ○ Shop/duka ○ Health centre ○ Private clinic
- ○ Hospital ○ Chemist ○ Other

2.2 Has the child taken any medications for this illness ? ○ Yes ○ No ○ Unknown medication

What was your child given?				Where was it obtained? *1=Lwak,2=other clinic, 3=other hospital, 4=duka, 5=other*					
SP	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	sp sp_obt
Amodiaquine	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	aq aq_obt
Chloroquine	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	cq cq_obt
Quinine	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	qu qu_obt
Co-artem	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	co_artem co_artem_obt
Analgesics	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	anal anal_obt
Septrin (CTX)	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	ctx ctx_obt
Penicillin / amoxacillin	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	pen pen_obt
Other antibiotic	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	antib antib_obt
Traditional Medicine	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	ipdmttm ipdmttm_obt
Oral Rehydration Solution	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	ORS ORS _obt
	If yes, how many sachets ?						☐☐		ors_sachet
Zinc	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	Zinc Zinc _obt
	If yes, how many days ?						☐☐		Zinc_days
Intravenous fluids	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	ivf ivf _obt
	If yes, how many bottles ?						☐☐		ivf_bottles
Other:	○ yes	○ no	○ unknown	○ 1	○ 2	○ 3	○ 4	○ 5	other other_obt

Medication name ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ treatname

2.2.1 Is the child taking daily cotrimoxazole prophylaxis ? ○ Yes ○ No ○ Don't Know ○ Refuse dailyctx

2.2.1a Is the child taking antiretroviral meds (ART) ? ○ Yes ○ No ○ Don't Know ○ Refuse art

2.3 Did the patient sleep under a bednet covering the mat/bed last night? ○ Yes ○ No ○ Unknown ipdslp
(otieno mokalono)

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Part 3. SYMPTOMS

3.1 Is the child able to drink or breastfeed at all? *(madho gimoro kata dhoth)*	O Yes	O No	O Unknown	breastfeed2
3.1 a Is the child exclusively breastfed?	O Yes	O No	O Unknown	breastonly
3.2 a Has the child vomitted ? *(ngok)*	O Yes	O No	O Unknown	vomit
3.2 b Does the child vomit everything with each feeding?	O Yes	O No	O Unknown	vomitany
3.3 Has the child had convulsions with this illness ? *(rieruok/riere /talarieya)*	O Yes	O No	O Unknown	convulsions2
3.4 Has the child had hot body or fever with this illness? *(del maore / maliet)*	O Yes	O No	O Unknown	fever
3.4 b. If yes, how many days ?	☐☐☐ days			feverdays
3.5 Does the child have cough ? *(ahonda)*	O Yes	O No	O Unknown	cough
3.5 a. If yes, how long has the child had cough ?	☐☐☐ days			coughdays
3.5 b. If yes, coughing blood? (fuolo aremo)	O Yes	O No	O Unknown	coughblood
3.6 Does the child have difficulty breathing ? *(kor mathung)*	O Yes	O No	O Unknown	diffbreath
3.6b Does the child have chest pain when breathing ? (kor maremo)	O Yes	O No	O unknown	chestpain
3.7 Does the child have diarrhea ? *(diep)*	O Yes	O No	O Unknown	diarrhea
3.7 a. If yes, how long has the child had diarrhea ?	☐☐☐ days			diarrheadays
3.7 b. Is there blood in the stool ? *(diep mar remo)*	O Yes	O No	O Unknown	stool
3.7c. Is there mucus in the stool ? *(diep ma kirendarenda)*	O Yes	O No	O unknown	diarrmuc
3.8 Does the child have a runny nose ? *(um mamol)*	O Yes	O No	O Unknown	runnynose
3.9 Does the child have sneezing ? *(jir)*	O Yes	O No	O Unknown	sneezing
3.10. Does the child have sore throat ? *(duol maremo)*	O Yes	O No	O Unknown	sorethroat
3.11 Does the child have an ear problem ? *(it maremo)*	O Yes	O No	O Unknown	earproblem
3.11 a. If yes, how many days ?	☐☐☐ days			eardays
3.12 Has the child had dark urine ? *(lach rabuor)*	O Yes	O No	O unknown	darkurine
3.12 b. Has the child had yellow eyes with this illness ?	O Yes	O No	O unknown	jaundicehx
3.12 c. If yes, how many days ?	☐☐☐ days			
3.13 Has the child had pale stool ? *(oko ma marmar)*	O Yes	O No	O unknown	palestool

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Part 4. RISK FACTORS

" Complete these questions only if patient has cough or difficulty breathing (Yes answered to either question 3.5 or 3.6.)"

4.1 Have you seen more than the usual number of sick or dead birds in your village in the last two weeks? O Yes O No O unknown seenbird

4.2 Have there been rumors of sick or dead birds near in your village within the last 2 weeks? O Yes O No O unknown rumorbird

4.3 Has the patient touched sick or dead birds within the last 2 weeks? O Yes O No O unknown touchbird

4.4 Has the patient been near (1 meter) sick or dead birds within the last 2 weeks? O Yes O No O unknown meterbird

4.5 In the last two weeks, has the patient had any contact with any sick people who were around sick/dead birds, work at a poultry farm, or visited a country known to have bird flu? O Yes O No O unknown contact

4.6 Has the patient traveled outside of Kenya in the last 2 weeks? O Yes O No O unknown travel

if yes mark all that apply: ai_country

O Sudan O Egypt O Djibouti O Burkina Faso O India

O Nigeria O Niger O Cameroon O Ivory Coast (Cote d'Ivoire)

Other 1: other1

Other 2: other2

Part 5. EXAMINATION Signs *(To be done by clinical officer or nurse)*

Exams done by: examregcode

5.1 Is the child lethargic ? O Yes O No lethargic

5.1a Is the child unconscious? O Yes O No ipdment

5.1b AVPU scale O A O V O P O U avpu

5.2 Is the child convulsing now ? O Yes O No convulsion

5.3 Does the child have difficult breathing? O Yes O No diffbreathsign

5.3a Does the child have fast breathing?

O Yes O No

If <2months and >59 bpm --- severe disease

If 2-12months and >49 bpm } --- *pneumonia*

if >12 months and >39 bpm

breaths

5.3b Chest indrawing? O Yes O No indrawing

5.3c Nasal flaring? O Yes O No flaring

5.3d Stridor when calm? O Yes O No stridor

5.3e Wheezing? O Yes O No wheezing

5.3f Crackles/rales? O Yes O No crackles

5.3g Grunting? O Yes O No grunting

5.4 Is the child restless or irritable ? O Yes O No restless

5.5 Does the child have sunken eyes ? O Yes O No sunkeneyes

5.6 Is the child not able to drink or drink poorly ? O Yes O No poordrink

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5.7 Is the child drinking eagerly, thirsty ?	O Yes O No	thisty
5.7b Does your child have tears when he/she cries ?	O Yes O No O N/A	tears
5.8 After pinching the skin, how does it go back ?	O Very slowly O Slowly O Normally	pinch
5.9 Does the child have stiff neck ?	O Yes O No	stiffneck
5.10 Does the child have bulging fontanelle ?	O Yes O No	fontonelle
5.10b. Does the child a sunken fontanelle ?	O Yes O No	fontonelsunk
5.11 Does the child have rash ?	O Yes O No	rash
5.11.a. describe the rash ?	O Heat O Diaper O Maculopapular O Vesicular O Petechial	diaperrash
5.11.b other kind of Rash		diaperrashdes
5.12 Does the child have red eyes ?	O Yes O No	redeyes
5.13 Does the child have mouth ulcers	O Yes O No	mouthulcers
5.14 Does the child have pus draining from the eyes ?	O Yes O No	puseyes
5.14b. Does the child have pus draining from the ears ?	O Yes O No	pusears
5.15 Is there visible severe wasting ?	O Yes O No	wasting
5.16 Is there oedema of both feet ?	O Yes O No	oedema
5.17 Does the child have jaundice ?	O Yes O No	jaundice
5.18 Are there enlarged lymph nodes at 2 or 3 of the following sites, Neck, Axillae,Groin. ?	O Yes O No	lymphnode
5.19 Oral thrush ?	O Yes O No	oralthrush
5.20 Any other sign of anemia (paleness of palms, nailbed, conjunctiva) ?	O Yes O No	pale
5.21 Other symptoms 1.		othersymp1
5.22 Other symptoms 2.		othersymp2

Part 6. SAMPLES

6.1 Haemoglobin [ ][ ].[ ] g/dl

6.2 Blood slide done ?
O Yes O No O Refused/Not done

6.3 Field stain BS results?
O Positive O Negative

6.3b Giemsa stain BS results?
O Positive O Negative

6.3c parasite species?
O Falciparum O Malariae O Ovale O Vivax

6.3d parasite count [ ][ ][ ][ ] per 200 wbc

6.4 Nasopharyngeal swab	O Yes	O No	O Refused/Not Done	hb_16
6.4a Oropharyngeal swab	O Yes	O No	O Refused/Not Done	bloodslide bloodsmea
6.5 a. Stool sample taken	O Yes	O No	O Refused/Not Done	giemsa
6.5 b.Stool sample sent to kisian	O Yes	O No	O Refused/Not Done	malspec paracount
6.6 Serum sample taken ?	O Yes	O No	O Refused/Not Done	npswab orswab
6.7 Blood culture done ?	O Yes	O No	O Refused/Not Done	stoolsamp stoolsent sera bloodcx

Filenum [ ][ ][ ][ ][ ][ ]

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Part 7: Diagnosis

7.01 What do you diagnose the child with?

Malaria	O yes	Dysentery	O yes	svmalaria svdysentery
Pneumonia/Lower respiratory tract infection	O yes	Intestinal worms	O yes	svpneumonia svworms
Upper Respiratory Tract Infection(URTI)	O yes	Anemia	O yes	svurti svanemia
Wheezing/bronchospasm	O yes	Malnutrition	O yes	svbronchospasm svmalnutrition
Otitis media	O yes	Oral candidiasis	O yes	svotitis svcandidiasis
Conjunctivitis	O yes	Rash/skin problem	O yes	svconjuctiva svrashd
Meningitis	O yes	Scabies	O yes	svmeningitis
Diarrhoea/ Gastroenteritis	O yes	Burn	O yes	svscabies svdiarrhoea3
Dehydration	O yes	Wound/injury	O yes	svburn svdehydration svwound
Pharyngitis/tonsillitis	O yes	Amoebiasis	O yes	svPharyngitis svamoebi
Viral syndrome	O yes	Pulmonary TB	O yes	svViralsyn svptb
Convulsions	O yes	Influenza	O yes	ipdacon
Measles	O yes			svflu ipdams1
Other1				otherdx1

7.02 Was there any error in question 7.01? O yes ● no anyerror6_1

Part 8: MEDICATION

Antimalarials

8.1 Did you or will you give antimalarial treatment today? O yes O no antimalaria_16
If 'no', go to 8.2.

8.1a What was given?

SP	O yes	Amodiaquine	O yes	msp maq
Coartem	O yes	Quinine	O yes	mco_artem mqu

8.2 Did you or will you give antibiotics treatment today? O yes O no antibiotics_16
If 'no', go to 8.3.

8.2a What was given?

Septrin	O yes	Amoxacillin/ampicillin	O yes	Penicillin	O yes	mcbx mamox mpen
Gentamicin	O yes	Tetracycline	O yes	Metronidazole	O yes	mgent mtetra mmet
Ciprofloxacin	O yes	Nalidixic Acid	O yes	Antihelminthic	O yes	mcipro mnal mantih
Erythomycin	O yes	Cloxacillin	O yes	Ceftriaxone	O yes	merythro mclox mceft
Chloramphenicol	O yes					mchloro

8.3 Did you or will you give other treatment today? O yes O no mother_16
If 'no', go to 9.

8.3a What was given? manal mors

Analgesic	O yes	Salbutamol/ventolin	O yes	Piriton	O yes	MVI	O yes	msalbutamol mval mmvi
Oral Rehydration solution	O yes	Valium	O yes	Expectorant	O yes	Zinc	O yes	mpiriton mexpect mzinc

Other Medicin1 othermed1

Other Medicin2 othermed2

8.4 was there any error in questions 8.1, 8.2 or 8.3 ? O yes ● no

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Part 9: DISPOSITION - *Admit for any symptoms or signs in bold.*

9.1 What is the disposition of the child ?

O Home O Admit Lwak O Refer Bondo District Hospital O Refused admission — disposition

O Refer PGH

O Other *(specify)* — dispother

Part 10: HOSPITAL COURSE

Antimalarials

10.1 Did you give antimalarial medicines during the hospital course ? O yes O no — hantimalaria_16

If 'no', go to 10.2.

10.1a What was given?

SP	O yes	Amodiaquine	O yes	hmsp
Coartem	O yes	Quinine	O yes	hmaq, hmco_arte

Antibiotics — hmq

10.2 Did you give antibiotics medicines during the hospital course ? O yes O no — hantibiotics_16

If 'no', go to 10.3.

10.2a What was given?

Septrin	O yes	Amoxacillin/ampicillin	O yes	Penicillin	O yes	hmct, hmamox, hmgen
Gentamicin	O yes	Tetracycline	O yes	Metronidazole	O yes	hmpen, hmtetra, hmmet
Ciprofloxacin	O yes	Nalidixic Acid	O yes	Antihelminthic	O yes	hmcipro, hmnal, hmantih
Erythomycin	O yes	Cloxacillin	O yes	Ceftriaxone	O yes	hmerythro, hmclox, hmceft
Chloramphenicol	O yes					hmchloro

10.2b Did you give intravenous fluids? O yes O no — 10.2b1 How many bottles given — ivfluids, ivbottles

10.3 Did you give other medicines during the hospital course ? O yes O no — hmother_16

If 'no', go to 11.

10.3a What was given?

Analgesic	O yes	Salbutamol/ventolin	O yes	Zinc	O yes	hmanal, hmsalbutamol
Oral Rehydration solution	O yes	Valium	O yes			hmors, hmval, hmzinc
Cotrimoxazole prophylaxis	O yes	Antiretrovirals	O yes			hmcotripro, hmart

Other Medicin1 — hothermed1

Other Medicin2 — hothermed2

Part 11: DISCHARGE

11.1 Date of discharge/death? (dd/mm/yyyy) — hospddate

11.2 Outcome of hospital course ? — hospoutcome

O Discharge home without sequelae O Absconded O Died

O Discharge home with sequelae O Transferred

11.3 What is the discharge diagnosis ?

Malaria	O yes	Dysentery	O yes	hdalaria, hddysentery
Pneumonia/Lower respiratory tract infection	O yes	Intestinal worms	O yes	hdpneumonia, hdworms
Upper Respiratory Tract Infection(URTI)	O yes	Anemia	O yes	hdurti, hdanemia, hdbronchospasm
Wheezing/bronchospasm	O yes	Malnutrition	O yes	hdmalnutrition, hdotitis
Otitis media	O yes	Oral candidiasis	O yes	hdcandidiasis, hdconjuctiva
Conjunctivitis	O yes	Rash/skin problem	O yes	hdrashd, hdmeningitis
Meningitis	O yes	Scabies	O yes	hdscabies, swdiarrhoea3
Diarrhoea/ Gastroenteritis	O yes	Burn	O yes	hdburn, hddehydration
Dehydration	O yes	Wound/injury	O yes	hdwound, hdptb
Convulsions	O yes	Pulmonary TB	O yes	ipddcon
Measles	O yes	Influenza	O yes	hdflu, ipddms1

Other1 — svotherdx1

11.4 Was there any error in question 10.3 ? O yes ● no

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5019090262 Specimen Label Intake Form

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11.5 Did the patient have an HIV test as part of DCT during this hospitalization ? O Yes O No O Don't know hivtest

11.5a If No, was it because: O Illness not suspected to be HIV related O Already known to be HIV hivtestno
O Patient refused O Other hivtestother

11.5b If yes,*(Only answer if consent obtained)* what was the results of DCT?
O Positive O Negative O Indeterminate DCTresult

11.5c Did the child have blood for PCR taken? O Yes O No O N/A pcrtaken

11.5d Was PCR ? O Positive O Negative pcrresult

12.1 Has specimen been taken ? O yes O no specimenlabel

Place White Portion Here #1 Nasopharyngeal Swab /Oropharyngeal Swab Label

#2 Blood, Serum Label Place White Portion Here

Place White Portion Here #3 Stool Sample Label

#4 Urine Sample Label Place White Portion Here

Place White Portion Here #5 Blood, Culture Label

Visit Date Age

First Name Juok Name Last Name

Filenum