Effectiveness of District Health Systems in Malaria Control in Kericho District, Kenya

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Abstract
This study investigated effectiveness of malaria control in Kericho District in Western Kenya highlands which is prone to occurrences of malaria epidemics. Data on indicators of effectiveness of Malaria Control (EMC) were obtained from district's health facilities and 300 sampled household heads from 7 divisions of the district participated in the survey questionnaire measuring their knowledge of malaria control. The data was analyzed using time series graph and descriptive statistics. The results showed (EMC) ; an increasing trend of malaria morbidity at 20.64%annually in 1999-2005, hospitalization cases increased from 926 to 3167 in the surveillance period 1988 and 2002, case fatality rates ranged between 1 and 44 per 1000 annually; an average of 17 persons per 100 in all divisions needed and received treatment for malaria annually in 1999-2005 and indoor residual spraying of houses was 80% effective, effectiveness of anti-malaria drugs ranged between 60% and 80% and 31.2% of all medical staff was trained on malaria control and 5.9% of all households used ITNs regularly. These findings imply low effectiveness of DHS in malaria control thus a need to step up malaria control according to NMC strategy (2001-2010) guidelines so that vision 2010-2030 Millennium Development Goals can be tenable

Keywords: Effectiveness; Health Systems; Malaria Control; Kericho District; Western Kenya Highlands

1. Introduction

Despite several years of research and concerted efforts targeted at the control of malaria, the realization of malaria "free-world" still remains a dream because the disease remains the most important of all water-borne diseases in tropical developing countries in terms of people annually infected especially those whose quality of life and working capacity are reduced and in terms of death from it and estimated by WHO (2010) at least as 650,000 cases.

Globally annual incidences of malaria ranges from 400 to 500 million cases with annually death toll ranging from 2 to 3 million (Okenu, 1999, WHO, 2001; Lieshout et al, 2004) and Africa accounts for more than 1 million deaths mostly children under 5 years of age. Sub-Saharan Africa (SSA) accounts for 90% of Africa's death toll due to malaria and as an economic burden deprives Africa of United States dollars 12 billion annually in Lost Gross Domestics Product (Greenwood, 2004).

In Kenya, malaria accounts for 30% of outpatient hospital cases and 8 million malaria out-patient cases are treated in public health institutions yearly and over 40,000 infants die from the disease annually while 170 million days annually are lost to the disease (MOH, 2001; Worrel and Delacollette,2004)

Malaria in humans is caused by four species of protozoa of genus *Plasmodium (P); P. falciparum, P. malariae, P. ovale and P. vivax* (Giles, 1995; Lieshout et al, 2004). *P.falciparum* is the most predominant in tropical countries and responsible for 85-90% of all malaria cases causing malaria

burdens; still-births, abortions, anaemia, morbidity and deaths in non-immune individuals in tropical areas (Giles, 1995; Lieshout et al, 2004; Akhwale et al, 2004). In Kenya *Anopheles (A)* mosquitoes species, *A. gambiae* is the most widely spread transmitter of malaria (Coetze et al, 1999).

The increase in malaria cases in SSA is blamed on conducive environmental conditions, political instability, economic development projects, social factors, poverty, resistance phenomenon of *Plasmodia* and vector *A.* mosquitoes to anti-malarial drugs and insecticides respectivelly, accessibility to health facilities, prompt diagnosis and treatment, quality and use of anti-malarial drugs and inefficient health delivery systems and beliefs in much of SSA (Snow et al, 1999; Githeko and Ndegwa, 2001; Sachs and Malaney, 2002; WHO, 2003; Lieshout et al, 2004; Tonui, 2008; Tonui 2010).

Consequently, in order to reduce burdens hence poverty reduction amongst communities in SSA, there is a need to revaluate the efficiency of Health System (HS) in relation to malaria control at local and national level. This is inline with Kenya Government health policy e.g. framework of 1994 (KDHS, 1998) a strategic theme "investing in health" goal upto 2010 and beyond to increase cost-effectiveness and cost efficiency of resource allocation and use. At the district level the increase in the episodes of occurrences of malaria is an indicator of effectiveness of health programmes of DHS (Vaugh and Morrow; 1991; MOH 2001)

This paper presents the results of the analysis of the effectiveness of DHS in Kericho district in western Kenya highlands classified by Kenya Government in 2001(MOH, 2001) as one of malaria epidemic prone zones of the country and a high priority malaria control area according to National which is in line with Malaria Control Strategy (NMS) of 2001-2010.

The 38th World Health Organization (WHO) assembly in 1985 (WHO, 1986) which resolved, emphasized and recommended malaria control to be developed as an integral component of Primary Health Care (PHC) at the district level where operational responsibilities for control of malaria was to be transferred to and be maintained by general services at the district level where active detection and prompt treatment of malaria was emphasized. The WHO (1986) resolution was reached as a result of failure of vertical mosquito control programmes in most of developing tropical countries in 1970s and 1980s and this scenario has continued to persist in Africa.

2. Material and Methods

2.1. Study area

This study was done in Kericho district in SSA and one of a subset of 15 districts in western Kenya highlands classified by government of kenys (GOK) in 2001 as malaria epidemic prone area (MOH), 2001). In district domain (0° – 0° 23' S 35° 02' E – 35° 40'E) covered an area of 2110.6 Km^2 and sub- divided into 7 administrative divisions, Sigowet, Belgut, Soin, Ainamoi, Chilchila, Kipkelion and Londiani in 1999. (CBS, 2001).

Kericho district lies at an altitude of 1600-3000 m above sea level which is characterized as an epidemic malaria prone highland district where fatal cases of malaria epidemics have reemarged and patterns and trends of malaria burdens have been on increase since 1940's ,1980's , 1990's and 21st century and have assumed yearly seasonal episodes of occurrences. and blamed on changes in environmental conditions particularly small local changes in temperature thus providing suitable conditions for unstable transmissions among population with little occurred immunity(Garnham, 1945;Lindsay, 1998) (Fogh *et. al.*, 1979; Some, 1994: Hay et al, 2000; Shanks et al, 2005; Tonui, 2008; Tonui, 2010).

Kericho district is endowed with deep fertile loam and clay soils, good monthly rainfall (range 157-250mm) and monthly temperature (range 16.8°C – 18.6°C). The district is a relatively a rich district and supports small and large scale tea plantations besides horticulture, sugarcane, coffee, pyrethrum, maize, fruits, vegetables and livestock keeping. The large tea estates each covering a land area of more than 1000 hectors and employs more than 1000 workers predisposes the Kericho to malaria transmission due to people's mobility back and forth from holoendemic malaria Lake Victoria region due to employment opportunities in the district.

2.2 Data types, sources and methods of data collection

The data collected as indicators of a effectiveness of DHS in malaria control were malaria burdens; hospital admission cases, malaria morbidity and number of deaths due to malaria were

obtained from Kericho district main hospital. Data on population projection by division was based on 1999 National population census (CBS, 2001). Data on distribution of health facilities and availability of diagnostic equipments, utilization of health services and malaria control programmes were obtained from Kericho District Development Plan (1997-2001) and Kericho district main hospital statistics (1999-2006).

The estimated population of 456768 residing in 98867 households (CBS, 2001) in the district's 7 divisions in 1999 formed the target population. Purposively a random sample of 300 households out of 98867households were chosen. The 7 divisions were purposively chosen to represent the district and sub-locations to represent divisions. Using stratified sampling, 300 households were apportioned to each division according to the proportion of households in each division to the total number of households in the district in 1999 and accordingly the sampled household sizes were randomly chosen from each division. The household heads formed respondents to prepared questionnaires regarding professional advice on malaria control, malaria education and use of ITNs awareness in malaria control. Data was analysed using mainly descriptive statistics, averages, tables, bar graph and time series graph.

3.0 Results and discussion

3.1 Change of malaria hospital admissions over time, 1988-2002

Change of malaria hospital admissions cases was considered in this study as a measure of effectiveness of malaria control activities. The data for under 5 year old malaria patients was used in this study because this population stratum is vulnerable to malaria infection and also because this group was assumed not to have travelled much outside the district. Kericho district main hospital statistics showed total malaria hospitalization cases was 26372 resulting in 662 deaths due to malaria and case fatality rates ranged between 1 to 44 cases per 1000 per annum during 1988-2002.

3.2 Change of malaria morbidity cases over time 1999-2005

Health data from all health facilities in the district were obtained from Kericho district main hospital statistics (1999-2006) were used to study change of malaria morbidity cases over time. Figure 2 below shows trend of malaria morbidity cases during 1999-2005 surveillance period. The average incidences of episodes of occurrences were 156 per 1000 (range 98 to 211 per 1000) per annum. The trend of incidence rates were on upward trend at growth rate of 20.64% per annum and R^2=0.8013 i.e time (1999-2005) accounted for 80.13% of the variation in observed incidence rates of occurrences. This indicates malaria burden was on increase in 1999-2005 which suggests low effectiveness in prompt diagnosis and treatment for the disease as strategies for its control in the district during the surveillance period, 1999-2005.

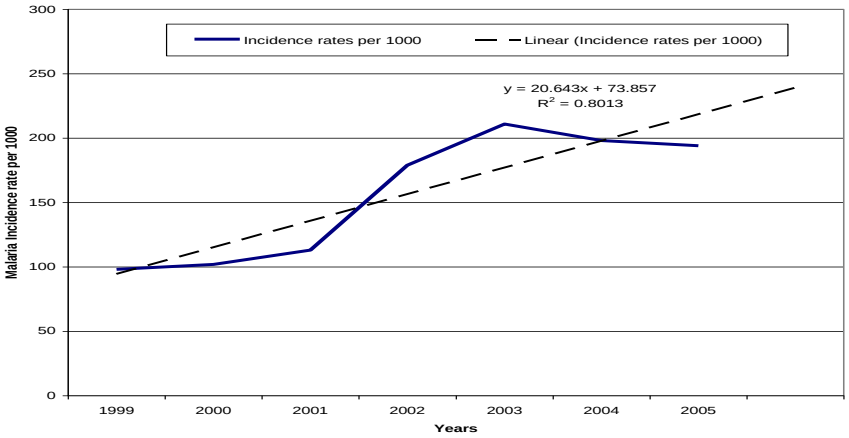

Fig 2: Trend in malaria morbidity in Kericho district, 1999-2005

3.3. Distribution of health facilities, projected population and availability of diagnostic equipment, 1999-2006

In this study distribution of low Cost Public or Government health facilities, population and diagnostic equipments were considered as important components of the DHS. In 2004-2010 there were a total of 58 Government health facilities consisting of Kericho district main hospital, Sub-District Hospitals, Clinics and Dispensaries. All these facilities served majority of the district's population. The total number of Non-Governmental health facilities were 27 and offered health services to the population but however were high cost thus a limited number of population sought medical services in these institutions despite their relative effectiveness in health delivery services.

Overall health facilities by divisions were not uniformly distributed in the district (KDDP, 1997-2001) for example Sigowet had the largest number of health centres serving a projected population of 70793 in 2005 in total area of 207.1 Km^2 which translated to a population of 5899 per health facility. Soin division, 101.5Km^2 had 5 health facilities with a projected population of 29557 or 5911 people per health facility. From the above data the average population per health facility in 2005 was 8948 against an estimate of 5528 malaria hospital admissions per annum (Tonui, 2008). This implied congestions in health facilities and thus delayed promt treatment for malaria due to delays in clinical based diagnosis of the disease which was characterized by specification of malaria parasites which led to unnecessary use of anti-malaria drugs such as chloroquine and sulfadoxine/ pyrimethamine which became ineffective in treatment of malaria due to resistance phenomenon of malaria parasites to these drugs in 1980s and 1990s and contributed to increased malaria burdens in the district (MOH, 2001).

Majority of health facilities had one Rapid Diagnostic Tests (RDTs) and one Microscope. RDTs are tests which are based on detection of antigens derived from malaria parasites lysed in human blood and used as a spot confirmatory test for malaria parasites, it detects *P. falciparum* the most widely spread malaria parasites in Kericho district is very sensitive (> 90 %) in detecting *P. falciparum* at densities > 100 parasites per µ*l* of blood. (Premji et al, 1994). Microscopy

laboratory method is used to confirm quantification and type of malaria parasites and also to define the type of early treatment failure (WHO, 1996). RDTs are preferred in rural areas where microscopes are not available and are useful in timely provision of results for malaria management and can be used by health personnel with little training skills (WHO, 2000). The microscopy and RDTs diagnostic approaches are complementary in confirmatory diagnostic tests for malaria and possibility of reducing emergence of anti-malaria drug resistance by malaria parasites hence reduction of malaria transmission in Kericho district.

3.4 Utilisation with health services with respect to malaria control

The number of people who needed treatment for malaria as indicated by the actual number of malaria morbidity cases in each division reported in the health facilities in the district during the surveillance period 1999-2005 is shown the Figure 3

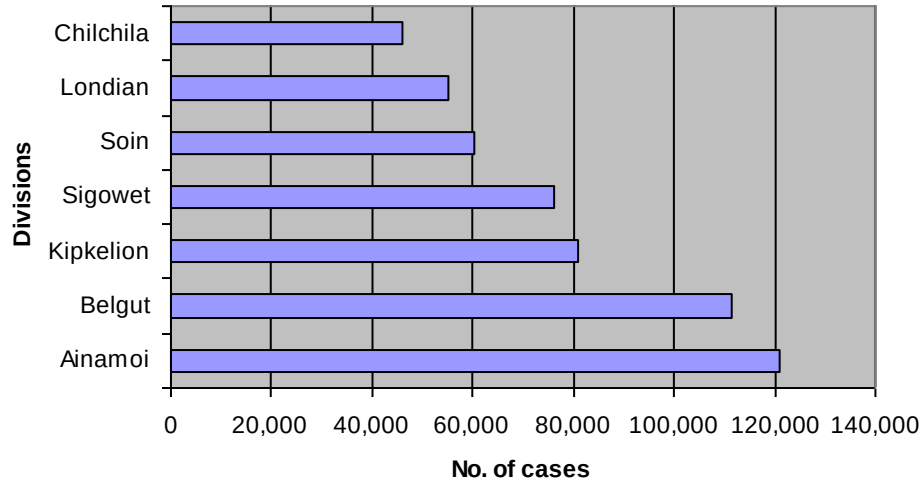

Fig. 3: Number people who needed treatment for malaria by division, 1999-2005

The overall average annual percentage of all people in the district who needed treatment for malaria was computed as a proportion of mean annual actual malaria morbidity cases reported in the health facilities (551250) in 1999-2005 to the total projected population of 536863 in the district in 2005. Also the mean annual percentage of the people who needed treatment for malaria was computed as a proportion of annual morbidity cases in each division to the projected population in the division in 2005.

The above results show average annual of 17% or 17000 people per 100,000 needed and actually received treatment for malaria in the district. Overall the % number of people who needed treatment for malaria was low in all divisions in 1999-2005; Soin and Londian had the highest (34%) and the lowest (13.5%) number of people who needed treatment for malaria respectively while Kipkelion, Chichilia, Sigowet, Belgut and Ainamoi had 18.3%, 18.1%, 18%, 16.2% and 14.7% respectively. The demand for malaria treatment suggests slow effectiveness of DHS in malaria control in the district due to the limited funding of malaria control programme in the district according to National Malaria control strategy of 2001-2010.

3.5 Professional medical advice on anti-malarials drug use by local community

Using stratified sampling of respondents (N=301), the percentage of respondents in divisions of the district who received professional advice on use of anti-malaria drugs were computed. Each respondent was asked to mention the sources of advice sought on the type of anti-malaria drugs, where they obtained them and their use and results are presented in Table 1 below.

Table 1: Use of professional advice by local community (N=301) in 2006

Response	Sigowet	Belgut	Soin	Ainamoi	Chilchila	Kipkelion	Londiani
Proportion of respondents seeking medical professional advice	n = 36	n = 70	n = 16	n = 86	n = 21	n = 37	n = 35
General medical advice	13 (36.1%)	33 (47.1%)	8 (50%)	10 (11.6%)	9 (42.9%)	11 (29.7%)	21 (60%)
Advice on the use of appropriate drug/source	10 (27.8%)	31 (44.3%)	4 (25%)	13 (15.1%)	8 (38.1%)	10 (29%)	9 (25.7%)
Use of anti-malaria drugs from local kiosks and shops	14 (38.9%)	32 (45.7%)	5 (29.4%)	30 (35.3%)	9 (42.9%)	12 (56.8%)	20 (57%)

Source: Field studies in the district, 2006

Results in Table 1 show that the % number of people who sought professional medical advice on the correct use of anti-malaria drugs ranged between 11.6%-57% and 40% purchased anti-malaria drugs from Kiosks/Shops without advice from medical professionals. Majority (65%) of people in the district did not seek general professional medical advice on the use of anti-malaria drugs. The above results suggests that lack of professional advice on type, sources and correct use of anti-malaria drugs might have contributed to resistance phenomenon of *Plasmodia* to these drugs in the district.

3.6 Malaria control programmes in Kericho district, 1999-2006

Malaria control programmes at the district level under the guidance of MOH (2001) and WHO (1986) frameworks is an important measure of effectiveness of DHS in malaria control at a district level. Data on malaria control programmes in the district in 1999-2006 consisted of prophylactic, pilot indoor residual spraying of houses, health talks and use of Impregnated Treated Bed NEts (ITNs) besides the use of Ant malarial drugs and their effective in treatment for malaria overtime are summaries in Table 2.

Table 2 Effectiveness of anti-malaria drugs, 1999-2006

Year	Anti malaria drugs type	Effectiveness (%) Range
1999-2000	Sulfadoxine/Pyrimethamine	18-20
	Quinine	40-45
	Chloroquine	18-20
	Fansider	18-30
	Amodiaquine	30-45
2001-2000	Amodiaquine	20-30
	Coartem	50-60
	ACT	70-80
2003-2004	Quinine	45-50
	Coartem	50-55
	ACT	75-80
2005-2006	Coartem	55-65
	Artemether	70-75
	Anumax	75-80
	ACT	75-80
	Artemisin	65-70
	Helfan.Poluther,Cotecxin	75-85

Source: Kericho District Main Hospital – Health Records, 1999-2006

The effectiveness of anti-malaria drugs ranged between 18% to 80% for chloroquine and Sulfadoxine/pyrimethamine (SP) and Artemisinin Combination Therapy (ACT) respectively during 1999-2006. Overall effectiveness according to MOH 2001-2010 percentage scale, Coartem, Helfan, Poluther and cotecxin ranged between 50% and 80% or an average of 60% effectiveness were effective in treatment for malaria. However, the sourcing and correct use and quality (counterfeit) may have led to resistance phenomenon of these drugs by *Plasmodia*. Though effectiveness of indoor residual spraying of houses was 80%, it was only confined to few pilot trials in Sigowet, Chilchila, Kipkelion and Soin divisions.

3.7 Malaria education and awareness of malaria control in Kericho district

Provision of health education to the general public is an important measure of effectiveness of a DHS as malaria control strategy. In this study respondents were asked about health education and the number of times health education was provided to them by Health providers during 2002-2006. Also sought from respondents were their knowledges of malaria causes, symptoms, treatment, environmental sanitation and use of local initiatives to control malaria. The information obtained from respondents (N=301) is shown in Table 3

Table 3. Malaria education awareness and control, sample (N=301), in 2006

Respondents knowledges about malaria	Correct responses overall	Information Sources			
		Radio	MOH	Newspapers	Others e.g. Meetings etc
Causes of malaria	200(66.5%)	220(73%)	149(49.5%)	80(27%)	36(12%)
Treatment of malaria	171(56.8%)	210(49.8%)	140(47.8%)	63(21%)	10(3%)
Prevention	160(53%)	190(63%)	131(44%)	50(17%)	12(4%)
Environmental sanitation	150(49.8%)	120(40%)	110(37%)	22(7%)	13(4.3%)
Use of local herbs to treat malaria	123(40%)	60(19%)	10(3%)	8(3%)	16(5%)
Symptoms	175(58%)	170(56%)	100(33%)	20(6.6%)	35(11.6%)

Source: Field studies in Kericho district in 2006

Overall malaria education provided to public by Health providers was minimal at an average of one visit to communities in the district by annum. The awareness of malaria based on correct answers and explanations to symptoms was generally high (65%) and 95% mentioned draining stagnant water and clearing of bushy vegetation around homestead as a method of malaria control. Hardly 30% of respondents could specify correctly the dosage for each drug requirement mentioned. Out of N=301 respondents asked the question of information about malaria and treatment; 35% mentioned DHS, 60% mentioned local Kiosks/Shopkeepers, 45% mentioned mass media mostly radio channels. The above results suggest that generally provision of malaria education, prevention and treatment of malaria was lacking in the district in 2006.

3.8 On-job training of health personnel in public health institutions

On-job training of health providers was considered in this study as an important component of resource management and an integral part of health systems so that improvement of competence and new skills and approaches of malaria control are acquired and above all to provide self satisfaction and retention of staff and also achievement of health objectives and relating them to the local communities are build up. Relevant data on Job training of health staff was obtained from Kericho district main hospital statistics and the results was summarized in Table 4.

Table 4: On-job training of health personnel in 2000-2006

Course Title of Staff	Number of MedicalAssistants Trained	Number of Rural Medical Assistants Trained.	Number of Maternal Child Health Assistants Trained	Total Number of Medical Staff Trained	Percentage Overall Medical Staff Trained

Malaria control	20	7	50	78	31.2
Aids control	60	25	50	135	54
Laboratory diagnosis. Use of diagnosis kits	-	-	-	-	-
Information systems	11	3	1	15	6.0
Use of essential drugs	50	10	20	80	32.0
Oral health	-	-	-	-	-
Immunization	100	35	15	150	60.0
Anaemia	-	-	-	-	
Diabetes	20	5	0	25	1.0
TB and Leprosy	60	36	10	106	42.4
Diarrhoea diseases	80	35	25	140	56.0
Vitamin A Deficiencies	40	10	10	60	24.0
Eye diseases	-	-	-	-	
Family planning	27	15	15	57	22.8
Maternal and child care.	100	35	15	150	60.0

Source: Kericho District Main Hospital Statistics 1999-2006

From Table 4 above, On–job training provided to health personnel in Kericho district health facilities were on AIDS control (54%), Immunization (60%), Diarrhoea (56%). Maternal child care (60%), use of essential drugs (32%), Tuberculosis(TB) and Leprosy (42.4%), Overall out of 250 health personnel in all health facilities in the district < 5% of them had attended on-job training during 2000-2006. Only 31.2% of all medical staff was trained on malaria control despite the fact that malaria accounted for 30% of all hospital admissions (MOH, 2001).

3.9 Use of Impregnated Treated Nets (ITNs)

The use of ITNs is receiving a wider popularity globally in malaria endemic countries because of their great success in reducing malaria morbidity and mortality in infants, children and expectant mothers (Snow et al, 1994; Goodman et al, 2000) is cost-effective method for malaria control. The information on the use of ITNs was obtained from respondents in divisions of the district in 2006. All respondents said they had no reasons not to use them and result revealed that that an evarage of 5.9% of all house holds interviewed in the district used ITNs regularly when sleeping at night in 2006. This suggest dissemination of information on the use uf INTs by health providers was minimal

4 Conclusion and recommendations

The findings of this study have shown that malaria burden is one of the major challenges for the effectiveness of DHS in Kericho district classified by Kenya Government (MOH, 2001) as epidemic malaria prone district in western Kenya highlands and therefore a priority district regarding malaria control. The growing trends in malaria burdens of occurrences is related to growing trend of resistance of *Plasmodia* to most anti-malaria drugs widely distributed and unregulated sourcing in the district. This problem also raises concerns about the sourcing and quality (counterfeit) anti-malaria drugs distributed and used in the district.

Limited malaria education by health providers, on-job training of health personnel, diagnostic equipment, indoor house residual spraying and use of ITNs are real challenges for DHS particularly in relation to sustainability and cost-effectiveness of malaria control considerations. However, planning and use of limited resources at the district level involving all stakeholders is important for effective malaria control to be achieved. One possible strategy of malaria control at the district level is to integrate malaria education and overall health education in Primary school curriculum so that children know about malaria and its control as they grow. Furthermore, all the Government through Ministry of Health should take responsibility of sourcing and distributing all anti-malarial drugs so that counterfeit anti-malaria drugs and role of shopkeepers and quacks in relation to anti-malaria drugs is eliminated. Furthermore, the Government subsidy and distribution of free ITNs especially to the most vulnerable to malaria population strata, infants, children and expectant mothers should go a long way to reduce and control malaria burdens; morbidity, hospital admissions, abortion, still births, anaemia and mental disorders; hence an overall improved receptiveness to education and reduction of poverty in the district.

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