

1 **Kenya needs cohesive policies and better strategies in its war against malaria in arid**
2 **and semi arid areas**

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19 **Abstract:**

20 Malaria is the greatest killer parasitic diseases in the world today. Kenya falls amongst the 15
21 high-burden countries in sub-Saharan Africa. Due to this, the Kenyan government and its
22 development partners launched the President's Malaria Initiative (PMI) to reduce malaria
23 related mortality by 50%. This was to be achieved through a rapid scale-up of four proven
24 and highly effective malaria prevention and treatment measures: insecticide-treated mosquito
25 nets (ITNs); indoor residual spraying (IRS); accurate diagnosis and prompt treatment with
26 artemisinin-based combination therapies (ACTs); and intermittent preventive treatment of
27 pregnant women (IPTp). Though the contributions of PMI, together with those of other
28 partners, have led to dramatic improvements in the coverage of malaria control interventions
29 especially in the high burden regions of the county, malaria outbreaks are frequently reported
30 in the arid and semi-arid land (ASAL) of Kenya like Baringo and West Pokot Counties. In
31 this Opinion, I try to address some of the reasons that could be the cause of these frequent
32 malaria outbreaks in the ASAL regions and what could be done to reduce them.

33 **Keywords:**

34 Anopheles spp
35 Arid and semi-arid regions
36 Malaria
37 Surveillance
38 Prevention

39 **1.0 Introduction**

40 In the past 15 years, Kenya where 70% of the population is believed to be at risk of Malaria
41 has made great strides in the prevention and control of Malaria. Countrywide, malaria
42 prevalence dropped from 11% to 8% between 2010 and 2015. During the same period,
43 Malaria which is pervasive along the Lake Victoria region dropped from high rates of 38% to
44 27%. A 29% drop in overall child mortality due to Malaria between 2008 and 2014 has also
45 been witnessed [1].

46 These have been achieved by a broad range of prevention efforts tailored to meet the widely
47 divergent needs of local populations. Insecticide-treated bednets have been the primary
48 preventive tool whereas indoor residual spraying (IRS) with insecticides is targeted towards
49 selected areas with high prevalence and transmission around Lake Victoria. By April 2017,
50 Kenya had distributed 16 million Long Lasting Insecticidal Nets (LLINs) in 36 counties
51 through mass campaigns and routine maternal and child welfare clinics. The LLINs and the
52 IRS have been accompanied by the diagnosis-based treatment policy and supply of
53 preventive medicine. Currently 87% of public health facilities have diagnostic capacity.
54 There has also been health promotion messages broadcast nationally, even to low
55 transmission areas, so residents can learn how to limit their exposure and, if they do fall sick,
56 recognize the symptoms and get diagnosed and treated. It's evident that these measures have
57 greatly impacted to the low transmission rates being witnessed [1].

58 Still, progress has not been uniform. There is need to sustain high coverage of malaria control
59 measures to the seasonal malaria transmission zones. As recent as February 2018 and October
60 2017, Kenya has witnessed outbreaks of Malaria in its arid Counties of Baringo, West Pokot
61 and Marsabit. Tens of Malaria cases were confirmed in Baringo in February 2018 with 20 of
62 them described as serious [2] whereas at least 400 people were hospitalised in West Pokot
63 and Baringo counties during a malaria outbreak in October 2017 that killed more than 10
64 people [3]. Another ,1, 300 people were admitted with malaria a week after the disease

65 claimed 17 people in Marsabit County in the same month. Majority of the patients were
66 children under the age of 5. Sadly, it is that age that gets ravaged by Malaria so badly that in
67 every 2 minutes somewhere in the world, a child is lost to this killer disease [4].

68 **2.0 Previous research findings in Baringo and their implications on Malaria control**

69 Malaria accounts for 11.8 % of the outpatient cases recorded in Baringo [5] This is higher
70 than the nationwide malaria prevalence of 8% [1]. The County falls under the seasonal
71 malaria transmission zone together with other counties including; Turkana, Kajiado,
72 Mandera, Wajir, Garissa, Marsabit, Samburu, Isiolo, Meru, Tharaka Nithi, Embu, Kitui and
73 Tana river[6]. Seasonal malaria experienced in these counties is associated with periodic
74 amplification of morbidity in the wet season prompted by limited immunity in inhabitants
75

76 It has been reported that increased number of malaria cases in Baringo occurs against the
77 backdrop of sub-optimal performance in health facilities due to structural
78 problems/weaknesses such as lack of malaria drugs, under-staffing, inadequate medical
79 equipment and sparsely distributed health facilities (the average distance patients travel to
80 health facilities is 15 kilometres) [5]. Insecurity in the region also aggravates the problems as
81 medical staff like nurses are reported to flee the few Medical facilities due to the persistent
82 insecurity [2] This leaves communities to identify and manage the disease largely on their
83 own even during outbreaks.
84

85 On the other hand, entomological research has observed that the *Anopheles arabiensis*
86 mosquito that readily feeds on not only humans but livestock too is one of the main malaria
87 vectors in Baringo. Livestock keeping is the main economic activity in Baringo, this coupled
88 with previous findings that breeding of the *An.arabiensis* is largely sustained by man-made
89 larval habitats like pan dams, marshes and adjoining drainage canals used for irrigation, is
90 evidence enough that Malaria outbreaks are likely to occur. During the dry season, the vector
91 is sustained by these man made habitats that are less dependent on rainfall. The habitats then
92 act as vector inocula to the natural larval habitats like rivers during the rainy season [7].

93 Entomological research also reports that entry and/or exit of malaria mosquitoes into houses
94 largely depend on house type. There is a strong preference for grass-thatched houses, making
95 house modification to limit mosquito flight into houses a plausible control strategy. This
96 finding reinforces the common belief that poverty is a major driver of malaria transmission in
97 Africa. Most communities in the continent's rural and resource constrained areas are largely
98 unable to afford decent housing with adequate screening measures to block mosquito entry
99 into houses [7]

100 The role of human activities in increasing human-vector contact has also been cited. Herding
101 which is a mainstay activity in Baringo and indeed, most semi-arid areas of Africa could be a
102 major cause of malaria outbreaks. Since as already mentioned, *An. arabiensis* a major vector
103 for malaria in Baringo feed on livestock, high livestock densities would mean high human
104 biting rates. The situation is worsened by the fact that the largest communal grazing fields are
105 used by hundreds of pastoralists from different villages. This would of course increase
106 malaria transmission rates and thus outbreaks. Previous research also observed that a high
107 number of Baringo residents expose themselves to infective bites when they stay out late in
108 the evening to irrigate their farms before temperatures sky-rocket during day time [7].

109 **3.0 A few suggestions on how the outbreaks could be reduced**

110 The government should provide enough diagnostic facilities and equipment. Following the
111 general elections in 2013, the health service delivery function was formally transferred to
112 counties in August of the same year. The Counties are responsible for three levels of care:
113 community health services, primary care services and county referral services. It's important
114 for the County governments of Baringo, West Pokot and Marsabit to help eliminate malaria
115 in their Counties. During the recent outbreaks lack of accessible well-staffed and equipped
116 hospitals was cited as the major factors that aggravated the situation. Patients had to travel
117 long distances for treatment. According to residents and local leaders, those who died failed
118 to get treatment in time. Malaria is a treatable disease and time is of essence when it comes to
119 Malaria. If patients are not attended to in time, they would most likely lose their lives.
120 Unfortunately residents in remote villages are unable to get to nearby hospitals located
121 kilometres away. Bad roads in these areas have even worsened the situation further as
122 patients have to walk long distances to get to the health facilities [8]. They should also
123 provide adequate supply of anti malarials. During the last outbreak, Marsabit County was
124 reported to lack anti-malaria medicines and was, therefore, unable to cope with an outbreak.
125 The county governments could also to consider deploying Beyond Zero mobile clinics for
126 emergencies so deaths are prevented. They could also invest on ambulances that could be
127 used to ferry patients from far-flung parts of the Counties. The national government on its
128 part should provide adequate security in these areas to prevent the medical staff and
129 development partners from fleeing these areas which results in unmanned hospitals even
130 during outbreaks [2].

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132 Targeted larval control will also be necessary. The highly localized and focal nature of
133 breeding sites in these semi-desert environments provides a good opportunity for targeted
134 larval control. The habitats are few, well-defined and easily traceable. They mainly consists
135 of pan dams, ditches, trenches and irrigation canals which make 60% of breeding sites for
136 the malaria vectors [9] Better environmental management that includes filling up the
137 unnecessary ditches and trenches, draining stagnant water and applying larvicides into the
138 irrigation canals would reduce the vector population immensely.

139 Since *Anopheles arabiensis* that readily feeds on livestock and man is one of the main
140 malaria vectors in Baringo, zoo prophylaxis, increasing herd sizes, could be a plausible vector
141 control strategy. However, this may be counterproductive under the circumstances in Baringo
142 where high livestock densities lead to converging of several herders in communal grazing
143 lands. This has the potential of increasing vector densities and high human biting rates within
144 these grazing lands and thus malaria transmission rates.

145

146 The shift from mud grass thatched huts to concrete houses with sealable windows would also
147 reduce exposure to mosquito bites. House type has actually become an important micro-
148 epidemiological factor in malaria transmission [9]. We can only hope that the economic
149 progress that Kenya has experienced could help the shift from mud huts to concrete houses
150 with sealable windows to reduce exposure to mosquito bites.

151 Public health education and awareness is also necessary as it will enable victims to seek
152 treatment quickly. This will also ensure that they don't become reservoirs for the mosquitoes
153 to get inoculum to be injected into the next person [9]. The residents should also be educated
154 on the cause of malaria, encouraged to sleep under insecticide treated nets and to avoid
155 unnecessary exposure to mosquito bites. The less educated in the population should be highly
156 targeted as previous research shows that unlike their educated counterparts who know that
157 malaria is transmitted by mosquito bites, the less educated population in Baringo highly
158 believes that malaria is caused by consumption of mangoes, fatty foods, sugary foods, green

159 maize and cow peas, sugar cane and maize stalks [9]. Pregnant women should also be
160 sensitized of the benefits of taking antimalarial drugs during pregnancy.

161 One preventive tool that has not yet been deployed in Kenya is the four dose malaria vaccine
162 RTS, S also known as Mosquirix. The vaccine is being evaluated as a potential complement
163 to the core package of WHO-recommended interventions currently in use for prevention,
164 diagnosis and treatment of malaria. Kenya is one of the three countries in Africa selected for
165 the trials of the vaccine which is administered to infants from five months [10]. This Vaccine
166 could provide a solution for residents in these seasonal transmissions zones who unlike their
167 counterparts in the high prevalence regions like the Lake Victoria region, lack naturally
168 acquired immunity against malaria and are thus knocked down very fast by the disease during
169 outbreaks.

170 Also, with declining resources, greater efforts are needed to better target their use. The
171 biggest funder of the Kenyan malaria control programme – the Global Fund to Fight AIDS,
172 Tuberculosis and Malaria – announced in December 2016 that its 2018–2020 package would
173 contain US\$ 63 million for malaria programmes in Kenya, less than half of what it had been
174 previously [1]. This leaves a huge gap. Kenya has made great strides in improving the quality
175 of available data for decision making, but more work is required when it comes to
176 implementation. For example, a considerable amount of data relevant to malaria control has
177 since become available in Kenya including: the largest ever Demographic and Health Survey
178 (DHS) undertaken in 2014-15 designed to provide measures precise at the county level [11].
179 These data need to be assessed especially by the county governments, to shape
180 implementable and effective policies that could help reduce recurrent outbreaks in the
181 Seasonal Malaria Zones.

182 Finally, it would be important for the international organization like WHO which has been
183 advising the Ministry of Health and Kenya’s National Malaria Control Programme ,
184 especially on policy and strategy issues, to help Kenya progress further toward its goal of
185 elimination of Malaria. Probably WHO should guide the country’s malaria programme
186 review to help re-focus anti-malaria work in the seasonal malaria zones even as they maintain
187 the efforts in the high risk areas.

188 It is clear that substantial progress has been made toward the objective of eliminating malaria
189 and other communicable diseases. If the Ministry of Health and its partners remain
190 committed to further reducing the malaria burden in the coming years a malaria-free Kenya is
191 possible.

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193 **Conflict of interest**

194 The author declares that she has no conflict of interest.

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