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# Zooprophylaxis: A Strategy for Effective Delivery of Endectocides for Vector Control

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## Abstract

A new strategy is needed for an effective management of residual malaria transmission attained after a wide use of Indoor residual spray and long lasting insecticidal nets. However, insecticides resistance has been a drawback factor for the attained success. The costs for changing insecticides for vector control annual still a challenges to be met by malaria transmission prone areas. The alternative strategy has to be in place for creating a dead end point for vectors than relying on insecticides for IRS and LLINs. The incorporation of zooprophylaxis strategy to deliver endectocides to blood feeding mosquitoes will kill even resistant populations of zoophilic mosquitoes and substantially reduce and eliminate residual malaria transmission.

**Keywords:** Endectocides; Mosquitoes; Mortality; Zoophily; Residual transmission; Malaria

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## Abbreviations

IRS: Indoor Residual Spray: LLINs: Long Lasting Insecticidal Nets

## Introduction

**Background:** The current vision of WHO is to achieve a malaria free world by 2030 [1] with indoor residual spray tools (IRS), as the main strategy for malaria control [2,3], as well as prompt diagnosis, timely treatment using effective antimalarial drugs [4] and a wide coverage of long lasting insecticidal nets (LLINs) [5]. Housing improvement [6] and larviciding [7] strategies needs to be considered at community level and incorporated into the community control approaches. New strategies such as vaccine are still evolving to add to the value of malaria control tool box [8]. The wide use of zooprophylaxis [9-12], though functional, should be improved and strategically emphasized. However, to achieve a malaria free world by 2030, innovative tools and strategies are needed to optimize and complement those available [1]. To date long lasting insecticidal nets (LLINs) and indoor residual spray (IRS) have remained at the core of malaria intervention in endemic areas. The LLINs provide both a physical barrier to mosquitoes and insecticidal effects [13,14]. The IRS has an effect on the mortality of malaria vectors when they rest on treated surfaces and are therefore susceptible to the insecticides applied on them. The success of pyrethroid-based IRS has been observed in different countries [15], with the recommendation, however, to switch to other classes of insecticides for IRS due to an increased pyrethroids resistance [16]. To manage the insecticides' resistance, an annual rotation of IRS insecticides is inevitable [17]. For both LLLNs and IRS, the resistance to the used insecticides remains a major drawback [16,18]. Another major challenge in malaria control is residual malaria transmission, which still poses outdoor biting risks, particularly in the elimination preparation phase [2].

Zooprophylaxis is the diversion of insect blood feeding from humans to other animals [19]. Transmission of a vector-

associated disease that requires a competent reservoir to sustain transmission is most stable when the vector only bites the reservoir. Zooprophylaxis has been referred to as the best environmental tool for vector-borne diseases management and control [20]. A new anti-helminths based approach for vector control can be incorporated in zooprophylaxis. Zooprophylaxis has been shown to work in vector control by delivering endectocides and insecticides [11,12,21] and can be used as a strategy to carry endectocides for a zoophilic mosquitoes reduction [22-24]. Ivermectin has been used for a long time as anti-helminths in humans [25] and livestock [26]. The evidence-based efficacy of Ivermectin against mosquitoes fed on treated animals blood meals has been documented for different mosquito species with a high effect on mortality and reduced fecundity; species involved were: *A. Stephensi* [27,28], *A. quadrimaculatus* [29,30], *A. punctulatus* and *A. koliensis* [31], *A. farauti* [32], and *A. gambiae* [21,33-37]. The duration of effectiveness of Ivermectin against mosquitoes from the time of animal treatment has been established for different scenarios and dosages [38]. The reduction of lifespan of mosquitoes has been documented too [21,32,39].

The evidence-based efficacy of zooprophylaxis strategy in delivering insecticides to mosquitoes has been reported [9-12]. This strategy can be adopted for delivering Ivermectin to mosquitoes as endectocides. The mass drugs administration for deworming in livestocks and human populations should be planned strategically to ensure wide treatment coverage. This strategy should be delivered simultaneously with an extensive coverage of LLINs and IRS in malaria transmission-prone areas. The small proportion of mosquitoes who survived IRS and LLINs insecticides exposure should reach a dead end point at blood meal success of anti-helminthes treated human and livestock populations. This commentary suggests the adoption of mass endectocides administration for human and livestock for an effective residual malaria transmission control to uplift the success attained by LLINs and IRS coverage across malaria transmission zones of sub-saharan Africa. This approach should be applied in joint venture between the Ministry of Health and the Ministry of Agriculture and Livestock.

## Conclusion

The administration of the endectocides (Ivermectin) with the intent to kill adult mosquitoes and reduce residual malaria transmission is innovative approach but additional steps are required to address implementation strategies and policy makers.

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