Short Communication
Volume 10:5, 2021

Malaria Control & Elimination

ISSN: 2470-6965

Open Access

Emerging Challenges in Vector Control Measures for Prevention of Malaria Transmission

Forwah Jacques Ndeh*

Chemical Pathology Unit, Department of Medical Laboratory Sciences, Faculty of Allied Medical Sciences, University of Calabar, Nigeria

Short Communication

The vector borne parasitic infections account to about 15% of all the infectious diseases causing more than 60000 deaths every year and the prevalence of these diseases is very high in tropical and sub-tropical countries. Malaria is the most common and significant vector borne parasitic infectious disease that causes more than 400000 fatalities every year worldwide and majority of the deaths are occurring among young population of less than five years of age [1].

Malaria vector control is generally undertaken as the elimination of adult mosquitoes using chemical insecticides, use of insecticide treated mesh, spraying of indoor repellents. These measures prevent the incidence of malaria and reduce the mortality associated with malaria by reducing the number of bites. The global malaria cases have in fact decreased significantly between 2000 to 2015 and such dramatic reduction has been attributed to the vector control measures using the insecticide treated nets and indoor residual spray. Between the year 2016 and 2019 countries of Srilanka, Paraguay, Algeria, Argentina and Uzbekistan were certified as Malaria free and about 19 different countries are slated to eliminate the indigenous transmission by the year 2020 [2].

Malaria cases are recorded in about 87 countries with substantial differences in the rate of transmission and the prevalence of malaria cases and the mortality rates. In case of malaria the term elimination is used when the transmission is no longer taking place in the country. The term eradication is used when there are no reports of malaria in the country. The overall global burden of malaria continue to rise including in almost eleven different countries of sub-Saharan Africa and India and nearly ten countries account for 70% of malaria cases worldwide. In the past 15 years, two billion pyrethroid treated long lasting insecticidal nets were distributed although the number of people protected by indoor residual spraying has dwindled by 64 million. This is mainly due to changes in the vector distribution pattern, resistance to the insecticides and changes in the location and timing of the mosquito biting pattern.

Who recommends universal coverage of LLIN and IRS for all population and age groups for the reduction of risk and transmission of malaria? On an overall basis, there are 41 malaria vector species that are dominant all across the world. The potential of the vector to transmit the disease and the control measures varies with respect to the species, location, epidemiological parameters. Additionally new control strategies are being developed constantly. Vector control measures are the most rewarding under public health scenario. Out of the total 81 endemic countries vector resistance to the insecticides was reported in 28 countries between 2010 and 2019 to all the major insecticides at separate occasions and only 8 countries reported no resistance to any insecticide class [1,3].

***Address for Correspondence:** Forwah Jacques Ndeh, Department of Medical Laboratory Sciences, Faculty of Allied Medical Sciences, University of Calabar, Nigeria, E-mail: ndehforwah@gmail.com*

Received 01 September 2021; **Accepted** 14 September 2021; **Published** 21 September 2021

The rise in the resistance of mosquitoes to the insecticides is leading to the resurgence of malaria. Therefore, new insecticides and pesticides are being developed with new formulations. It is important to consider the microclimatic conditions for deployment of such chemical agents. There is greater evidence of interaction of the chemical agents with the temperature for their efficacy. The mosquito vector control measures are also considering the alluring of the mosquitoes using semi-chemicals into a trap and then using these chemical agents [4].

As per the World Health Organization Pesticide Evaluation Scheme (WHOPES) recommends the usage of the pesticides for public health by using of mosquitocidal compounds and products and the recommended temperatures for their usage is nearly 25 ± 2˚C and slightly higher temperature of 27± 2˚C for the bednets. Many vectors of malaria actively host and seek the blood feeding from dusk until dawn when the temperatures are considerably low than the daily mean temperature. There is the probability that the susceptible mosquitoes are more resistant to the chemical agents during the cool night temperatures.

The insecticides used for the vector control interfere with the nervous system functioning of the mosquitoes. But the metabolic activities of the mosquitoes for the degradation of the insecticides and for their effect on the nervous system are dependent on the temperature. It was found that the effect of the insecticidal toxicity is more with higher temperature. Pyrethroids are most commonly used insecticide for malaria vector control. These insecticides perform better under nighttime conditions. However, the carbamates and the organophosphates may be less efficient under night conditions due to the lower temperature. The use of the mosquito repellents or the traps are also dependent on the temperature. Currently the vector control for malaria elimination depends on limited number of insecticides from four classes such as organo chlorines and organophosphates, carbamates and pyrethroids. Resistances to the chemical agents are mainly knockdown resistance and metabolic resistance due to the elevated levels detoxifying enzymes. The major malaria vectors are Anopheles gambiae sensu stricto that are indoor feeders and An. gambiae arabiensis (An. arabiensis) that are outdoor feeders [2,4].

Long lasting insecticidal nets are being used for prevention of the mosquito bites and minimizing the mosquito bites and the indoor residual spraying are most common for repellent activity. All these agents rely on the chemical agents. Phenotypic resistance is commonly observed. Elevated levels of the esterases and oxidases result in the resistance to the chemical agents. However, multiple insecticidal resistances remain the major challenge for mosquito vector control.

Mosquito vectors have phenotypic, physiological and behavioural resistance to the insecticides. Knockout resistance mutations in the genes and the mosquito speciation and other mosquito sporozoite infections are also monitored. Anopheles gambiae s.l. was found to be most predominant species. An. gambiae and An. Funestus were the high indoor resting densities. The resting and the biting pattern of the mosquitoes pose great challenges to the current interventional strategies that are more designed to the outdoor mosquitoes [5].

References

1. Glunt KD, Blanford JI and Paaijmans KP (2013). "Chemicals, climate, and control: increasing the effectiveness of malaria vector control tools by considering relevant temperatures". *PLoS pathogens* 9:1003602.

2. Iqbal J, Ahmad S, Sher A and Al-Awadhi M (2021). “Current epidemiological characteristics of imported malaria, vector control status and malaria elimination prospects in the Gulf Cooperation Council (GCC) Countries”. *Microorganisms* 9:1431.

3. Ashley EA, Dhorda M and Fairhurst RM. “Spread of artemisinin resistance in Plasmodium falciparum malaria”. *N Engl J Med* 371(2014): 411-423.

4. Roper C, Pearce R, Nair S and Sharp B. “Intercontinental spread of pyrimethamine-resistant malaria”. *Science* 305 (2004): 1124.

5. Uwimana A, Legrand E and Stokes BH. “Emergence and clonal expansion of in vitro artemisinin-resistant Plasmodium falciparum kelch13 R561H mutant parasites in Rwanda”. *Nat Med* 26 (2020): 1602-1608.

How to cite this article: Forwah Jacques Ndeh. "Emerging Challenges in Vector Control Measures for Prevention of Malaria Transmission." *Malar Contr Elimination* 10 (2021): 168.