PIIVeC
Partnership for Increasing the Impact of Vector Control
Partenariat pour accroître l'impact de la lutte antivectorielle

POLICY BRIEF

Evidence to inform how new bed nets can be used to prevent malaria in Malawi

March 2020

KEY MESSAGES

- Mosquitoes that transmit malaria in Malawi are resistant to pyrethroid insecticides; this is compromising the effectiveness of bed nets for malaria control
- The Ministry of Health is currently deciding which nets to use in the 2021 distribution campaign
- IG2 is a net with a combination of two insecticides, one of which (chlorfenapyr) has never been used for the control of malaria transmitting mosquitoes
- Studies in other African countries have found IG2 nets are better at killing pyrethroid-resistant mosquitoes compared to standard ITNs but there is no locally generated evidence in Malawi and importantly very little data on their efficacy against *An. funestus*, the main malaria vector in southern Malawi
- PIIVeC is evaluating the performance of IG2 nets in Malawi on local populations of mosquitoes starting March 2020
- There is also a third type of new net now available called Royal Guard® which contains a chemical that sterilises mosquitoes (pyriproxyfen). As far as we are aware, there are no ongoing studies on the efficacy of these nets in Malawi

Purpose

Malawi is planning the 2021 insecticide-treated net (ITN) distribution campaign to potentially include the deployment of Interceptor® G2 (IG2) nets. This policy brief aims to inform this decision by presenting:

1. Current evidence supporting the efficacy and use of IG2 nets
2. Plans for PIIVeC research to address key evidence gaps

Context

Malaria is a major public health problem in Malawi, causing 3.8 million cases and 6,500 deaths in 2018.[1] ITNs form a key pillar of the national malaria prevention strategy. They work by preventing mosquitoes from biting humans that sleep under ITNs, thereby stopping malaria transmission. ITNs are also treated with pyrethroid insecticides that kill mosquitoes when they contact the net. However, many mosquitoes responsible for malaria transmission are now resistant to pyrethroids, meaning that standard ITNs are less effective at killing them.[2] In recognition of pyrethroid resistance, some districts in Malawi have recently introduced pyrethroid-piperonyl butoxide (PBO) nets. IG2 is another new type of ITN that combines a pyrethroid with a different type of insecticide (halogenated pyrrole) called chlorfenapyr. Chlorfenapyr resistance has not been detected in wild malaria vectors and hence it is anticipated that this IG2 net will be effective at controlling pyrethroid resistant mosquitoes. However, there are still important gaps in our knowledge about how these nets perform against different mosquito populations.

Evaluation of IG2 net use in Malawi

WHO policy on IG2

WHO have concluded that IG2 nets are safe and fulfil the laboratory (phase 1) and semi-field (phase 2) requirements of an ITN. They have given IG2 interim approval for use in malaria control.[3] These nets are currently being tested in clinical trials in Benin and Tanzania, but results are not expected before the end of 2021.

Mosquitoes and pyrethroid resistance in Malawi

Anopheles funestus, is a major malaria vector throughout Malawi (Fig.1) and is resistant to pyrethroids. Available evidence suggests that certain members belonging to the *An. gambiae* group, prevalent in the north of Malawi, are also resistant to pyrethroids but less so than *An. funestus* (Fig. 1).

Analysis of IG2 net efficacy

Seven studies have evaluated the ability of IG2 nets to kill wild mosquitoes in semi-field experimental hut trials. All studies involved pyrethroid-resistant mosquitoes, but only two studies tested *An. funestus* (Fig.2).

IG2 consistently induced greater mortality than standard pyrethroid nets, but this difference was less pronounced with *An. funestus*, and sample sizes were much smaller, making it hard to draw conclusions. No field studies have been conducted in

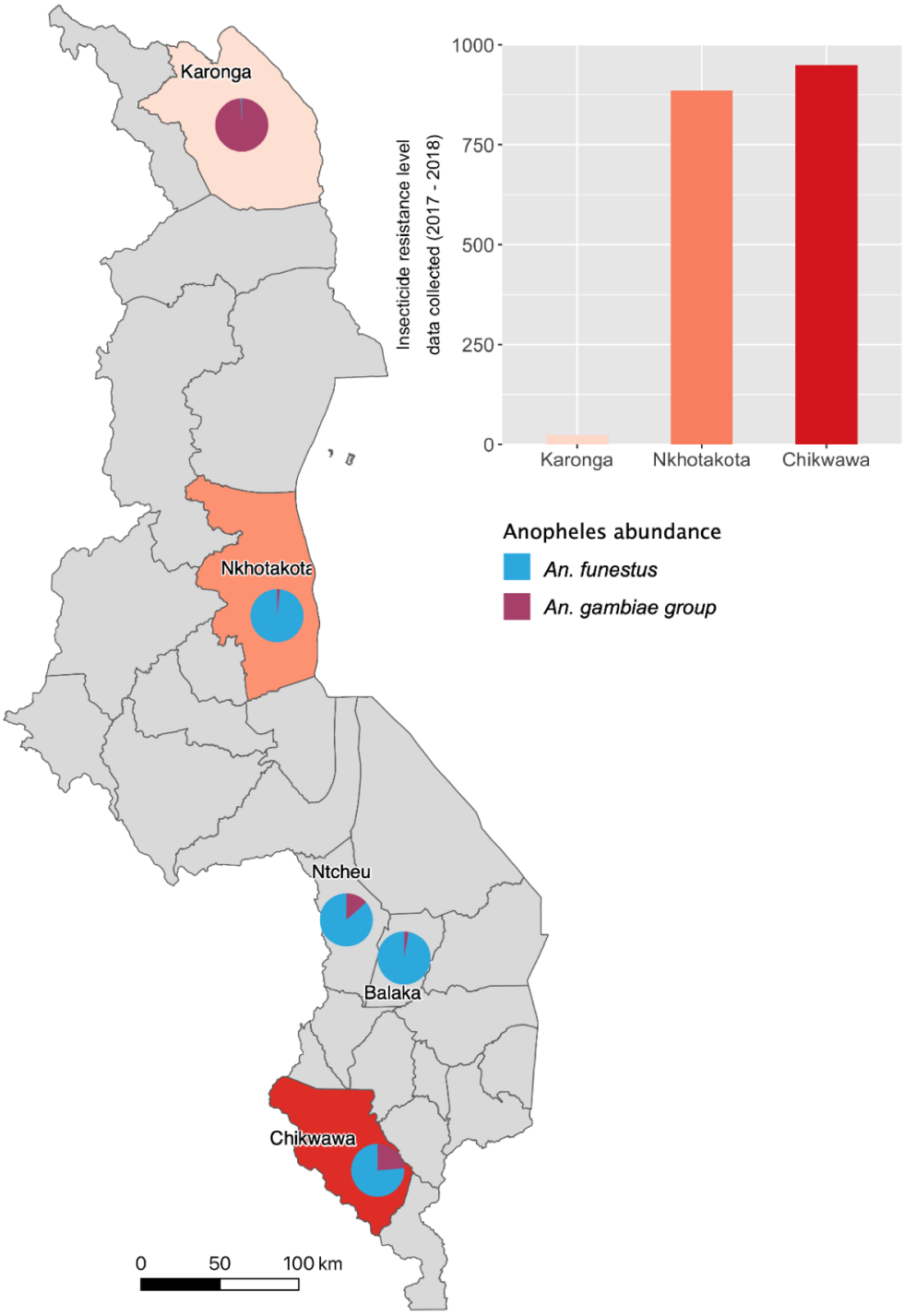
[1] https://www.who.int/publications-detail/world-malaria-report-2019
[2] https://www.pnas.org/content/109/47/19063.long
[3] https://apps.who.int/iris/bitstream/handle/10665/259743/WHO-HTM-NTD-VEM-2017.11-eng.pdf?sequence=1

Malawi. Therefore, while the growing evidence base suggests that IG2 are effective against pyrethroid resistant mosquito populations, there are few data supporting the use of IG2 nets in the Malawian context.

How PIIVeC is filling this gap

Dr. Elizabeth Bandason, a PIIVeC research fellow based at the Malaria Alert Centre, College of Medicine, is about to conduct an experimental hut study in Chikwawa district. This study will commence in March 2020 and it is the first study in Malawi that will test wild populations of pyrethroid-resistant *An. funestus* against IG2 nets. The hut study will run for 9 weeks and test an untreated net, a conventional Interceptor® net (IG1), and an IG2 net against each other. The results of this study should shed light on how these nets perform against local vectors in Malawi.

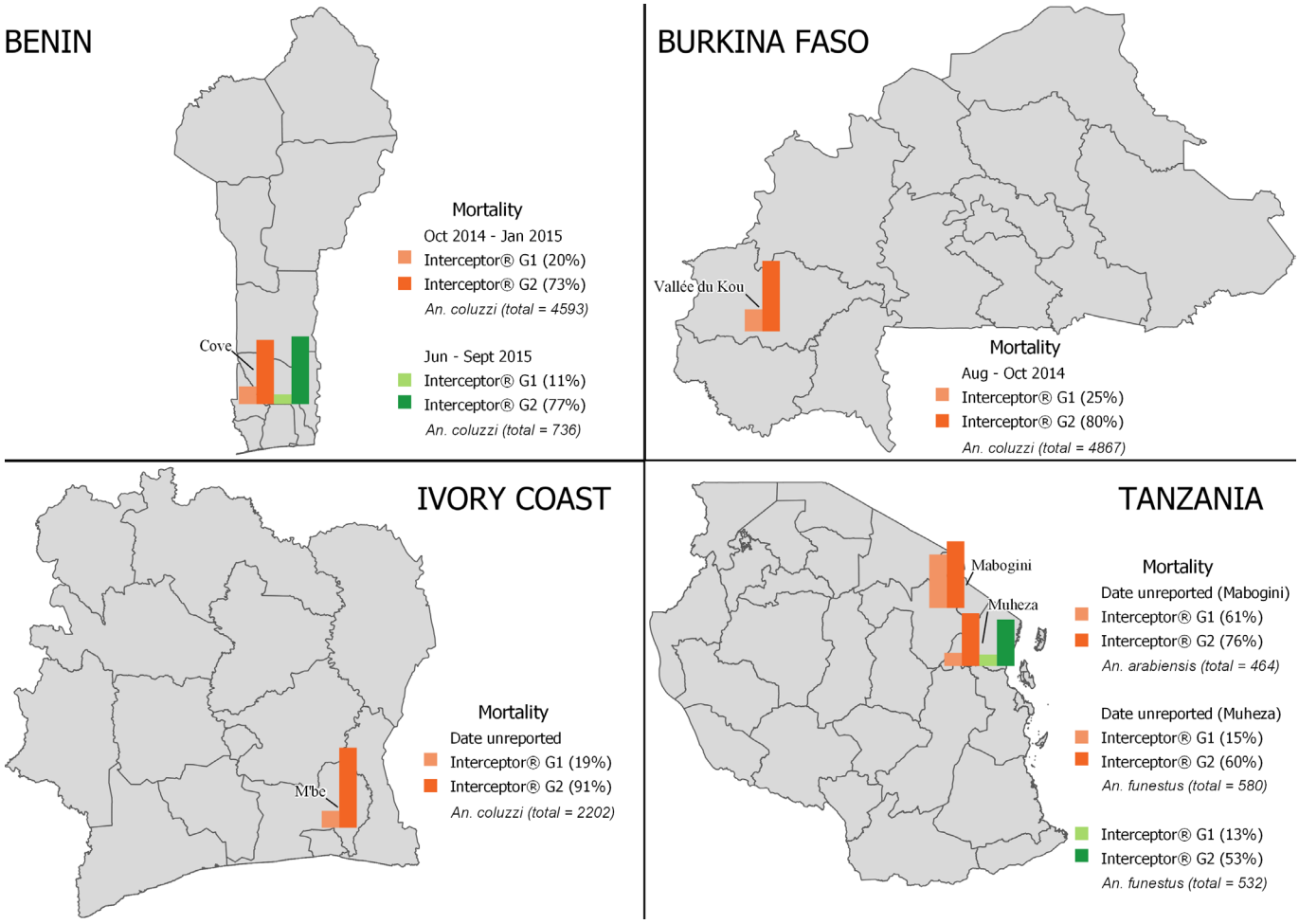
Figure 1: Pyrethroid-resistant *Anopheles* species abundance in three districts[4]



Interpretation: Two malaria mosquito species are abundant in five districts in Malawi. Pyrethroid resistance was also measured in three of these districts. The insecticide resistance level shows the multiple compared to a normal dose of pyrethroid it takes to kill these mosquitoes (e.g. in Chikwawa, over 900x the normal dose of pyrethroid was required to kill mosquitoes)

[4] https://www.pmi.gov/docs/default-source/default-document-library/implementing-partner-reports/malawi-entomological-monitoring-final-report-december-2017.pdf

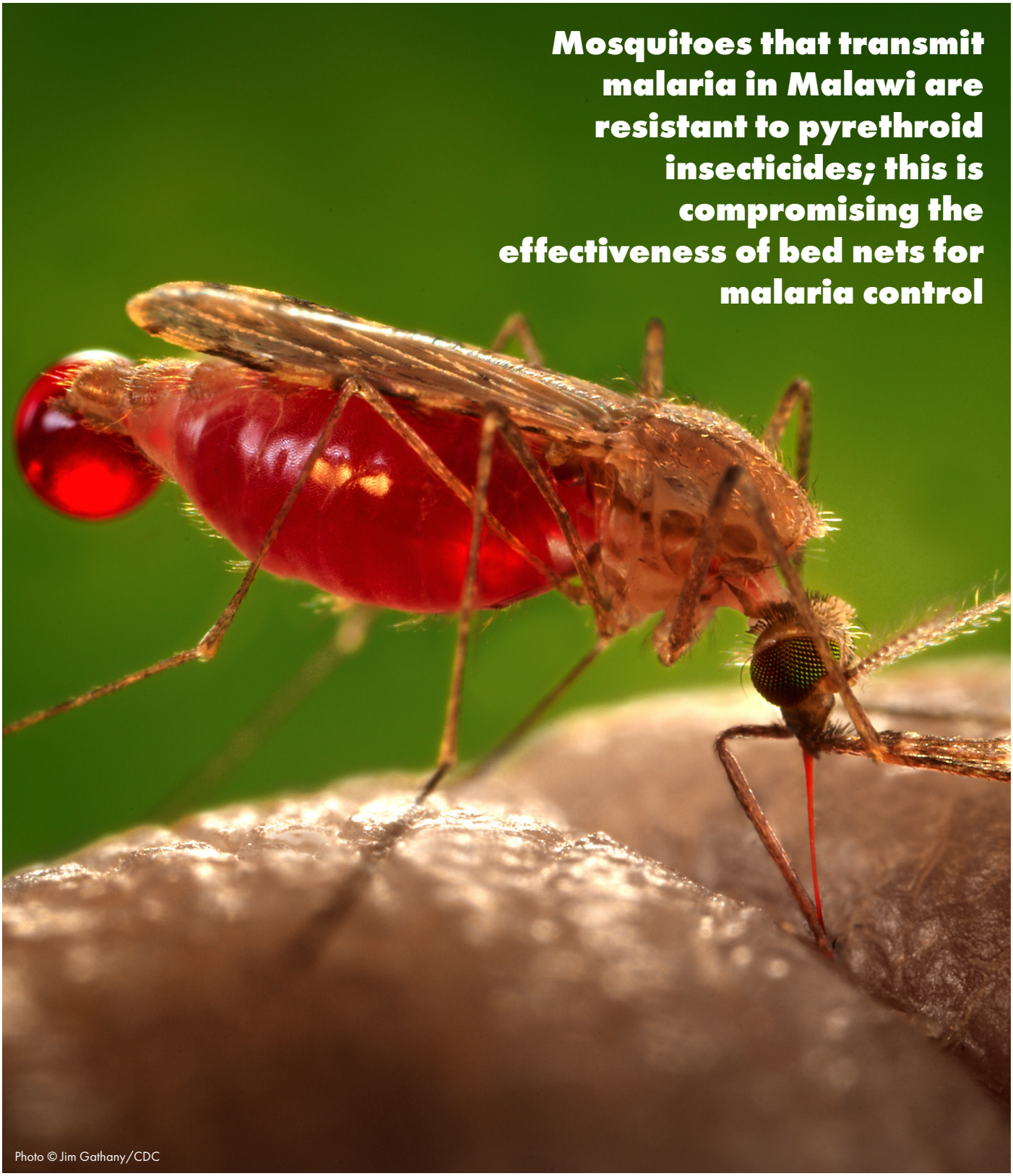
Figure 2: Study characteristics and results of semi-field experimental hut studies of Interceptor® G2 net against a standard pyrethroid-only Interceptor® net[5]



Interpretation: This figure shows results from semi-field (experimental hut) studies comparing the mosquito killing ability of IG2 nets with that of standard pyrethroid nets. IG2 consistently performs better than the standard nets but the magnitude of this difference varies. All wild population of mosquitoes used in these studies were resistant to pyrethroids.

Dr. Elizabeth Bandason, a PIIVeC research fellow based at the Malaria Alert Centre, College of Medicine, is about to conduct an experimental hut study in Chikwawa district.

[5] https://apps.who.int/iris/bitstream/handle/10665/258921/WHO-HTM-NTD-WHOPES-2017.04-eng.pdf;jsessionid=B4E5C53082AAFC38EC03AAAE527D0CBB?sequence=1



PIIVeC

With funding from the UK Global Challenges Research Fund, the Liverpool School of Tropical Medicine (LSTM) in 2017 established the Partnerships for Increasing the Impact for Vector Control (PIIVeC) with the purpose of promoting vector control to address VBDs burden in Burkina Faso, Cameroon, and Malawi. Vector control is key in preventing the spread of VBDs. This policy brief aims at promoting the support for continued investment in vector control solutions.

MAC Communicable Diseases Action Centre

LSTM Liverpool School of Tropical Medicine

University of Malawi

AFIDEP African Institute for Development Policy
Bridging Development Research, Policy and Practice