Maintaining effective Vector Control in Light of Increasing Insecticide Resistance

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President’s Malaria Initiative
Fighting Malaria and Saving Lives
Introduction to PMI Vector Control

• IRS
  – Supported in collaboration with country strategies

• ITNs
  – Universal coverage through campaigns
  – Continuous distribution through country specific mechanisms

• Entomological Monitoring
  – Supports IRS and LLIN programs
  – National surveillance and resistance monitoring
Indoor Residual Spraying

FY 2014: 13 countries, >5 million houses, ~20 million people
PMI supports IRS for

1) insecticide resistance management purposes
2) as a tool to implement where ITN accessibility, coverage, and/or use are low
3) to provide additional support in areas with high malaria transmission despite high ITN coverage
4) to support malaria elimination goals
5) to target outdoor-feeding mosquitoes that rest indoors
2013-2014 Pyrethroid Resistance

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IRS Trends and Challenges

• IRS budget is staying roughly the same, but absolute coverage decreasing due to shift toward organophosphophate spraying

• Resistance Management and Rotations
  – Already widespread pyrethroid and DDT resistance
  – Bendiocarb (currently only carbamate on market being sold by WHOPES approved manufacturer) has a short residual life on mud surfaces (1-2 months in Mali and Ethiopia)
  – This leaves Actellic CS as the only option for IRS in many countries but at a significant cost ($23 dollars a bottle versus $2-3 dollars for a PY sachet)
Insecticide Usage Patterns

- **Pyrethroids**
- **Carbamates**
- **Organophosphates**
- **Combo of PYR + Non-PYR**
- **Combo of Non-PYR**

2011

- Pyrethroids: Large portion
- Carbamates: Medium portion
- Organophosphates: Small portion
- Combo of PYR + Non-PYR: Small portion
- Combo of Non-PYR: Very small portion

2013

- Pyrethroids: Medium portion
- Carbamates: Very large portion
- Organophosphates: Very small portion
- Combo of PYR + Non-PYR: Small portion
- Combo of Non-PYR: Small portion

2015

- Pyrethroids: Very small portion
- Carbamates: Medium portion
- Organophosphates: Large portion
- Combo of PYR + Non-PYR: Very small portion
- Combo of Non-PYR: Very large portion
IRS Impact - Ghana

Prevalence of Parasitemia among Children and EIR (infective bites/man/night), Bunkpurugu-Yunyoo District (2010-2013)

- 2010 - No IRS: 52.4% Parasitemia Prevalence, 0.35 EIR
- 2011 - Pyrethroids: 50.0% Parasitemia Prevalence, 0.13 EIR
- 2012 - Pyrethroids: 47.7% Parasitemia Prevalence, 0.021 EIR
- 2013 - OPs: 20.6% Parasitemia Prevalence, 0.018 EIR

Percent Parasite Prevalence High Transmission Season

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PMI IRS - Moving Forward

• Innovating to reduce implementation costs
• Increasing support to government IRS programs
• Using entomological and epidemiological data to better target our IRS programs for the most impact
• Undertaking operational research on focalized spraying (spraying sub-district level hot spots)
Insecticide-Treated Nets

FY 2014: procured >31 million LLINs
Monitoring LLIN Durability

• Critical quality control activity for countries
  – Guide procurement, replacement, BCC
  – Motivate industry to improve LLINs

• New PMI guidance follows WHO guidelines
  – Recommend all countries monitor LLINs distributed in campaigns

• Activities supported
  – Survivorship/attrition
  – Physical durability
  – Insecticidal activity
  – Where practical, insecticide content

Using PMI data, Sumitomo changed knitting pattern on Olyset nets
Resistance to Damage Scores

• Resistance to Damage (RD) scores look like a promising method of evaluating field longevity of LLINs based on laboratory testing.

• PMI supports the development of a global vision around using durability data as one of a number of procurement criteria.

• Additional data is necessary to:
  • Validate lab testing across laboratories.
  • Correlate laboratory scores with field survivorship.
  • Improve our understanding of LLIN survivorship in the field across different brands.
Next Generation Nets

- Supporting trials of new dual AI/combo nets to ascertain efficacy in differing resistance profiles
- Generating an evidence base to support development of normative guidance to optimally roll out next generation ITNs in the field
Entomological Monitoring
Intensity of Resistance

- In Zambia, seeing operational impact of resistance when mosquitoes survive at higher concentrations of insecticide
  - Survival at 5x and 10x the concentration of insecticide used to test for resistance is associated with blood-fed mosquitoes in houses where ITNs were recently distributed
  - Outbreak malaria in areas where mosquitoes survive after being exposed to 5x the diagnostic dose
Key Questions

How do we best target new & existing VC tools to maintain effective coverage, given already stretched budgets and (likely) more expensive products?

• IRS
  – How do we strategically use IRS given the cost of non-pyrethroid insecticides?
  – Is focal IRS effective/cost-effective?

• ITNs
  – Do resistance to damage (RD) scores correlate with field survivorship?
  – Can RD scores be used to guide procurement of more durable nets?
  – How effective are dual action nets and how best to employ them?

• Entomological Monitoring
  – How variable is insecticide resistance intensity?
  – How do varying levels of resistance intensity affect vector control efficacy?
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