ANEMIA DATA IN EVALUATING IMPACT OF MALARIA INTERVENTIONS: A MULTI COUNTRY ANALYSIS

Anemia Task Force
October 18, 2013
Outline

• How does PMI assess impact of malaria control?
• Severe anemia as an indicator of impact
• Monitoring anemia
• Country examples
Framework for Impact Evaluation

1. **Determine if:**
   - All-cause under-five mortality decreased
   - Malaria morbidity (anemia, parasitemia) decreased
   - Malaria control intervention coverage increased
   - Alternate explanations exist for decreased mortality

2. **Conclude** whether it is plausible that scale up of malaria control interventions reduced malaria-related deaths

Adapted from Rowe et al, Trop Med Int Health 12: 1524-1539
Severe anemia as an indicator of impact

- Severe anemia, defined as blood hemoglobin levels <8 g/dL, is associated with malaria-related mortality and it is measurable at the population level with less seasonality than parasitemia.
- Declines in severe anemia have been found to be associated with malaria control interventions.
- In sub-Saharan Africa, between 17% and 54% of malaria-attributable deaths are estimated to be due to severe anemia.
National HH Surveys Supported by PMI
2006 – Planned 2014

Guinea, Nigeria, Kenya, Rwanda, Mali
Measuring Mortality

Reduction in All-Cause Mortality Rates of Children Under Five
PMI Progress: ITN Coverage

Increasing ITN Ownership

% Household ITN Ownership

Angola 35
Benin 35
Ethiopia (Oromia) 41
Ghana 53
Kenya 40
Liberia 50
Madagascar 50
Malawi 55
Mali 50
Mozambique 51
Mozambique 56
Rwanda 63
Senegal 67
Tanzania 72
Uganda 47
Zambia 36

90% PMI Target
Measuring Morbidity

Parasitemia Prevalence in PMI Countries With Two or More Measurements

Percent prevalence parasitemia

Malawi  Liberia  Zambia  Angola  Tanzania  Senegal  Kenya  Rwanda  Ethiopia
## Results of Impact Evaluations to Date

<table>
<thead>
<tr>
<th>Country</th>
<th>U5 Mortality Decline</th>
<th>Malaria Intervention Coverage Increase</th>
<th>Decline in Malaria Morbidity</th>
<th>Do contextual factors explain all mortality decline?</th>
<th>Plausible Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanzania</td>
<td>45%</td>
<td>√</td>
<td>Anemia □</td>
<td>No</td>
<td>√</td>
</tr>
<tr>
<td>Malawi</td>
<td>41%</td>
<td>√</td>
<td>Anemia □ Parasitemia □</td>
<td>No</td>
<td>√</td>
</tr>
<tr>
<td>Angola</td>
<td>21%</td>
<td>√ (still low)</td>
<td>Parasitemia □</td>
<td>Likely</td>
<td>Subnational</td>
</tr>
<tr>
<td>Rwanda</td>
<td>61%</td>
<td>√</td>
<td>Anemia □ Parasitemia □ Malaria Incidence □</td>
<td>No</td>
<td>√</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>47%</td>
<td>√</td>
<td>Epidemics □ Malaria Deaths □</td>
<td>No</td>
<td>√</td>
</tr>
<tr>
<td>Zanzibar</td>
<td>34%*</td>
<td>√</td>
<td>Anemia □ Parasitemia □ Malaria Incidence □</td>
<td>No</td>
<td>√</td>
</tr>
</tbody>
</table>

*Overlapping confidence intervals*
All-cause Under-five and Infant Mortality* Rwanda, 1998-2008

*Mortality is shown at the midpoint of the five-year period.
Household ITN Ownership and Use
Rwanda, 2000 - 2010

ITN Ownership
- 2000
- 2005
- 2007/8
- 2010

ITN Use
- 2000
- 2005
- 2007/8
- 2010

Household ownership
Pregnant women
Severe Anemia* & Malaria Parasitemia in Children 6-59 Months Old, 2005-2010

*Hemoglobin <8 g/dL
Prevalence of severe anemia in children 6–59 months, by oversampled districts, Malawi, 2004 & 2010, DHS
Declining Prevalence of Malaria Morbidity and Mortality

- HMIS data show that malaria incidence declined by 70% between 2005 and 2010
  - Malaria outpatient visits declined by 60%
  - Malaria mortality in inpatient admissions declined by 54%

Inpatient Malaria Deaths All Ages, 2001-2010
Baseline and endline estimates of the proportion of last-born children age 6–23 months using ITNs and the prevalence of moderate-to-severe anemia at the national level
Issues
Subnational Heterogeneity: Tanzania Malaria Prevalence

**2007/8**

**20011/12**

Source: National Bureau of Statistics (NBS) and ORC Macro 2008
Tanzania HIV and Malaria Indicator Survey 2007-8, Dar es Salaam, Tanzania.

Tanzania HIV/AIDS and Malaria Indicator Survey 2011-12.
Figure 9. Correlation between ITN use and moderate-to-severe anemia in last-born children age 6-23 months.
Figure 10. Adjusted odds ratios of moderate-to-severe anemia in last-born children age 6–23 months comparing ITN users with nonusers, by survey and pooled across survey*
Figure 12. Scatterplot of proportion of last-born children age 6-23 months who used an ITN the night preceding interview by the proportion with moderate-to-severe anemia in surveys with ITN use greater than 20%
Figure 13. Scatterplot of proportion of last-born children age 6-23 months who used an ITN the night preceding interview by the proportion with moderate-to-severe anemia in surveys with ITN use less than 20%
Figure 18. Adjusted odds ratios of moderate-to-severe anemia in last-born children age 6-23 months who used an ITN the previous night compared with those who did not*

*Adjusted for urban-rural residence, wealth quintile, multiple births, mother’s education, sex, age, mother’s age, and recent fever. Baseline pooled I² test for heterogeneity = 33.8% (p=0.138). Endline pooled I² test for heterogeneity = 0.0% (p=0.661). Overall pooled I² test for heterogeneity = 10.9% (p=0.319).