

water and sanitation. The first principal component with its associated variance was used to rank the households.

The MIS protocol received ethical clearance from the Emory University Institutional Review Board (IRB#6389), the CDC Ethical Review (IRB#990132), the Program for Appropriate Technology in Health (PATH) Ethical Committee, and the Ethiopian Science and Technology Agency. Verbal informed consent, which was approved by the above ethical boards and recorded in the PDA, was obtained from the heads of the household to participate in the household questionnaire, each eligible woman to participate in the women's questionnaire, and again from every individual prior to blood sample collection. Additional verbal assent was obtained from children 6 to 18 years of age.

Table 1 shows the comparative household and individual characteristics in the survey for all women and a subset of those women who were mothers of children U5. Data from a total of 6,657 women (5,949 households) which included 4,714 mothers of children U5 (3,447 households) were analyzed. Fewer of the latter lived in urban EAs (11.7%) compared to all women (17.2%). Mothers of children U5 also lived in larger households (5.5 mean number of household members) compared to all women (4.9 mean number of household members). Fewer (15.0%) mothers of children U5 lived in households of the highest wealth quintiles compared to all women (20.1%), while more (57.4%) mothers of children U5 lived in households that owned at least one ITN.

More women in general attended any school (23.7%) and had some level of literacy (15.7%) compared to women who were mothers of children U5 (16.9%; 12.5%, respectively). Although, 5,023/6,657 (73.8%) women had heard of malaria, only 2,953 (43.6%) stated that

2.0]), and interaction terms between correct malaria knowledge and school attendance ($p = 0.04$) and between EA category and

interaction terms between malaria knowledge and wealth index ($p = 0.04$) and between malaria knowledge and school attendance ($p = 0.05$). Again, malaria knowledge was a significant factor in predicting fever treatment seeking only amongst mothers who did not attend school. Albeit non-significant, the direction of association between malaria knowledge and fever treatment varied depending on the household wealth quintile.

Although a majority of women had heard of malaria in this survey, only a small proportion knew the cause, signs or symptoms, and preventive measures. We show that women belonging to the poorest wealth quintile, with no formal education, and living in rural EAs had lower levels of malaria knowledge [6]. These findings are similar to previous smaller studies in Ethiopia, which noted limited malaria knowledge amongst women [39,40] and strong socioeconomic disparity with malaria knowledge (e.g. 96% of respondents in the highest SES quintile had heard of nets versus to 35% in the lowest quintile) [39]. These findings contrast with those reported in the Zambia MIS, where almost 100% of the women had heard of malaria, and knowledge disparities amongst wealth quintiles and education levels were less striking [31].

Women most often received their malaria information from government clinics/hospitals and from friends and family, and least often from print media. This is consistent with the very low rates of literacy reported in Ethiopia. Targeting information,

education, communication/behavior change communication (IEC/BCC) efforts to women attending government clinics and hospitals could be an effective way to reach women and change their (and their household's) behavior at a time of high perceived susceptibility [41]. With the high illiteracy rates and lack of formal education, less emphasis should be placed on print media as a delivery mechanism.

Further attention is also needed on the content and types of malaria messages delivered. Less than half of the women and mothers knew fever as a symptom of malaria, or knew any danger signs of malaria. Noting the limited emphasis on fever treatment seeking in IEC activities, it is not surprising that rates of treatment seeking are unacceptably low. Increasing the quantity and improving the quality of this messaging could have a large impact

malaria knowledge independent of school attendance appeared to improve malaria health-related behaviors. However, broader goals of economic development and improving access to education, especially for women remain a significant and modifiable social determinant of health-related behavior and can only aid the malaria control efforts.

Although knowledge is one aspect of a complex interplay of factors, it is an important prerequisite for instigating behavior change and could likely inform attitudes about malaria health-related behaviors. With the global efforts to achieve universal coverage by 2010 [49], programs should not only focus on delivery

1. World Health Organization (2008) World Malaria Report 2008. Geneva: World Health Organization.