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Factors associated with participation in mass drug administration of azithromycin for trachoma control in Amhara, Ethiopia

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Bachelor of Science
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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Global Epidemiology
2018

Abstract

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Mass drug administration (MDA) with azithromycin is a core component of the WHO recommended strategy to eliminate trachoma as a public health problem, but low participation rates in MDA campaigns may undermine the effectiveness of this intervention. Following an azithromycin MDA in Amhara, Ethiopia in May 2017, we conducted multi-level cluster random coverage surveys in 4 districts to collect data on self-reported MDA participation and predictors. We then explored factors associated with individual MDA participation at the individual, head of household, and household levels. Random-effects logistic regression modeling was used to identify correlates of MDA participation while adjusting for nesting of individuals at the household and village level. A total of 100 villages were surveyed, from which we obtained data on 6613 participants from 1629 households. The district-level self-reported participation in the trachoma MDA ranged from 78.5% to 86.9%. We developed a model for all participants and found several positively-associated factors for MDA participation: excellent and fair health status (Odds Ratio [OR] = 7.3; 95% Confidence Interval [CI]: 2.6, 20.3; OR = 9.4; 95% CI: 3.1, 28.6), length of household's residency (OR = 2.4; 95% CI: 1.3, 4.2), advanced knowledge of the MDA campaign (OR = 4.3; 95% CI: 2.6, 7.0), and knowledge of trachoma (OR = 1.67; 95% CI: 1.05, 2.67). A second model was run, which excluded heads of household and included head of household participation in the model. Factors associated with participation were similar to those found in the first model, in addition to the head of household participation (OR = 6.0; 95% CI: 3.9, 9.3). These results provide insight into the factors associated with MDA participation in Amhara, and suggest that heads of households hold a strong influence over household participation. To increase the impact of MDA campaigns, MDA mobilization strategies—including comprehensive trachoma and azithromycin messaging and MDA campaign awareness—should target heads of households, new residents, those in poorer health, and at older ages.

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Introduction

Trachoma is an ocular infection that is the primary infectious cause of blindness (1). Similar to other neglected tropical diseases, trachoma clusters in areas of high poverty and low hygiene; infrequent face washing and unsafe human waste disposal are the primary causes of transmission (2). Over 190 million people globally live in trachoma endemic areas, with the majority of those in Ethiopia and Sudan (3). Approximately all rural residents (65 million) in Ethiopia are at risk for blindness due to trachoma (4). In 2008, 9.8 million children in Ethiopia had active trachoma, and another 1.3 million adults had trachomatous trichiasis (TT), which is defined by an entropic eyelid with all lashes touching the eye (4). Within Ethiopia, the region of Amhara has the highest burden of disease, with approximately 45% of the national TT cases (5).

The etiological agent of trachoma is a bacterium, *Chlamydia trachomatis.* Transmission can occur from person to person, most commonly between groups of children or between children and their mother. Through this mechanism, children and women are at highest risk for trachoma (6). It is also transmitted through eye-seeking flies, *Musca sorbens*, where the vector acquires the bacterium from eye secretions of infected individuals or human/animal feces (7).

The World Health Organization (WHO) established the Alliance for Global Elimination of Trachoma with the year 2020 (GET 2020) as their goal to eliminate trachoma as a public health problem (8). The WHO has endorsed the SAFE (**S**urgery, **A**ntibiotics, **F**acial cleanliness, and **E**nvironmental improvement) strategy as the recommended control effort (9). Treatment of trachoma through mass drug administrations (MDA) of antibiotics is one component of SAFE that has been demonstrated to reduce the reservoir of *C. trachomatis* in a community (9, 10). MDA programs aim for a minimum of 80% medication coverage, and achieving this level of coverage in practice can be difficult in settings like Ethiopia. Reluctant members of the community may undermine the effectiveness of the resource- and labor-intensive MDA campaigns by serving as a source for re-emergent infection (11).

Limited studies from other parts of Sub-Saharan Africa (outside Ethiopia) have quantified factors associated with individuals and households not attending or receiving the MDA medications (12-14). Those factors can be categorized into individual, head of household, household, and campaign factors (13, 15). Factors relating to the decision-making member of the household, include age, gender, educational attainment, trachoma knowledge, and level of social interaction (13). These predictors could also be interpreted as individual factors, in addition to perceived health status and recent travel history (13). Household factors include number of children and distance (traveling time) to the MDA distribution site. Factors related to the MDA campaign itself include length of campaign (in days), and the gender and trustworthiness of the MDA distributors. To better target MDA-related health messages and design more inclusive campaigns, further research is needed to understand the factors of MDA participation in Ethiopia. This knowledge could help trachoma control programs improve the success of MDAs and help them achieve the WHO goal of trachoma elimination as a public health problem faster.

In this study, we determined the individual, head of household, and household factors associated with participation in a MDA campaign in East Amhara, Ethiopia. By identifying correlates of MDA participation, future MDAs in the region could be improved using data-driven targeting, and thus the program may decrease the time to trachoma elimination as a public health problem

Methods

Study Location. In May 2017, an MDA of azithromycin and tetracycline eye ointment (for those who declined azithromycin or were not eligible to take azithromycin) for trachoma was simultaneously carried out in eligible districts of East Amhara, Ethiopia. Sixty-one districts were eligible for the MDA. These districts had a prevalence of follicular trachoma (TF) among children ages 1–9 years of at least 5%, which were determined from previous trachoma impact surveys. After completion of the MDA, four districts (locally called woredas) were selected to participate in a survey assessing the district-level self-reported coverage of the MDA. These districts were identified based on having a continued high TF prevalence, ranging from 22% to 52%, despite repeated years of MDA treatment. All districts had received at least 10 annual rounds of MDA prior to May 2017. Additionally, districts with previously low-reported MDA coverage were considered for inclusion.

Sample Size. A multi-stage cluster random sample was performed to create the household sampling frame in each selected district. To adequately estimate MDA coverage of at least 70%, we used an alpha level of 0.05 and a design effect of 4.0. An anticipated non-response rate of 15% was incorporated into the calculation, which increased the number of required study participants to 1486. According to impact assessments conducted in Amhara, there are 4.1 residents per household, and thus 316 households per district would be visited to achieve the estimated sample size.

Study Design. Out of a total of 1128 villages (locally called gotts) in the four districts, 25 were randomly selected per district from a geographically ordered list using a probability proportional to size method. From each village, one development team (defined as an administrative unit of approximately 30 households) was randomly selected from each village. The development team was divided into two, roughly equivalent, segments using a sketch map technique and one segment was randomly chosen. All households within the selected segment were eligible for inclusion in the survey.

All households within the selected segment were eligible to participate. Vacant houses were revisited by the study team. Households vacant on the second visit were skipped and not replaced. All consenting household members (defined as someone who slept in the house the night before) were eligible to be interviewed. The survey team returned, at the end of each day, to households where there were absent individuals. If residents were still absent, the head of household answered several questions on behalf of the absent household members. Beyond Table 1, these proxy data were not used in this analysis.

Data Collection. Data recorders, who were not involved with the MDA, were trained on the study methodology. Survey questionnaires were translated into the local language, Amharic. Prior to deployment, the survey team piloted the assessment in two nearby sub-districts (locally called kebeles) that were not included in the survey. Community assistants accompanied and guided each administrator through the community but did not assist in data collection. Three Amhara Regional Health Bureau employees were responsible for gaining permission from the village chiefs to conduct the study and inform the local community health workers.

The survey was administered 3 to 5 weeks (June 10th to June 22nd) following the MDA (May 14th to May 18th). Each data recorder sought verbal consent from the head of household (or an available adult household member answering on the head of household's behalf) before conducting the survey. A household-level questionnaire was administered once per household to collect information on household demographics, MDA campaign knowledge and participation, and trachoma knowledge. The team then enumerated all household members (regardless of their presence) and interviewed each present and consenting/assenting member. Members were shown azithromycin (Zithromax®) and tetracycline eye ointment samples to assist in recall. The results of the two surveys were recorded electronically on Android tablets using Carter Center ODK-based NEMO software.

Measures. The primary outcome was MDA participation, defined as individual self-report of taking the MDA medication (either azithromycin or tetracycline eye ointment). For children who were unable to accurately report about themselves, data recorders asked the head of household. Individuals were asked about their age, sex, and self-reported health status (characterized poor, fair, or excellent) during the week of the MDA. Head of household and household factors included length of residency, information on MDA campaign, trachoma knowledge, social capital, household size, and head of household participation in the MDA. Household length of residency was classified as lived in their current village for more than 10 years versus 10 or fewer years. Heads of households were asked about awareness of the MDA campaign at least one day prior to the first day of MDA, as well as background knowledge of trachoma. To measure social capital, heads of households were asked if faced with an emergency, how many neighbors could they turn to for financial and/or familial assistance.

Statistical Analysis. Survey data were entered, cleaned, and analyzed in Stata (Version 15; Stata Corp, College Station, Texas). Data from all present and consenting/assenting participants were included in the analysis. Distributions of variables were graphed and then we used exploratory logistic regression analyses to examine bivariate associations between each potential correlate and the outcome of MDA participation. From our sampling methodology, we calculated weights based on the inverse of the probability of selection at each stage of selection. District-level self-reported MDA coverages were weighted and estimated using the *svy* package. Random-effects logistic regression, using *melogit*, allowed us to model factors for individual MDA participation while adjusting for nesting of individuals at household and village levels. We built two final models with individual, head of household, and household variables that were informed by existing evidence in the literature and our exploratory bivariate analysis. The first model included all presenting and consenting/assenting participants. In our second model, we removed all heads of households and included a head of household MDA participation variable. Both models were adjusted for head of household age and gender. We calculated the intraclass correlation coefficient (ICC) of MDA participation within households to measure the degree of clustering by running the random effects model without the inclusion of independent variables. The map was created in ArcGIS 10.6 (ESRI, Redlands, CA).

Ethics. The study protocol was approved by the Emory University IRB (#079-2006) and the Amhara Regional Health Bureau. Informed consent or assent was obtained from everyone responding to the survey. Respondents were allowed to terminate the interview at any point without a need of explanation.

Results

Following the MDA in East Amhara, we surveyed 1629 households in four districts. An average of 16 households were surveyed within each cluster, with a mean of 4 (standard deviation = 1.8) members per household. Of the 7200 individuals residing within these households, 6613 (91.8%) individuals were present and completed the study, 586 (8.1%) were absent, and 1 (0.1%) declined to respond (Figure 2). Data on absent individuals and the one refusal were not included in any of the analyses following Table 1. Residents who were absent were more likely to be male than female (Table 1). Just over half of the respondents were female (52.5%) and the mean age was 24 years. Children younger than 10 years represented over a quarter (26.3%) of the respondents. A majority (90.8%) of respondents self-reported their health status to be excellent.

The district-level self-reported MDA participation ranged from 78.5% to 86.9%. At the village level, there is a wider range of self-reported MDA participation (See Figure 3 in Supplemental Appendix). The ICC for MDA participation of members within the same household was 0.64 (95% Confidence Interval [CI] = 0.59, 0.68), ranging from 0.55 (95% CI = 0.46, 0.65) in Eferatana Gidim to 0.75 (95% CI = 0.67, 0.82) in Wogidie. These ICC values suggests evidence of clustering at the household level (Supplemental Appendix, Figure 4)

Three individual factors were examined for association with MDA participation. While gender was not associated with MDA participation, better health status and younger age were (Table 2). An excellent or fair health status (compared to poor) increased the odds of participating in the MDA more than three-fold. With each year increase in age, the likelihood of participation slightly declined (OR = 0.99; 95% CI = 0.98, 0.99).

Several head of household and household factors were associated with MDA participation (Table 2). Head of household knowledge of trachoma and information regarding the MDA campaign significantly contributed to participation in the MDA. Residing in a household where the head of household was informed of the MDA at least one day in advance of the campaign increased the odds of participation by over 4-fold. Head of household's awareness of trachoma also predicted MDA participation (OR = 1.76).

The degree of MDA campaign knowledge also influenced participation. Each additional named MDA source (e.g., health development army, health extension worker) resulted in nearly a four-fold increase in participation (OR = 3.78; 95% CI = 3.23, 4.41). Reporting a background understanding of trachoma—including the causes and outcomes of trachoma, as well as behaviors and activities that can protect oneself from acquiring the disease—led to increased MDA participation.

Community integration and engagement were also associated with MDA participation. Residents belonging to a household that has been within the community at least 10 years were more likely than shorter-term residents to participate (OR = 1.73; 95% CI = 1.04, 2.87). Living in a household that could rely on at least 5 neighbors in times of emergency also increased the likelihood of participation compared to having fewer or zero such neighbors. Similarly, household members whose heads of households were heavily engaged in the community—defined by socializing daily with community members—were more likely to participate in the MDA (OR = 2.44; 95% CI = 0.95, 6.27) compared to household members whose heads of households socialized less frequently.

Our first model (Table 3), including all study participants (n = 6613), identified several important factors, at all three levels (individual, head of household, and household) for participation in the MDA. Notably, prior knowledge of the MDA campaign significantly increased the likelihood of MDA participation (OR = 2.89; 95% CI = 2.01, 4.17) compared to no advanced knowledge. We found a similar relationship with awareness of trachoma. Individuals who know of trachoma were two-times more likely to participate than those who did not. Better health status, longer residency in the current village, and the household's ability to rely on neighbors also increased the odds of a household member's MDA participation. Meanwhile older residents (OR = 0.98; 95% CI = 0.98, 0.99) and ones from larger families had a decrease in odds of participation.

We ran a second model, excluding the heads of households (n = 4969) and including a variable to measure head of household participation in the MDA. The model yielded similar results to our first model (Table 4). Positively associated factors retained their directionality with MDA participation as did the negatively associated factors, except for household size. The addition of head of household self-participation in the MDA substantially increased the odds of participation by other household members (OR = 3.33; 95% CI = 2.45, 4.53).

Discussion

In this study, we found support for individual, head of household, and household factors that influenced participation in MDA campaigns. We found the estimated self-reported MDA coverage level to be greater than 80% in three of the four districts. Even with these coverage levels, there remains a substantial fraction of community members not receiving MDA treatment. While individual factors cannot be discounted, it is critical to fully examine head of household and household factors. These factors likely affect all members of the household, especially the most vulnerable, children (under the age of 9), whose healthcare is dependent upon the head of household (13).

Our study suggested some social connectedness towards MDAs that is consistent with previous campaigns in other locations. De Martin et al. found, for example, that active participation in an MDA for malaria in The Gambia was dependent on altruism (16). Participation in azithromycin MDAs is also an altruistic act as it provides a level of herd immunity (community protection of those not treated) against persistent trachoma transmission and infection (17). Although we did not directly assess altruism as a motive for participation, we sought to measure connection and engagement of individuals with their communities. Long-term residents, who have had the time to integrate and develop a sense of belonging to the community, were more likely to participate in the MDA than newer residents. However, this factor was only statistically significant in our first model. Members from households with greater social capital, where the head of household could rely on a greater number of neighbors during times of emergency, were also more likely to participate. While this factor did not obtain statistical significance in either of our two models, prior studies have suggested that greater connection to a community may confer feelings of good will that can outweigh the fears of azithromycin (and TEO) side effects and the time-intensive nature of MDA participation (18).

Perceived health status was also shown to be associated with MDA participation, but this association has been mixed across the literature. "Healthy" individuals can be misinformed about their health status—perceiving themselves as not at risk—and choose to not participate in MDAs (13). Evidence of this concept was seen in a study in Vanuatu that found healthy individuals to be the primary non-compliant and non-participatory members of lymphatic filariasis MDAs because they saw no reason to be adherent (19). While healthy individuals may choose to not participate, those in poor health condition may not have a choice. Astale et al. found in Ethiopia that a primary reason individuals do not participate is due to physical difficulties in reaching the distribution site, which results from or is exacerbated by poor health conditions (20). On the other hand, Desmond et al. and Krentel et al. found that people perceive medication as a health maintenance method and thus regularly participate (21, 22). Our study agreed with this latter hypothesis. Having a higher self-rated health score had higher participation in the MDA than "poor" health residents.

Health status is related to social network factors, which can partially explain integration and connectedness to the surrounding community (23). In addition to ability to rely on neighbors for familial or financial support in times of emergency, we asked about the frequency of head of household socialization. Daily interaction with neighbors increased the likelihood to participate in the MDA. This was similarly found in previous trachoma MDA studies conducted in Tanzania where there is a strong kinship system (13, 24). Having a stake in the community results in individuals perceiving community efforts like an MDA to be important and worth their time, thus increasing participation rates (13).

Other factors associated with MDA participation revolved around knowledge of the campaign and of trachoma. Communities must first be made aware of the advancing MDA campaign, including its basic logistics (location, time frame, purpose), for participation to occur (25). After providing foundational information, clear and candid communications about the purpose and possible side effects of MDAs have been shown to increase participation (26). This type of knowledge may reduce panic and fear about the disease and the intervention to control it (13, 26). The benefits at the individual and community level should be explicit (27). Equally as important is the knowledge of trachoma. Kajeechwa et al. found along the Thailand-Myanmar border that being unable to name the causes of malaria was associated with lower participation in the anti-malarial MDA (18). A generalized understanding of the causes, symptoms, and consequences of a disease may strongly motivate participation in MDAs (25, 28). Without health education messages being a part of azithromycin MDA mobilization strategies, increasing participation will be difficult. In The Gambia, communities had persistent non-participation because of a lack of health education (14). Our data suggest that increasing the length of health messaging in Amhara prior to an MDA as well as incorporating greater trachoma-related content may be beneficial in increasing participation in the MDA.

Finally, logistical challenges of bringing a family to the MDA distribution site can be burdensome, especially when the family is large or the site is far from the household. Larger families may be less likely to participate, resulting in a greater risk of trachoma transmission within the household and the community (2, 24). It has been recommended that extending the timeframe of MDA campaigns affords heads of households more time to bring their families

(13). While a majority of the MDA distribution sites in the May 2017 MDA campaign were within a 30-minute walk, our results from the second model were consistent, but not statistically significant, with previous findings that larger households have persistent challenges in participation and this should be addressed in future campaigns.

Recommendations. Our results provide significance evidence of the role that heads of households play in MDA participation, which suggests that messaging should be focused on them. However, heads of households will not be the only ones to benefit from targeted MDA awareness and trachoma messages. As made evident by the high degree of clustering we found, if the head of household participates in the MDA, the other household members are likely to follow suit and participate. Simple modifications in the message's content and intended audience may reduce gaps in MDA coverage. Finally, our data support the identification of marginalized households, due to household size or community connection, and engagement in community inclusive efforts to further increase MDA participation.

Limitations. There are several limitations with our study. There was potential for recall bias given the three- to five-week period between the MDA and our survey. We attempted to mitigate this issue by showing azithromycin tablets and TEO samples to every respondent as well as keeping the time frame between the two events short. Furthermore, no other MDA medication was distributed in East Amhara during this time period. Recall bias could have ultimately affected the results in either direction, and thus it is difficult to say how our data were impacted. There is also a limitation of missing data and selection bias. Males, on average, were more likely to be absent from the household at the time of the survey. Similar to recall bias, this non-random missingness may have biased our results. We had survey teams visit each household twice in attempt to avoid absentee members. Additionally, respondents who were present for this survey may have been more likely to be present for the MDA campaign itself (e.g., were not traveling for work, were not away for schooling) than absent household members, thus representing an underestimation of MDA coverage and the predictors for participation. Finally, we recognize that there may be other factors influencing participation in the MDA that were not collected in our survey or challenging to address in empirical data collection, including temporary migration of some residents. Another limitation of our survey was that we included novel health and social capital questions that have not yet been validated with our study population. We also did not collect robust data on campaign factors and thus this fourth level of MDA-related factors was not evaluated. Despite these limitations, strengths of our study include the use of survey teams different from the MDA teams and the randomization of village and household selection. Our standard survey methodology and high response rates yielded findings consistent with similar interventions in similar communities.

Conclusions. Our study provides new evidence of factors associated with participation in azithromycin MDAs for trachoma control, notably at the head of household and household levels. While our results demonstrated fairly high coverage, we identified several factors that may offer insight on how to further improve MDA coverage. Based on the current literature and our study, MDA campaigns should be tailored to increase the overall participation. Targeting marginalized households within communities and increasing awareness of trachoma knowledge and MDA logistics may help close the gap in non-participation. Investing in the initial mobilization of MDAs should ultimately increase the reach of these campaigns and reduce the need for individual follow-up of non-participating community members, saving time and funding. Further research is needed to identify factors not yet explored in the study, as well as to follow up on factors such as social capital. WHO goals of trachoma elimination as a public health problem may be possible with future evidence-driven, inclusive MDA campaigns that increase coverage.

Appendix

Figure 1. Location of surveyed districts in East Amhara, Ethiopia

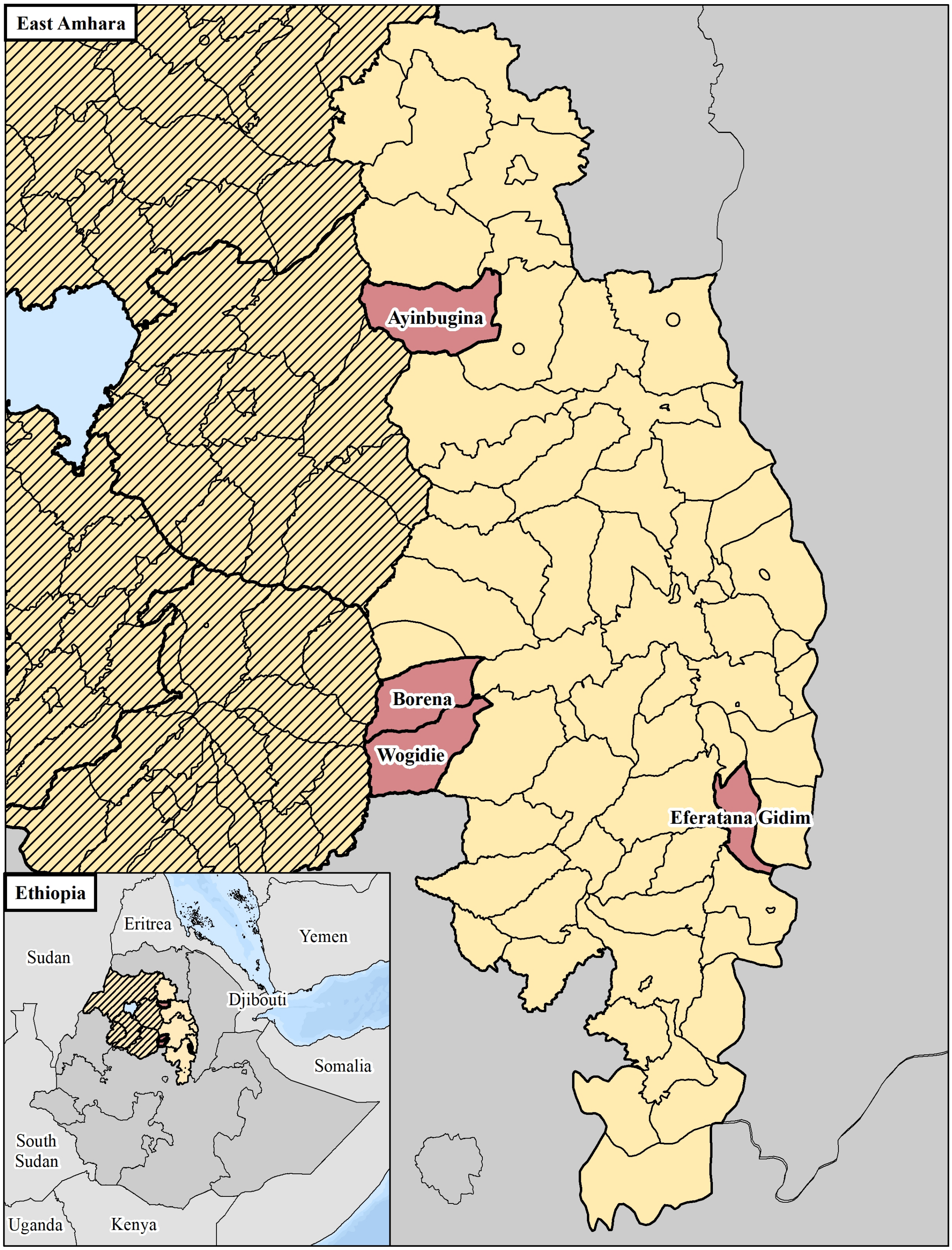

Figure 2. Flow diagram of participation in the post-campaign coverage survey

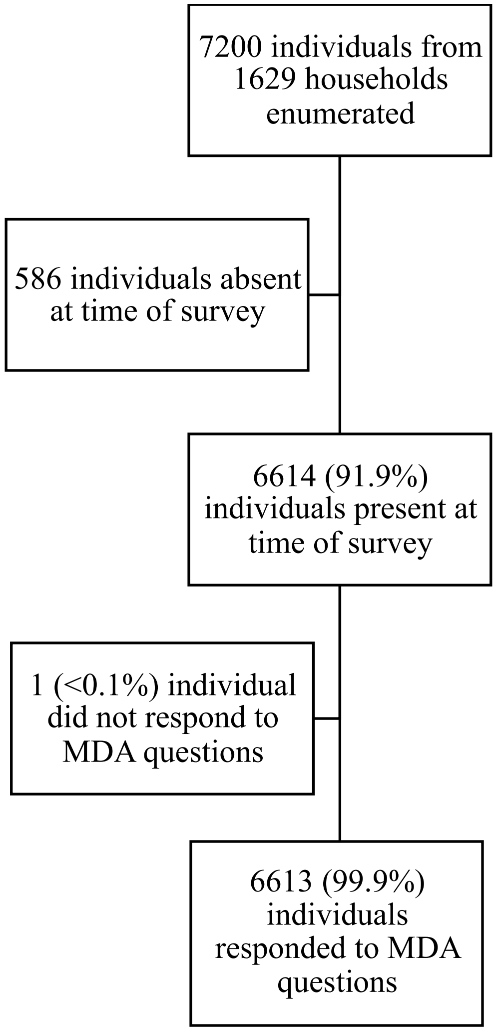

Table 1. Demographic characteristics of present and absent participants

	Present		Absent[a]	
	N	%	N	%
	6613	91.9	586	8.2
Age				
0 - 9	1736	26.25	41	7.00
10 - 19	1738	26.28	173	29.52
20 - 29	825	12.47	104	17.75
30 - 39	745	11.26	86	14.68
40 - 49	530	8.01	73	12.46
50 - 59	414	6.26	54	9.22
60 - 69	319	4.82	31	5.29
70+	307	4.64	24	4.10
Sex				
Male	3139	47.47	452	77.13
Female	3473	52.53	134	22.87
Health				
Excellent	5986	90.75		
Fair	511	7.75		
Poor	99	1.50		
Participated in MDA				
Yes	5426	82.05	360	74.53
No	1187	17.95	123	25.47

[a]Head of household provided information on behalf of absent household member(s)

Table 2. Individual, head of household, and household factors for participation in MDA versus no participation in MDA

Categorical Variables	Participated N (%)	Did Not Participate N (%)	OR	95% CI
Age				
0 - 9	1507 (27.7%)	228 (19.2%)	1.00	
10 - 19	1472 (27.1%)	266 (22.4%)	0.84	0.69-1.01
19 - 29	625 (11.5%)	200 (16.9%)	0.47	0.38-0.58
30 - 39	602 (11.1%)	143 (12.1%)	0.64	0.51-0.80
40 - 49	434 (8.0%)	96 (8.1%)	0.68	0.53-0.89
50 - 59	323 (6.0%)	91 (7.7%)	0.54	0.41-0.70
60 - 69	244 (4.5%)	75 (6.3%)	0.49	0.37-0.66
70+	219 (4.0%)	88 (7.4%)	0.38	0.28-0.50
Sex				
Female	2847 (52.5%)	626 (52.7%)	1.00	
Male	2577 (47.5%)	561 (47.3%)	1.01	0.89-1.15
Health[a]				
Poor	57 (1.1%)	42 (3.6%)	1.00	
Fair	427 (7.9%)	84 (7.1%)	3.75	2.30-5.17
Excellent	4932 (91.1%)	1054 (89.3%)	3.45	2.36-5.95
Highest Level of Household Education				
None	2010 (37.0%)	419 (35.3%)	1.00	
Religious	210 (3.9%)	42 (3.5%)	0.95	0.42-2.16
Primary school	638 (11.8%)	162 (13.7%)	0.81	0.50-1.32
Junior secondary	1270 (23.4%)	269 (22.7%)	1.05	0.70-1.56
Senior secondary	743 (13.7%)	199 (16.8%)	0.65	0.41-1.02
College/university	93 (1.7%)	25 (2.1%)	0.88	0.29-2.66
Non-formal education	462 (8.5%)	71 (6.0%)	1.77	0.95-3.32
Head of Household's Place of Birth				
Within the kebele	3259 (60.1%)	650 (54.8%)	1.00	
Outside the kebele	2167 (39.9%)	537 (45.2%)	1.35	0.99-1.82
Years of Residency[b]				
Greater than 10 years	2276 (82.3%)	504 (77.7%)	1.00	
10 years or fewer	540 (17.7%)	167 (22.3%)	1.73	1.04-2.87
Prior Knowledge of MDA Campaign[c]				
No	3292 (59.8%)	966 (78.8%)	1.00	
Yes	2134 (40.2%)	221 (21.2%)	4.55	3.26-6.36
Knowledge of Trachoma[c]				
No	2692 (49.6%)	710 (59.8%)	1.00	
Yes	2734 (50.4%)	477 (40.2%)	1.76	1.30-2.37

Social Capital: Social time spent with friends[c]				
Zero times (in a month)	1000 (18.4%)	227 (19.1%)	1.00	
1-4 times a month (< weekly)	1893 (34.9%)	382 (32.2%)	1.24	0.81-1.90
5-8 times a month (< biweekly)	927 (17.1%)	186 (15.7%)	1.14	0.69-1.87
9-29 times a month (< monthly)	1392 (25.7%)	365 (30.8%)	0.80	0.51-1.24
Every day	214 (3.9%)	27 (2.3%)	2.44	0.95-6.27
Social Capital: Ability to rely on neighbors[c]				
No one	1793 (33.0%)	357 (30.1%)	1.00	
1-2 people	1041 (19.2%)	297 (25.0%)	0.64	0.42-0.96
3-4 people	1045 (19.3%)	277 (23.3%)	0.72	0.47-1.09
5+ people	1482 (27.3%)	245 (20.6%)	1.31	0.88-1.97
Don't know	65 (1.2%)	11 (0.9%)	0.94	0.23-3.90
Travel Time from Household to Distribution Site				
0 - 30 minutes	4485 (92.7%)	330 (91.2%)	1.00	
31 - 60 minutes	338 (7.0%)	29 (8.0%)	0.80	0.48-1.35
> 60 minutes	14 (0.3%)	3 (0.8%)	0.26	0.05-1.54
Head of Household Participated in MDA				
No	528 (9.8%)	437 (54.7%)	1.00	
Yes	4837 (90.2%)	362 (45.3%)	13.56	10.81-17.01
Continuous Variables	Mean (SD)	Mean (SD)		
Household Size[e]	4.85 (1.74)	4.68 (1.79)	1.12	1.03-1.22
Head of Household's Age	41.69 (14.31)	42.97 (15.10)	0.99	0.98-1.00
Number of Sources of MDA Knowledge	1.749 (0.94)	0.885 (1.00)	3.78	3.23-4.41
Number of Known Causes of Trachoma[f]	0.955 (1.20)	0.713 (1.08)	1.30	1.14-1.48
Number of Sources of Trachoma Knowledge[f]	1.04 (1.20)	0.75 (1.06)	1.36	1.19-1.55
Number of Known Outcomes of Trachoma[f]	0.633 (0.72)	0.490 (0.67)	1.48	1.20-1.84
Number of Known Protective Activities[f]	1.172 (1.32)	0.864 (1.188)	1.31	1.16-1.47

[a]Self-reported

[b]Number of years the household has lived in their current village

[c]Reported by the head of household

[d]Percentage of the entire household participating in the MDA. None = 0%; Some = > 0% and < 100%; All = 100%

[e]Number of individuals living in the household

[f]Asked to head of household who answered "Yes" to knowledge of trachoma; N = 3211

Table 3. Adjusted[a] random effects logistic model for MDA participation in all study participants (n = 6613)

	OR	95% CI
Age	0.98	0.98-0.99
Health[b]		
Poor	1.00	
Fair	7.06	3.46-14.38
Excellent	5.72	3.02-10.83
Years of Residency[c]	1.28	0.84-1.96
Prior Knowledge of MDA Campaign[d]	2.89	2.01-4.17
Knowledge of Trachoma[d]	1.60	1.17-2.18
Social Capital: Ability to rely on neighbors		
No one	1.00	
1-2 people	0.96	0.66-1.40
3-4 people	0.85	0.56-1.29
5+ people	1.01	0.66-1.53
Don't know	1.62	0.48-5.52
Household Size[e]	1.02	0.95-1.11

[a]Adjusted for head of household’s age and sex

[b]Self-reported

[c]10+ years vs. 10 years or fewer

[d]Yes vs. no

[e]Number of individuals living in the household

Table 4. Adjusted[a] random effects logistic model for MDA participation in non-heads of households (n = 4969)

	OR	95% CI
Age	0.98	0.98-0.99
Health[b]		
Poor	1.00	
Fair	7.25	3.02-17.40
Excellent	6.06	2.82-13.00
Years of Residency[c]	1.13	0.75-1.71
Head of Household Participated in MDA[d]	3.33	2.45-4.53
Prior Knowledge of MDA Campaign[d]	1.73	1.26-2.38
Knowledge of Trachoma[d]	1.20	0.91-1.60
Social Capital: Ability to rely on neighbors		
No one	1.00	
1-2 people	1.32	0.92-1.89
3-4 people	1.09	0.74-1.59
5+ people	1.24	0.86-1.80
Don't know	3.04	0.89-10.43
Household Size[e]	0.97	0.90-1.05

[a]Adjusted for head of household’s age and sex

[b]Self-reported

[c]10+ years vs. 10 years or fewer

[d]Yes vs. no

[e]Number of individuals living in the household

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Supplemental Appendix

Figure 3. Distribution of Cluster-Level Self-Reported MDA Participation

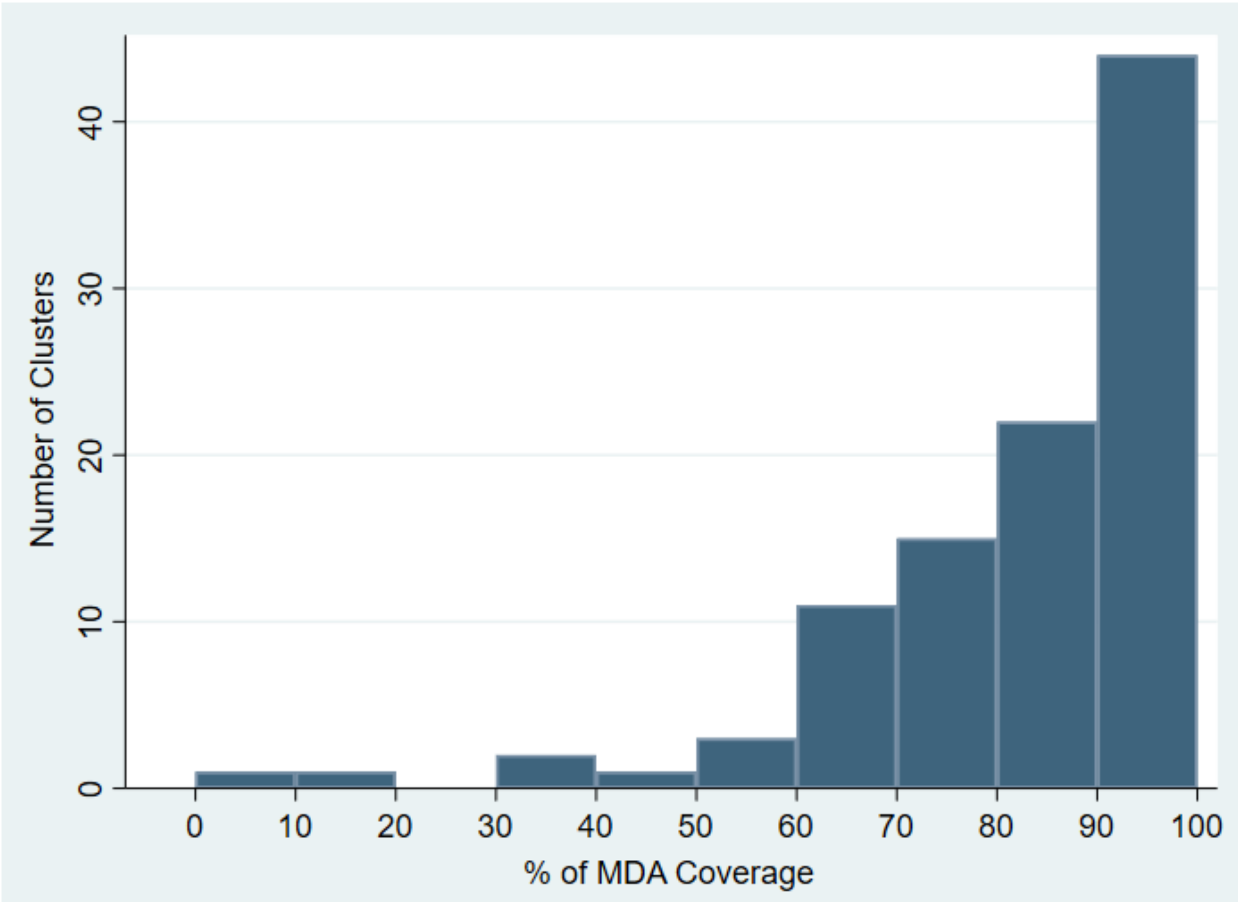
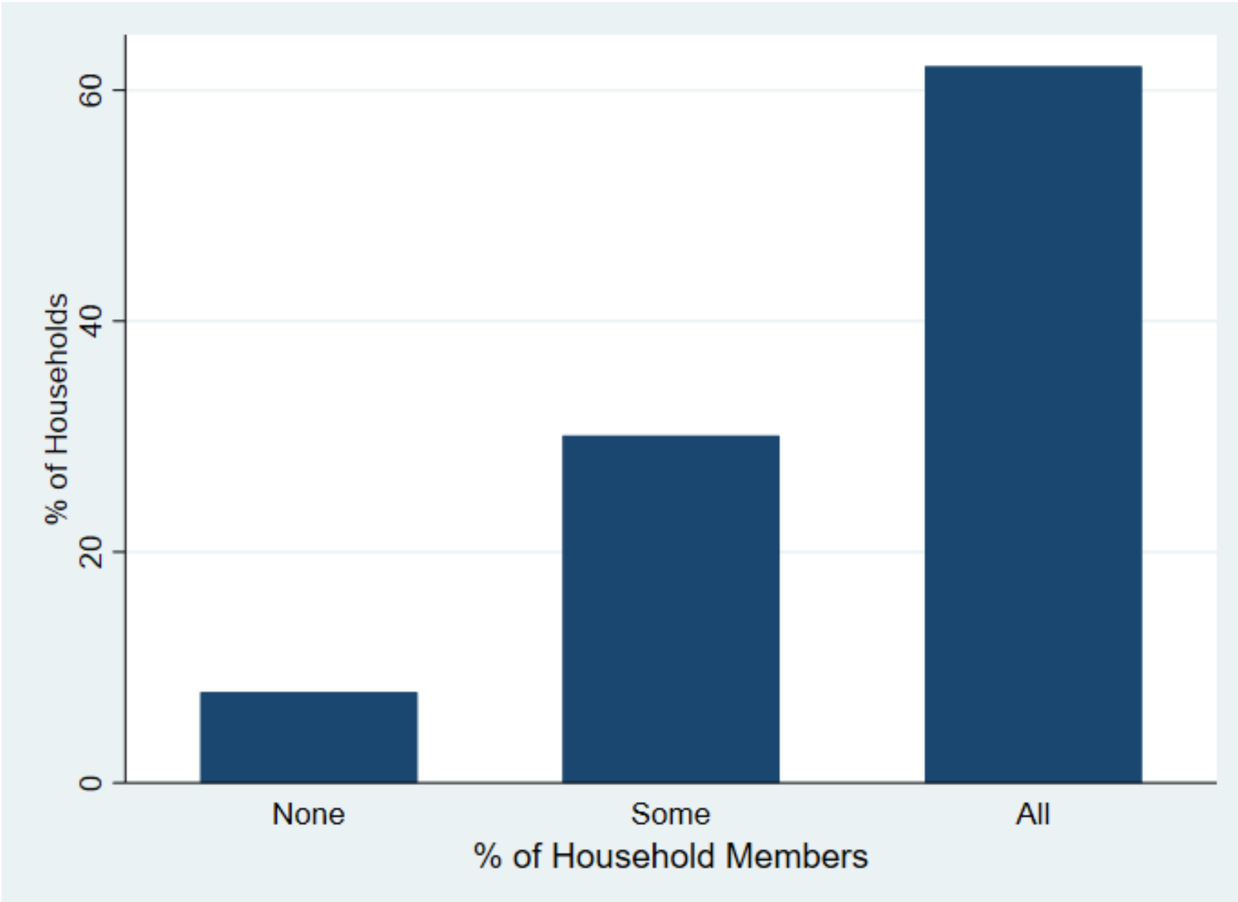


Figure 4. Distribution of the Percentage[a] of Household Members Participating in the MDA



[a]None = 0%; Some = > 0% and < 100%; All = 100%