

## The Ethiopian SORT IT Course

# Does mass drug administration for community-based scabies control works? The experience in Ethiopia

Wendemagegn Enbiale<sup>1,6</sup>, Ashenafi Ayalew<sup>2</sup>, Teklehaymanot Gebrehiwot<sup>2</sup>, Yared Mulu<sup>1</sup>, Muluken Azage<sup>1</sup>, Rony Zachariah<sup>3</sup>, Lucia Romani<sup>4</sup>, Kristien Verdonck<sup>5</sup>, Johan van Griensven<sup>5</sup>, Henry JC de Vries<sup>6,7</sup>

<sup>1</sup> Bahir Dar University, Bahir Dar, Ethiopia

<sup>2</sup> Amhara Public Health Institution, Bahir Dar, Ethiopia

<sup>3</sup> UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR), World Health Organization, Geneva, Switzerland

<sup>4</sup> The Kirby Institute, University of New South Wales, Sydney, NSW, Australia

<sup>5</sup> Institute of Tropical Medicine, Antwerp, Belgium

<sup>6</sup> Department of dermatology, Amsterdam Institute for Infection and Immunity (AI and II), Amsterdam UMC, University of Amsterdam, Amsterdam, Netherlands

<sup>7</sup> STI outpatient clinic, Department of Infectious Diseases, Public Health Service Amsterdam, The Netherlands

### Abstract

**Introduction:** After a scabies outbreak in Amhara Region, Ethiopia in 2015/2016, the Regional Health Bureau performed an extensive Mass Drug Administration (MDA). In May 2017, we collected data to assess the impact of the treatment on the scabies control.

**Methodology.** We retrieved baseline data from the 2015/16 burden assessment: campaign organization and administration information. We did a community based cross-sectional study using a structured questionnaire on disease and treatment history plus the presence or absence of active scabies in three Zones. We selected households using stratified random sampling deployed 7581 questionnaires and performed key informant interviews.

**Results:** 46.3% had a previous scabies diagnosis in the last 2 years of which 86.1% received treatment, and the cure rate was 90.6%. Fifteen months after intervention the scabies prevalence was 21.0 % (67.3% new cases and 32.7% recurrences). The highest burden of new cases (93.1%) was found in the North Gondar zone. The likelihood of treatment failure was higher for treatments offered in clinics (12.2%) as opposed to via the campaign (7.9%). Failure to follow the guidelines, shortage of medicine and lack of leadership prioritization were identified as reasons for resurgence of the disease.

**Conclusions:** We demonstrated that community engagement is essential in the success of scabies MDA, alongside strong political commitment, and guideline adherence. Effectiveness and sustainability of the MDA was compromised by the failing of proper contact treatment, surveillance and case management.

**Key words:** Scabies outbreak; operational research; Amhara region; public health emergency.

*J Infect Dev Ctries* 2020; 14(6.1):78S-85S. doi:10.3855/jidc.11892

(Received 01 August 2019 – Accepted 28 February 2020)

Copyright © 2020 Enbiale *et al.* This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

### Introduction

Scabies is a disease caused by infestation with the mite *Sarcoptes scabiei* var. *hominis*. Scabies is transmitted via direct human-to-human contact. Individuals living in an overcrowded environment and in poverty are at highest risk. Scabies is one of the world's commonest Neglected Tropical Diseases with a global point prevalence of about 147 million and annual incidence of 455 million cases [1,2]. The 2016 Global Burden of Disease (GBD) estimated that scabies causes about 3.8 million Disability-Adjusted Life-Years (DALYs), making an age adjusted morbidity burden similar to lymphoid leukemia, *Haemophilus*

influenza and type B meningitis [2-7]. The predominant symptom of scabies infection is severe, persistent pruritus which can be highly debilitating and stigmatizing. Moreover, skin barrier breaches are associated with secondary bacterial skin infection in more than two third of infested children, leading to acute and chronic complications [1,2,8]. The establishment of a clinical diagnosis is recommended for community-based interventions. A range of effective topical and systemic treatments are available for scabies [9].

In Ethiopia, an outbreak of scabies has been going on since 2015. In response to that, a national control

program was launched. In October 2015, 1.2 million people were screened for scabies during a community-based survey in the Amhara region and about 379,000 cases of scabies were identified [9,10]. Scabies diagnosis and contact identification was performed clinically using previously validated case and contact definitions [10-12]. The scabies control campaign was conducted from November 2015 to February 2016 in 10 zones in Amhara region. Oral ivermectin was recommended as the main drug for the MDA. Topical treatments such as Benzyl Benzoate Lotion (BBL), Permethrin 5% and sulfur cream were also available for those who were not eligible to take ivermectin.

While the efficacy of MDA for scabies control has been shown in trial settings and several small studies [13-23], a number of operational research questions/or knowledge gaps remain. Particularly for Africa, detailed follow-up studies of large-scale community-based programs evaluating what was actually achieved in terms of treatment coverage and cure rates are lacking. The effectiveness of MDA has also varied across studies. A potentially important factor could relate to barriers in field implementation, and scarce evidence is available. Finally, there is risk of ongoing transmission, and subsequent increases in caseloads when MDA campaign control activities are not sustained. Therefore, the aims of this study were to a) assess coverage and cure rates of the scabies MDA campaign and clinic-based treatment; b) identify administrative and organizational challenges and barriers; 3) determine the prevalence of scabies 15 months after the scabies MDA campaign.

## Methodology

### General setting

Ethiopia is the second most populous country in Africa. Most recent data estimate the total population for the year 2019 to be about 100 million, with 45% below the age of 15. The average size of a household is 4.7 [24]. The population living below \$1.25 purchasing power parity (PPP) a day was 23.5 % in 2016 [25]. With the presence of 16 out of the 20 neglected tropical diseases (NTDs) in the WHO list, Ethiopia has the third highest number of NTD cases in Africa [27]. The country is a federal parliamentary republic composed of nine Regional States and two City Administrations council (Dire Dawa and Addis Ababa).

### Specific setting

The Amhara National Regional State in the North West and East of the country has a population of 21,234,988. The region is further divided in to 13 administrative zones [24]. East Gojjam zone with a population of 2,539,491, is considered to have a strong administration, stable political environment and relatively good health outcomes in the region. Wag Himra zone with a population of 528,764 is also politically stable although remote. Economically it is the poorest zone in the region with a high rate of malnutrition and weak healthcare structure. South Gondar zone with a population of 3,704,740 inhabitants is a politically unstable corner of the region with poor infrastructures and poor health service indicators.

### The Mass Drug Administration campaign for scabies

The treatment campaign followed two scenarios, based on burden of the disease. In the first scenario, in a community with scabies prevalence less than 15%, treatment was given for cases and household contacts. In the second scenario, in communities with prevalence equal or greater than 15%, the management was MDA

**Table 1.** Scabies treatment types and categories in the Mass Drug Administration campaign in Amhara Region Ethiopia (June-August 2017).

Drug	Dosage	Whom to treat
5% permethrin lotion	- 60 mL for adults and 30 to 40 mL for children (for two separate applications)	- Infants above 2 months' old - Children and adult (both pregnant and lactating).
5%-10% sulfur	- For children under 10 years: one tube (50 gm) - For children above 10 years and adults: two tubes of 10% sulfur - Applied below the whole body daily for three days	- Children under 10 years, pregnant and breast feeding women
25% benzyl benzoate lotion	- 100 mL, one bottle - Applied below the neck the whole body daily for three days	- Children above 2 years old and adult
Oral ivermectin	- Age 2 year to 6: 1 tab of 3 mg Age 7 to 12: 2 tabs - Age 13 to 18: 3 tabs - Age 18 and above:4 tabs	- Except pregnant, breast feeding women and children aged < 2 years

for all community members [11]. In general, 55% of the population were candidate for MDA [12]. Ivermectin and permethrin were given in two doses one week apart and sulfur and benzyl benzoate lotion (BBL) were to be applied for three consecutive days for both patient and contacts (Table 1) [6].

We defined a scabies case as the presence of itching with typical lesions in the inter-digital areas of the hands, breast, inter-gluteal and/or genitalia area. We defined a scabies contact as a person who did not fulfil the clinical criteria of a scabies case, but had direct contact (skin-to-skin) with a suspected or confirmed case in the two months preceding the onset of scabies in the identified case [11].

*Study design and participants’ selection*

We conducted a community based cross-sectional study in May 2017 in the three selected zones with a total population of 6,772,995. The three zones were selected randomly from ten previous scabies endemic areas. In each zone, three districts were selected randomly. Each district (woreda) has on average 100,000 residents. From each district, two villages were selected randomly. Each house within a village has community-based health insurance (CBHI) numbers. Households were selected using a simple random sampling technique from the Community Based Health Insurance (CBHI) records. The sample size for each village (18 villages) was calculated using a single proportion formula for each, with consideration of the previous 34% scabies prevalence [9].

*Data Collection*

In each district, three health officers were recruited as supervisor and six health extension workers (HEWs) were recruited as data collectors and trained for one day on clinical scabies diagnosis and data collection methods. We deployed in total 7581 questionnaires in the three zones. A structured questionnaire on demography, history of previous scabies diagnosis, history of scabies treatment, place of treatment, type of treatment, response for treatment and scabies at time of the interview was administered to 7562 residents.

For the desk review, the pre-intervention data for the three zones was retrieved from the 2015/16 burden assessment; data on intervention campaign timing, drug distribution and drug utilization were collected from the zonal health offices. We used semi-structured questionnaires for key informant interviews. Key informants were the focal persons for the scabies intervention response in the district, Public Health

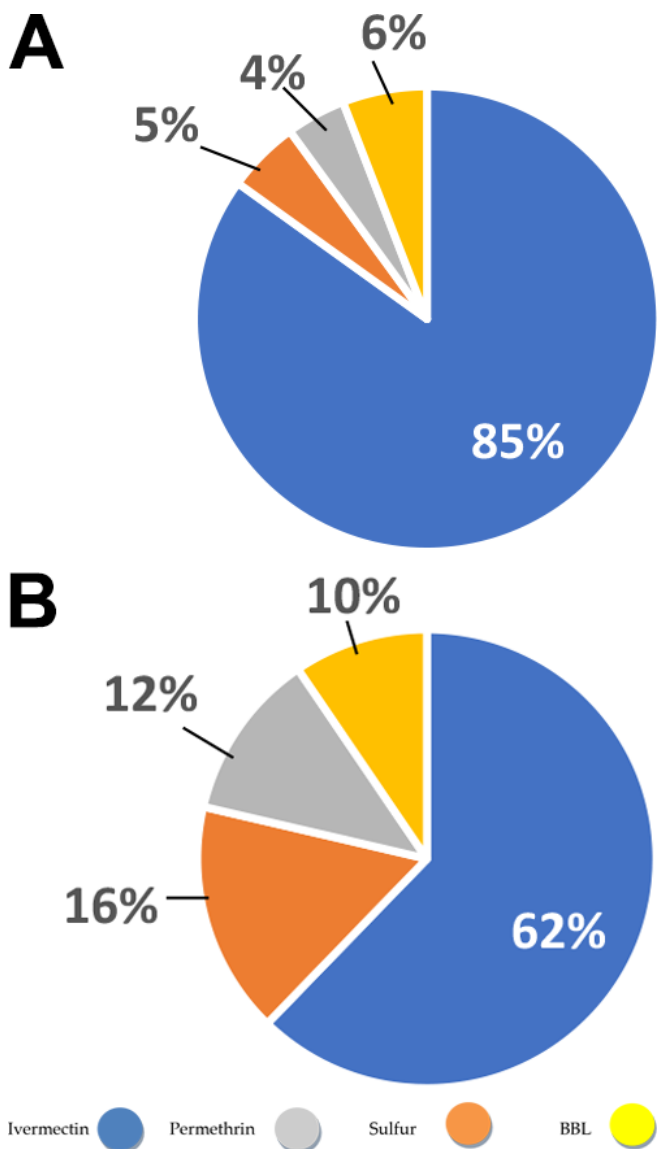
Emergency Management (PHEM) focal person in Zone and the Regional Health Bureau PHEM expert.

*Data analysis*

Data were entered and cleaned in excel and exported to stata version 14 for analysis. Descriptive statistics such as mean, proportions, standard deviation were computed and reported. Prevalence of scabies with 95% confidence intervals was also calculated to compare results pre-and post-interventions.

The qualitative data was transcribed, organizing based on objectives and tabulated. The accuracy of some of the information generated from the key informant interview was cross validated with the

**Figure 1.** The medicines given in the campaign (A) and medicine given in clinic (B) in the three zones involved in the impact assessment study. Amhara region Ethiopia, May 2017.



information generated by the desk review that uses health facility routine reports from district health offices.

### Ethical Consideration

Permission to conduct the study was obtained from the Amhara Regional Health Bureau (Approval reference APHI 01/795) as part of the regional health bureau operational research. Permission was also secured from the zonal and district health offices. Written informed consent was collected for each participant in the quantitative study. Written informed consent was also collected from the health workers and health service managers who were involved in the qualitative key informant interview.

### Results

A total of 7562 participants consented for the interview and physical examination of which 50.2% were women. Approximately one third of the interviewees lived in East Gojjam, one third in North Gondar, and one third in Wag Himra (Table 2).

The median number of people living in the participants' houses was 5 (range 1-12; interquartile range 4-7). Two percent of the women were pregnant at the time of interview.

The proportion of participants who reported a previous diagnosis of scabies was 46.3% (3502 out of 7562) and 86.1% of them received treatment. About half (51.5%) of the total participant said that they had received treatment for scabies before. The median time between the previous treatment and the interview was 15 months (interquartile range 12-17). The majority of those who received treatment got it through the MDA

**Table 2.** The number and proportion of participants per district in the three zones involved in the impact assessment study. Amhara region Ethiopia, May 2017.

Zone / District	N (%)
<b>East Gojjam</b>	
Debay	1070 (14.2)
South Bernta	1462 (19.3)
<b>North Gondar</b>	
Dabat	998 (13.2)
Debark	855 (11.3)
Wogera	536 (7.1)
<b>Wag Himra</b>	
Dehana	889 (11.8)
Gazgibla	1154 (15.3)
Sekota Zuria	598 (7.9)
<b>Total</b>	<b>7562</b>

campaign (69.8%; 2436/3492) and the remainder (30.2%; 1056/3492) got it at a clinic.

The medicines used in the campaign were mainly ivermectin (83.91%). In the clinics, there was more variation in the treatments used (Figure 1).

Regarding the outcome of the previous treatment, 91.1% said that they improved or were cured (2854/3134). The treatment coverage was 86.0%: 3011 out of the 3502 subjects who said they got a diagnosis of scabies before, also reported a previous treatment. Furthermore, 15.8% (537) interviewees reported a previous treatment but no previous diagnosis. The cure rate in East Gojjam Zone was 97.6% (95% CI of 95.9-98.6), in Wag Himra 89.6% (95% CI of 88.2-90.9), North Gondar 87% (95% CI of 83.4-89.8).

When analyzed by treatment given, there is no significant difference on the cure rate of those who received topical versus systemic treatment. But the

**Table 3.** People who report a previous diagnosis and a previous treatment for scabies and factors associated with a poor response to treatment in the three zones involved in the impact assessment study. Amhara region Ethiopia, May 2017.

	Improved	Not improved	Total	Odds ratio (95% confidence interval)	P-value
<b>Sex</b>					
men	1351 (91.7%)	122 (8.3%)	1473	1	0.07
women	1318 (89.8%)	150 (10.2%)	1468	1.26 (0.98-1.62)	
<b>Household size</b>					
mean (SD)	5.5 (1.9)	5.6 (1.8)			
< 5	831 (91.6%)	76 (8.4%)	907	1	0.5
≥ 5	1669 (90.8%)	169 (9.2%)	1838	1.11 (0.83-1.47)	
<b>Medicine</b>					
ivermectin	2105 (90.6%)	218 (9.4%)	2323	1	0.3
BBL	206 (89.2%)	25 (10.8%)	231	1.17 (0.74-1.78)	
permethrin	183 (94.3%)	11 (5.7%)	194	0.58 (0.29-1.03)	
sulphur	180 (90.9%)	18 (9.1%)	198	0.97 (0.56-1.56)	
<b>Place</b>					
campaign	1873 (92.1%)	161 (7.9%)	2034	1	<0.001
clinic	802 (87.8%)	111 (12.2%)	913	1.61 (1.25-2.08)	

likelihood of treatment failure was significantly higher for those who received their treatment in a clinic compared to treatment through the MDA campaign (OR of 1.61 and P- Value<0.001) (Table 3).

The study also showed the success rate of both topical and systemic scabies treatment was more than 90% (Table 4).

At the time of the interview, 21% had active scabies with wide differences in prevalence between the zones, East Gojjam 3.2 %, WagHimr 15.3 % and North Gondar 46.1 % (Table 5). The duration of itching ranged from 1 week to more than 1 year (median 6 months; interquartile range 2-7 months). In 72.9% cases the itching led to sleep disturbances. Of those with scabies, 32.7% were treated for scabies before while

**Table 4.** People who report a previous diagnosis and a previous treatment for scabies and factors associated with a diagnosis of scabies in the three zones involved in the impact assessment study. Amhara region Ethiopia, May 2017.

	No diagnosis of scabies at time of interview	Scabies at time of interview	Total	Odds ratio (95% confidence interval)	P-value
<b>Sex</b>					
men	1260 (85.7%)	210 (14.3%)	1470	1	0.3
women	1240 (84.2%)	232 (15.8%)	1472	1.12 (0.92-1.38)	
<b>Household size</b>					
mean (SD)	5.5 (1.9)	5.3 (1.8)			
< 5	772 (86.3%)	123 (13.7%)	895	1	0.2
≥ 5	1619 (88.0%)	221 (12.0%)	1840	0.86 (0.68-1.09)	
<b>Medicine</b>					
ivermectin	1954 (84.8%)	350 (15.2%)	2304	1	0.01
BBL	197 (84.9%)	35 (15.1%)	232	0.99 (0.67-1.43)	
permethrin	176 (93.1%)	13 (6.9%)	189	0.41 (0.22-0.70)	
sulphur	170 (82.1%)	37 (17.9%)	207	1.22 (0.83-1.75)	
<b>Place</b>					
campaign	1727 (86.3%)	274 (13.7%)	2001	1	0.01
clinic	770 (82.7%)	161 (17.3%)	931	1.32 (1.07-1.63)	

**Table 5.** Scabies relapse versus new cases at time of the impact assessment in the three Zone’s, Amhara region Ethiopia 2017.

Geographic zones	Previous scabies (n)	Relapse scabies (n/%)	New scabies (n/%)	CI	OR	P-value
East Gojjam	559	51/9.1	30/2.1	1.5-3.0	1	
North Gondar	868	621/71.5	484/36.4	33.8-39.0	26.2 (18-38.3)	< 0.001
Wag Himra	2075	400/19.3	6/2.4	1.1-5.2	1.1(0.46-2.73)	0.792
Total	3502	1072/30.6	520/14.9			

**Table 6.** People who report a previous diagnosis and a previous treatment for scabies and factors associated with a diagnosis of scabies in the three zones involved in the impact assessment study. Amhara region Ethiopia, May 2017.

	No diagnosis of scabies at time of interview	Scabies at time of interview	Total	Odds ratio (95% confidence interval)	P-value
<b>Sex</b>					
men	3143 (90.4%)	333 (9.6%)	3476	1	0.9
women	3179 (90.5%)	335 (9.5%)	3514	0.99 (0.85-1.17)	
<b>Household size</b>					
mean (SD)	5.4 (1.9)	5.3 (1.8)			
< 5	1902 (92.8%)	147 (7.2%)	2049	1	0.2
≥ 5	3896 (93.7%)	261 (6.3%)	4157	0.87 (0.70-1.07)	
<b>Previous scabies diagnosis</b>					
no	3397 (95.0%)	177 (5.0%)	3574	1	< 0.001
yes	2923 (85.6%)	492 (14.4%)	3415	3.23 (2.70-3.86)	
<b>Previous scabies treatment</b>					
no	2852 (93.3%)	206 (6.7%)	3058	1	< 0.001
yes	2978 (86.6%)	460 (13.4%)	3438	2.14 (1.80-2.54)	



67.3% had never been treated. The highest burden of relapse (57.9%) and new cases of scabies (93.1%) were recorded in North Gondar zone.

Scabies diagnosis at the time of the interview was significantly more common on those with a previous diagnosis of scabies and those with a previous treatment for scabies (Table 6).

The qualitative study revealed that in East Gojam zone the scabies control program was well coordinated with better political commitment; prior to the campaign HEW were trained and the scabies management was based on the national guideline. In Wag Himra zone MDA scabies control program failed due to the lack of political commitment and inter-sectorial collaboration. Moreover, the existing weak health system structures led to limited resource mobilization and poor access to hard to reach area, despite the commitment of the individual experts in collecting/reporting the baseline data, and the training of HEWs (Table 7).

## Discussion

This is an impact assessment study of one of the largest scabies control public health interventions using community health workers in a low income country. We show the efficacy (91.1%) and feasibility of MDA. The key factor in addressing such massive MDA was the involvement of trained community based HEW in scabies diagnosis, treatment and contact management [4]. The study showed Ivermectin based MDA is significantly effective for community scabies outbreak control. The assessment has also revealed that there was a higher cure rate for those who received treatment through the MDA campaign (92%) compared to those who receive treatment in regular clinics (88%). This

finding has implications for future MDA interventions planned in Africa, and potentially can improve large scale MDA in scabies control efforts.

The study strength is its large and representative sample size. The study has also used both quantitative and qualitative methods to triangulate the results. The study also adhered to STROBE guidelines on the reporting of observational studies in epidemiology [26]. Finally, this study addresses an identified NTD operational research priority in Ethiopia and beyond, which may impact policy [6, 7].

A limitation of the study is the delay between the MDA and the impact assessment study (15 months) which may create difficulty to recall for the respondent some of the questions about the MDA and previous history of scabies.

Significant reductions in the prevalence of scabies in endemic settings have previously been described with community treatment using topical permethrin [23] and oral ivermectin [10].

A recently published Cochrane systematic review of the use of permethrin and oral ivermectin for treatment of scabies has reviewed fifteen studies and concluded that for the most part, there was no significant difference detected in the efficacy of permethrin compared to ivermectin [12]. Our study has also showed no significant difference in cure rate of those who has taken Ivermectin versus applied permethrin.

In general, the ease of administration, reports of the effectiveness, and the safety data from MDA interventions for lymphatic filariasis and onchocerciasis led to the choice of oral ivermectin as the main treatment in community based scabies

**Table 7.** Summary of the qualitative assessment on pre-campaign preparation, campaign implementation and post campaign activities, Amhara region Ethiopia, May 2017.

Activities	East Gojam	Wag Himra	North Gondar
Soliciting high-level leadership commitment	Good	Poor	Worst
Inter-sectoral coordination	Good	Poor	None
Health professional engagement	Good	Good	Poor
Local community engagement	Good	Poor	Not done
Baseline data and action plan development	Good	Good	Worst
Social and resource mobilization	Good	Poor	Worst
Addressing hard to reach areas	Good	Poor	Worst
Training	Good	Good	Poor
Distribution of supplies to districts	Good	Poor	Not on time
Drug distribution to patient	Good	poor	worst
Drug distribution to contacts	Good	Poor	Note done
Supervision and monitoring	Good	Good	Poor
Post Campaign reporting	Good	Good	Poor
Post campaign surveillance	Poor	Good	Not done
Report writing and feedback	Poor	Good	worst
Adhering to the treatment guideline	Good	Poor	Worst

management or MDA [15,23,27]. Taking into consideration the pharmacodynamics of ivermectin, and reports on treatment failures of a single dose of treatment to eradicate all stages of the parasite [28], we have used two doses of ivermectin given in two weeks intervals.

A study from Panama in an area with a baseline scabies prevalence of 33% showed that community-based scabies control, using community workers, continued surveillance and active case treatment, kept the prevalence of scabies below 1.5% for over 3 years [23]. Sustained contact treatment was a key factor of success. In our study in North Gondar Zone both qualitative and quantitative assessment showed that for different reasons (lack of leadership commitment, absent of health professional engagement and not using the treatment guideline) contact treatment could not be sustained, which could explain the failure of the MDA campaign in this zone. Experience has shown that programs not successfully reaching the contacts of symptomatic individuals are not successful, thereby jeopardizing the success of the MDA intervention as a whole [28]. Treatment of index cases with clinically evident scabies only had an effectiveness as low as 50% [29]. Our study also showed a resurgence of scabies, despite the initial effectiveness in East Gojam and Wag Himra up until 15 months after the MDA administration. The most likely reason is a lack of sustained case surveillance and intensified case management. Of concern is that poor surveillance and ineffective use of scabicides in endemic communities can promote the spread of resistance. This is an issue to be addressed in future studies.

## Conclusions

Our study demonstrated the essential role of community engagement in the success of scabies MDA campaigns. Strong commitment and coordinated response with other sectors are key factors of success, apart from the availability of baseline data. Failure to establish and sustain contact treatment, surveillance and intensified case management severely compromises MDA interventions.

## Acknowledgements

This research was conducted through the Amhara Public Health Institution, Public Health Emergency Management request and support.

Special thanks for the Amhara Regional Health Bureau, Zonal and District (Woreda) Health offices for giving as the access and permission to use the program data for this publication and their unreserved support.

## Funding

The program was funded by St. Paul Hospital Millennium Medical College financially and a logistic support from Bahir Dar University and Amhara Regional Health Bureau.

## Authors' Contributions

WE has made substantial contributions to the conception and design of the work; data acquisition, analysis, and interpretation of data, have drafted the manuscript, substantively revised, and has approved the submitted version. AA was involved in conceptualization of the study, data collection and result validation and he has approved the submitted version. TG was involved in conceptualization of the study, data collection and result validation and he has approved the submitted version. MA has contributed on result analysis, revision of the draft and he has approved the submitted version. YM has been involved in data acquisition and he has approved the submitted version. LR has involved on the study design, revision and she has approved the submitted version. RZ has contributed in the conception of the design and revised the manuscript. He has approved the submitted version. KV has contributed on result analysis, revision of the draft and she has approved the submitted version. JvG has contributed in the conception of the design and substantial revisions of the manuscript. He has approved the submitted version. HDV has contributed substantial revisions of the manuscript. He has approved the submitted version.

Authors agree to be personally accountable for the author's own contributions and for ensuring that questions related to the accuracy or integrity of any part of the work.

## References

- Engelman D, Cantey PT, Marks M, Solomon AW, Chang AY, Chosidow O, Enbiale W, Engels D, Hay RJ, Hendrickx D, Hotez PJ, Kaldor JM, Kama M, Mackenzie CD, McCarthy JS, Martin DL, Mengistu B, Maurer T, Negussu N, Romani L, Sokana O, Whitfield MJ, Fuller LC, Steer AC (2019) The public health control of scabies: priorities for research and action. *Lancet* 394: 81–92.
- Hay RJ, Steer AC, Engelman D, Walton S (2012) Scabies in the developing world--its prevalence, complications, and management. *Clin Microbiol Infect* 18: 313–323.
- World Health Organization (2018) Report of the Tenth Meeting of the WHO Strategic and Technical Advisory Group for Neglected Tropical Diseases. Available: [http://www.who.int/neglected\\_diseases/NTD\\_STAG\\_report\\_2017.pdf?ua=1](http://www.who.int/neglected_diseases/NTD_STAG_report_2017.pdf?ua=1). Accessed: 20 July 2017.
- Global Burden of Disease 2015 Disease and injury incidence and prevalence collaborators (2016) Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 388: 1545–1602.
- Global Burden of Disease 2016 Disease and injury incidence and prevalence collaborators (2017) Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990–2016: a

- systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 390: 1211–1259.
6. Global Burden Disease 2016 DALYs and HALE collaborators (2017) Global, regional, and national disability-adjusted life-years (DALYs) for 333 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 390: 1260–1344.
  7. Karimkhani C, Colombara DV, Drucker AM, Norton SA, Hay R, Engelman D, Steer A, Whitfeld M, Naghavi M, Dellavalle RP (2017) The global burden of scabies: a cross-sectional analysis from the Global Burden of Disease Study 2015. *Lancet Infect Dis* 17: 1247–1254.
  8. Enbiale W, Ayalew A (2018) Investigation of a scabies outbreak in drought-affected areas in Ethiopia. *Trop Med Infect Dis* 3: 114.
  9. Marks M, Engelman D, Romani L, Mason D, Sokana O, Kama M, Whitfeld M, Steer AC, Kaldor J (2018) Exploration of a simplified clinical examination for scabies to support public health decision-making. *PLoS Negl Trop Dis* 12: e0006996.
  10. Federal ministry of health of Ethiopia (2015) Scabies outbreak preparedness and response plan: Addis Ababa, Ethiopia. Available: [www.humanitarianresponse.info](http://www.humanitarianresponse.info). Accessed: 23 July 2015.
  11. Federal Ministry of Health of Ethiopia (2015) Interim-guideline for multi sectorial scabies outbreak emergency response. Addis Ababa, Ethiopia. Available: [https://www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/documents/files/final\\_ethiopia\\_interim\\_guideline\\_for\\_multisectoral\\_scabies\\_outbreak\\_response\\_final\\_14\\_dec15.pdf](https://www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/documents/files/final_ethiopia_interim_guideline_for_multisectoral_scabies_outbreak_response_final_14_dec15.pdf) Accessed: 06 June 2020
  12. Amhara public health institution, Ethiopia (2018) Guideline for scabies control. Amhara Health Bureau printing press, Bahir Dar, Ethiopia, p. 26.
  13. Dressler C, Rosumek S, Sunderkötter C, Werner RN, Nast A (2016) The Treatment of scabies. *Dtsch Arztebl Int* 113: 757–762.
  14. Martin D, Wiegand R, Goodhew B, Lammie P, Mkocho H, Kasubi M (2018) Impact of ivermectin mass drug administration for lymphatic filariasis on scabies in eight villages in Kongwa District, Tanzania. *Am J Trop Med Hyg* 99: 937–939.
  15. Leppard B, Naburi AE (2000) The use of ivermectin in controlling an outbreak of scabies in a prison. *Br J Dermatol* 143: 520–523.
  16. Mila-Kierzenkowska C, Woźniak A, Krzyżyńska-Malinowska E, Kałużna L, Wesołowski R, Poćwiardowski W, Owczar M (2017) Comparative efficacy of topical permethrin, crotamiton and sulfur ointment in treatment of scabies. *J Arthropod Borne Dis* 11: 1-9.
  17. Rosumek S, Nast A, Dressler C (2018) Ivermectin and permethrin for treating scabies. *Cochrane Database Syst Rev* 4:CD012994.
  18. Haar K, Romani L, Filimone R, Kishore K, Tuicakau M, Koroivueta J, Whitfeld M (2014) Scabies community prevalence and mass drug administration in two Fijian villages. *Int J of Dermatol* 53: 739-745.
  19. Abedin S, Narang M, Gandhi V, Narang S (2007) Efficacy of permethrin cream and oral Ivermectin in treatment of scabies. *Indian J Pediatr* 74: 915-916.
  20. Romani L, Whitfeld MJ, Koroivueta, J, Kama M, Wand H, Tikoduadua L, Tuicakau M, Koroï A, Andrews R, Kaldor JM, Steer AC (2015) Mass drug administration for scabies control in a population with endemic disease. *N Engl J Med* 373: 2305-2313.
  21. Kearns TM, Speare R, Cheng AC, McCarthy J, Carapetis JR, Holt DC, Currie BJ, Page W, Shield J, Gundjirryirr R, Bundhala L, Mulholland E, Chatfield M, Andrews RM (2015) Impact of an ivermectin mass drug administration on scabies prevalence in a remote Australian Aboriginal community. *PLoS Negl Trop Dis* 9: e0004151.
  22. Marks M, Toloka H, Baker C, Kositz C, Asugeni J, Puiahi E, Asugeni R, Azzopardi K, Diau J, Kaldor JM, Romani L, Redman-MacLaren M, MacLaren D, Solomon AW, Mabey DCW, Steer AC (2019) Randomized trial of community treatment with azithromycin and ivermectin mass drug administration for control of scabies and impetigo. *Clin Infect Dis* 68: 927–933.
  23. Romani L, Marks M, Sokana O, Nasi T, Kamoriki B, Wand H, Whitfeld MJ, Engelman D, Solomon AW, Steer AC, Kaldor JM (2018) Feasibility and safety of mass drug coadministration with azithromycin and ivermectin for the control of neglected tropical diseases: a single-arm intervention trial. *Lancet Glob Health* 6: e1132–e1138.
  24. Ethiopian Central Statistical Agency (2013) Population projections for Ethiopia 2007-2037 Addis Ababa July 2013. Available: [file:///ICPS-%20Population%20Projection%202007-%202037%20produced%20in%202012.pdf](http://www.csa.gov.et/ICPS-%20Population%20Projection%202007-%202037%20produced%20in%202012.pdf). Accessed: 3 May 2019.
  25. Deribe K, Meribo K, Gebre T, Hailu A, Ali A, Aseffa A, Davey G (2012) The burden of neglected tropical diseases in Ethiopia, and opportunities for integrated control and elimination. *Parasites Vectors* 5: 240.
  26. Vandembroucke JP, Von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, Poole C, Schlesselman JJ, Egger M, STROBE initiative (2007) Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. Version 2. *PLoS Med* 4: e297.
  27. Taplin D, Porcelain SL, Meinking TL, Athey RL, Chen JA, Castillero PM, Sanchez R (1991) Community control of scabies: a model based on use of permethrin cream. *Lancet* 337: 1016–1018.
  28. Pacqué M, Muñoz B, Greene BM, White AT, Dukuly Z, Taylor HR (1990) Safety of and compliance with community-based ivermectin therapy. *Lancet* 335: 1377–1380.
  29. Pacque MC, Dukuly Z, Greene BM, Munoz B, Keyvan-Larijani E, Williams PN, Taylor HR (1989) Community-based treatment of onchocerciasis with ivermectin: acceptability and early adverse reactions. *Bull World Health Organ* 67: 721–730.

### Corresponding author

Wendemagegn Enbiale (MD, MPH),  
Associate professor in Dermatology and venereology  
Bahir Dar University  
P.O.Box: 79  
Bahir Dar, Ethiopia  
Tel: 251911034612  
Fax: 251 583 20 60 94  
E-mail: [Wendemagegnenbiale@gmail.com](mailto:Wendemagegnenbiale@gmail.com)

**Conflict of interests:** No conflict of interests is declared.