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*The Ethiopian SORT IT Course*

# "Stopping the itch": mass drug administration for scabies outbreak control covered for over nine million people in Ethiopia

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## Abstract

Introduction: In 2018, the Ethiopian Ministry of Health embarked on a Mass Drug Administration (MDA) campaign that involved over 9 million people in Ethiopia – the largest scabies MDA campaign ever conducted on a global level. We describe its implementation and report on a) numbers screened and identified with scabies, b) treatment category and drug type and c) human resources used, duration, and cost of the campaign.

Methodology: The MDA campaign was conducted according to national guidelines and activities including: planning and organization, engagement of local leaders, community mobilisation and advocacy, awareness-raising among health workers, field implementation, and monitoring and evaluation. The campaign was conducted between July and August 2018.

Results: The MDA campaign was implemented by about 15,000 people, mostly from the community, over an average of 6 days and reached 9, 057, 427 people. A total of 875,890 (9.7%) scabies cases were detected and 995,471 (11.0%) contacts received treatment. (Contact-to-case ratio = 1.3). Scabies prevalence varied, the highest prevalence was seen in Central Gondar (39.2%), South Gondar (16.7%) and North Gondar (15.0%), these neighbouring zones contributing more than two third of all scabies cases in the region. Of 1,738,304 (93%) who received treatment, 94% received ivermectin, the rest topical permethrin and sulfur. The average coverage capacity of an MDA campaign staff member was 84 people per day. The total cost was 11,696,333 United States Dollars (USD). Cost per 100,000 population = 129,135 USD.

Conclusions: This experience of rapid-large scale implementation would be useful to scale up similar interventions and "stop the itch" in other regions of Ethiopia.

**Key words:** Operational research; population-based prevalence; community health workers, mass drug administration.

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## Introduction

Human scabies, caused by the mite *Sarcoptes scabiei* var *hominis* is transmitted through person-to-person contact. It is a Neglected Tropical Disease (NTD) of public health importance [1] and one of the "commonest dermatological conditions" in tropical climates where overcrowding and poverty exist [2]. Globally there are an estimated 175 million scabies cases, causing debilitating itch, social stigmatization, and complications including septicaemia, glomerulonephritis and chronic rheumatic heart disease [3-7].

In Ethiopia, national attention on the disease followed reports of scabies outbreaks in drought-affected areas in 2015 [8]. Mass drug administration (MDA) campaigns which involve administration of scabies treatments (ivermectin and permethrin) to large communities is known to be useful for controlling scabies and reducing community prevalence by more than 90% [8-10].

The Amhara region in Ethiopia is one of the scabies endemic areas in the country. In 2015, the Ethiopian Federal Ministry of Health embarked on an MDA campaign resulting in the screening of 1.2 million people and treatment for 850, 200 cases and contacts [8]. The experience guided to a much broader campaign that took place in 2018 and involved over 9 million people.

During the 2018 campaign, aggregate data were routinely collected and uniquely; the entire target population was screened for scabies prior to drug administration. This MDA campaign provided first an opportunity to get information on community scabies prevalence. This is more reliable than health facility-based data as health-seeking behaviour, access and availability of treatments may affect attendance, and prevalence may be underestimated [11]. A systematic review of scabies prevalence studies published between 1985 to 2015 included only five African countries (Egypt, Tanzania, Ethiopia, Nigeria and Cameroon with prevalence ranging 0.2 to 9.2%) highlighting the paucity of prevalence data in Africa [5,7].

Second, the "how to deliver" of an MDA campaign involving over 9 million people, which has never been described previously. The experience and knowledge may guide the scale-up of scabies control in Ethiopia and beyond. Previous publications on scabies MDA campaigns have focused on the pacific islands and on small populations [10, 11]. A PubMed search revealed no MDA studies from the African region on a scale of millions. Such information can also contribute to the Sustainable Development Goal (SDGs) target of eliminating NTDs by 2030 [12].

We aimed to describe the implementation of a mass drug administration campaign conducted for scabies outbreak control in the Amhara region of Ethiopia between June and August 2018.

The specific objectives were to report on a) numbers screened and identified with scabies (cases and contacts) stratified by geographic zones, b) scabies cases treated according to treatment category and treatment type and c) the human resources, duration of the campaign and associated costs.

## Methodology

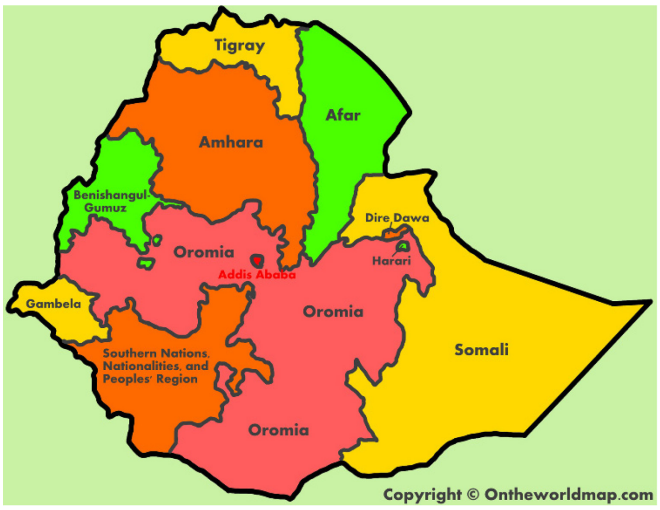
*Study design*

Cross-sectional descriptive study using routine monitoring data from the MDA campaign.

*General setting*

Ethiopia is a landlocked country in the horn of Africa, with a population of 99 million. It shares borders with Eritrea in the north and northeast, Djibouti and Somalia in the east, Sudan and South Sudan to the west, and Kenya to the South [13]. The country has limited health coverage (39% of the entire population) and the current annual health expenditure per capita is 24 United States Dollars (USD) [14]. Ethiopia registers 16 of the 21 NTDs on the WHO list [15].

**Figure 1.** Map of Ethiopia showing the Amhara region (©2012-2020 Ontheworldmap.com).




*Specific setting – Amhara region*

The Amhara Regional State in the North West of the country is the second-most populous region (21,234,988 inhabitants) after Oromia Region. It is divided into 13 administrative Zones and 142 districts (Woreda's) (Figure 1). This region has an estimated population density of 108.2 persons per square kilometer. The average household size is 4.3 persons, with 85% of the population living in rural areas [13]. The Amhara Region covers approximately 161,828.4 $Km^2$. The region's topography embraces plains, gorges, plateaus, hills and mountains [16].

*The Mass Drug Administration campaign for scabies*

The MDA campaign was conducted in line with regional guidelines for large-scale scabies control [17]. A preliminary survey was conducted in all zones of the Amhara Region between May 14$^{th}$ to June 20$^{th,}$ 2018, in order to determine scabies prevalence and guide the MDA campaign process. Figure 2 shows the mapping of scabies cases detected during this exercise. In brief, it included: planning and organization, community mobilisation and advocacy, awareness-raising among health workers, engagement of local leaders, field implementation, logistics and monitoring and evaluation. The specific activities of the MDA

campaign are shown in Table 1. Drug treatment based on age-group and pregnancy/lactation status are shown in Table 2.

The MDA strategy was based on community scabies prevalence. When community prevalence was less than 15%, the drug was given for cases and contacts after the active household screening. When community prevalence was equal or greater than 15%, no screening was needed and the community was subjected to mass drug administration. Treatment for scabies with ivermectin or permethrin involves two doses given one week apart. For Sulfur, the ointment is applied daily for three consecutive days.

*Definitions of cases and contacts of scabies [17]*

*A scabies case* was defined as the presence of itching with a typical lesion in the inter-digital areas of the hands, inter-gluteal and/or genitalia area and/or

**Figure 2.** Spatial distribution of scabies cases in the Amhara region, Ethiopia (May to June 2018).

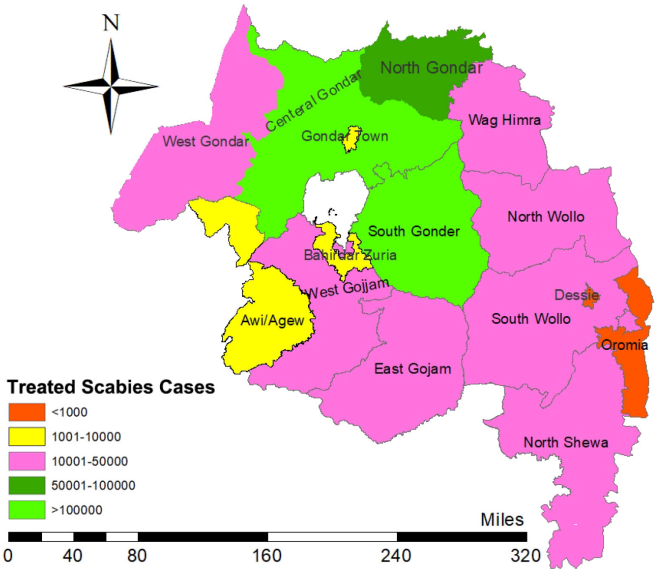



**Table 1.** Main components and activities of the Mass Drug Administration (MDA) campaign in Amhara Region Ethiopia (June-August 2018).

| Component | Activities |
|---|---|
| **Pre-campaign** (Planning and organization) | **Political commitment and coordination**<br>- Soliciting high-level political commitment at government and community level (community leaders /elders)<br>- Establishing appropriate inter-sectoral coordination sub-committees<br>**Baseline data and action plan development**<br>- Collection of base-line data on populations from household screening<br>- Drug forecasting, health worker availability and addressing hard to reach areas.<br>- Developing a plan of action, that specifies the target population, target area, timelines for the various activities.<br>- Developing logistics planning and monitoring tools<br>- Adapting training materials/ guidelines<br>**Social and resource mobilization**<br>- Social Mobilization (Community awareness raising and advocacy)<br>- Resource mobilization (logistics, human resources, drugs)<br>**Training and distribution of supplies**<br>- Organizing district-level training of MDA teams<br>- Conducting micro-planning workshops<br>- Distribution of drugs, supplies and other campaign materials to all sites/teams |
| **Intra-campaign** (MDA Implementation) | **Crowd control**<br>- Ensure that order is maintained around screening sites.<br>**Drug distribution.**<br>- Fixed treatment center screening by MDA teams<br>- Providing treatment for cases and contacts<br>- Logistics and supplies: Monitor logistics and drug availability and address shortages if any through reserve stocks.<br>**Community reassurance**<br>- Provide clarifications and answer questions when asked.<br>**Supervision and monitoring**<br>- Monitor daily coverage and drug utilization reports through completed tally sheets.<br>- Mobilize contingency resources to address exceptional situations such as delays or shortages in screening teams<br>- On the job supervision of campaign implementation |
| **Post-campaign** (Reporting and feedback) | - Compiling data<br>- Compiling MDA report<br>- Post campaign surveillance<br>- Report writing and feedback |

**Table 2.** Scabies treatment types and categories in the Mass Drug Administration campaign in Amhara Region Ethiopia (June-August 2018).

| 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,<br>- Children and adult (both pregnant and lactating). |
| **5% - 10% Sulfur** | - For children under 10 years: 1 tube (50 g)<br>- For children above 10 years and adults: 2 tubes of 10% sulfur | - Children under 10 years, pregnant and breast feeding women |
| **Oral Ivermectin** | - Age 2 year to 6: 1 tab of 3 mg; age 7 to 12: 2 tabs<br>- Age 13 to 18: 3 tabs<br>- Age 18 and above: 4 tabs | - Except pregnant, breast feeding women and children aged < 2 years |

have had close contact with an individual who had itching or lesions in a typical distribution.

A *scabies contact* was defined 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.

*Study population and period*

The study included all individuals screened for scabies during the MDA campaign in the Amhara Region from July to August 2018.

*Data collection*

Data on household scabies screening and treatment were collected on standardized reporting forms by Health Extension Workers (HEW), compiled at the district level and entered into a dedicated database. District data were transferred to the zone and finally to the regional public health emergency management directorate. All HEWs were trained on scabies identification, data collection and were supervised by a member of the district Monitoring and Evaluation unit, who was part of the MDA team. Data entry was done from tally sheets into Microsoft Excel by a dedicated person at the district level. This database (MDA database) constituted the data source for the study.

*Data analysis and statistics*

Scabies cases detected by zones were standardized as percentages to give estimated prevalence by zone. The "population coverage capacity per campaign staff per day" was calculated using the formula [target population ÷ total number of campaign staff used ÷ duration of the campaign in days]. Results were presented descriptively.

*Ethics considerations*

Permission to conduct the study was obtained from the Amhara Regional Health Bureau. Ethics approval was received from the Amhara regional Public Health Institution ethical review board, Bahir Dar, Ethiopia.

**Table 3**. Numbers screened and identified with scabies (cases and contacts) by geographic zones during a mass drug administration campaign in Amhara Region, Ethiopia (July to August 2018).

| Zone | Population | Target population *n | Treated for scabies | | | |
|---|---|---|---|---|---|---|
| | | | Cases | | Contact | |
| | | | n | (%) | n | (%) |
| S. Gondar | 2,527.510 | 1,133,323 | 193,340 | (15.0) | 238,245 | (21.0) |
| N. Gondar | 1,248,908 | 447,694 | 749,09 | (16.7) | 139.023 | (31.0) |
| C. Gondar | 2,474.331 | 992,731 | 389,552 | (39.2) | 337,358 | (46.9) |
| W. Gondar | 360,793 | 182,533 | 10,905 | (6.0) | 13,954 | (7.6) |
| S. Wello | 3,241,394 | 1,130,920 | 31,017 | (2.7) | 27,633 | (2.5) |
| N. Wello | 1,704,036 | 1,195,035 | 41,316 | (3.6) | 40,543 | (4.3) |
| E. Gojjam | 2,633,358 | 463,169 | 14,461 | (3.1) | 22,769 | (9.1) |
| W. Gojjam | 2,656,040 | 650,688 | 39,629 | (6.1) | 59,461 | (2.9) |
| WagHimra | 549,731 | 411,526 | 42,645 | (10.4) | 67,044 | (20.4) |
| Awi | 1,264,552 | 929,165 | 5,039 | (0.5) | 2,550 | (0.3) |
| N. Shewa | 2,202,631 | 1,093,277 | 30,223 | (2.8) | 43,058 | (4.1) |
| Oromia | 567,487 | 392,806 | 947 | (0.2) | 1,545 | (0.4) |
| Bahirdar | 314,094 | 34,560 | 1,907 | (5.5) | 2,288 | (6.6) |
| **Total** | **21,384,072** | **9,057,427** | **875,890** | **(9.7)** | **995,471** | **(11.0)** |

* The target population was established based on a prior scabies prevalence survey to guide planning the mass drug administration campaign of scabies.

**Table 4.** Number (and proportion) of scabies cases stratified by treatment sub-groups and treatment type during a mass drug administration campaign in Amhara Region Ethiopia (July to August 2018).

| Treatment category | | Type of scabies treatment | | | | | | Total |
|---|---|---|---|---|---|---|---|---|
| | | Ivermectin | | Permethrin | | Sulfur | | |
| | | n | (%) | n | (%) | n | (%) | |
| 2 to 6 years | Case | 81,305 | (73.9) | 28,148 | (25.6) | 570 | (0.5) | 110,023 |
| | Contact | 66,075 | (71.0) | 26,886 | (28.9) | 119 | (0.1) | 93,080 |
| 7 to 17 years | Case | 153,696 | (97.6) | 3,610 | (2.3) | 197 | (0.1) | 157,503 |
| | Contact | 212,446 | (98.7) | 2,651 | (1.3) | 78 | (0.0) | 215,175 |
| ≥ 18 years | Case | 146,492 | (100) | | | | | 146,492 |
| | Contact | 211,218 | (100) | | | | | 211,218 |
| Pregnant/ Lactating | Case | | | 16,482 | (96.5) | 596 | (3.5) | 17,078 |
| | Contact | | | 11,375 | (99.4) | 73 | (0.6) | 114,48 |
| Unrecorded | Case | 399,466 | (96.8) | 13,324 | (3.2) | | | 412,790 |
| | Contact | 363,573 | (96.5) | 13,218 | (3.5) | | | 376,791 |
| **Total** | | **1,634,271** | **(94.0)** | **102,370** | **(5.9)** | **1663** | **(0.1)** | **1,738,304** |

**Table 5.** Human resources used and time taken (in days) to conduct a mass drug administration campaign for scabies control in Amhara Region Ethiopia (July to August 2018).

| Zone | Target population | Campaign staff used | Days for the campaign | Population covered per campaign staff per day |
|---|---|---|---|---|
| S. Gondar | 1,133,323 | 2,550 | 7 | 68 |
| N. Gondar | 630,227 | 1,676 | 6 | 68 |
| C. Gondar | 992,731 | 1,993 | 7 | 67 |
| S. Wollo | 1,130,920 | 2,594 | 5 | 89 |
| N. Wello | 1,195,035 | 2,122 | 6 | 94 |
| E. Gojjam | 463,169 | 874 | 6 | 93 |
| Wag Himra | 411,526 | 773 | 5 | 99 |
| Awi | 929,165 | 1,380 | 7 | 92 |
| Bahir Dar | 34,560 | 156 | 3 | 74 |
| Oromia | 392,806 | 678 | 6 | 93 |
| W. Gojjam | 650,688 | Unrecorded | - | - |
| N. Shewa | 1,093,277 | Unrecorded | - | - |
| **Total** | **9,057,427** | **14,796** | **Mean = 6** | **Mean= 84** |

**Table 6.** The estimated cost to conduct a Mass Drug Administration campaign for scabies control in Amhara Region Ethiopia (July to August 2018).

| | Cost (Ethiopian Birr) | Cost (USD) |
|---|---|---|
| Training logistics | 4,194,000 | 144,621 |
| Per diems | 23,952,000 | 825,937 |
| Transportation | 1,864,000 | 64,276 |
| **Drugs** | | |
| Ivermectin | 288,678,127 | 9,954,418 |
| Permethrin | 20,178,150 | 695,798 |
| Sulfur | 327,220 | 11,284 |
| **Total** | **339,194,297** | **11,696,333** |

The study was also approved by the Ethics Advisory Group of the International Union against Tuberculosis and Lung Disease, Paris, France. As this was a record review study without patient identifiers, the issue of informed patient consent did not apply.

## Results

*Numbers screened and identified with scabies (cases and contacts) by geographic zones*

Table 3 shows the numbers of individuals screened and identified with scabies by geographic zone in the Amhara region. Thus, of 21,384,072 people in the 13 zones of the Amhara region, 9, 057, 427(42%) people were targeted (screened) for the MDA campaign. A total of 875,890 (9.7%) scabies cases were detected with 995,471 (11 %) contacts, all of whom were treated (contact-to-case ratio = 1.3).

Scabies prevalence varied by zone and ranged between 0.2% and 39.2%, the highest prevalence was seen in Central Gondar (39.2%) followed by South Gondar (16.7%) and North Gondar (15%). These three neighbouring zones contributed 70.9 % of all scabies cases detected in the region.

*Numbers (and proportion) of scabies cases and contacts stratified by treatment category and treatment type*

Of 1,871,361 scabies cases and contacts who should have been treated for scabies, 1,738,304 (93%) were registered as having received treatment, the vast majority (94%) having received ivermectin. Information on treatment type was specified for all, while the treatment category (age group and pregnancy status) was unrecorded in 789,581 individuals (45.4%). Of 948,723 individuals for whom both treatment category and treatment type were recorded, all individuals aged ≥18 years received ivermectin while it was avoided in all pregnant and lactating mothers. This is in line with national guidelines.

In children aged 2-6 years who were eligible (148881 cases and 131099 contacts) to receive ivermectin [17], only 73.9% of cases and 71% of contacts received the drug. The remaining were given permethrin and or sulphur (Table 4).

*Human resources used, duration of the MDA and cost of the campaign*

Table 5 shows the numbers of human resources used in the MDA campaign, the duration (in days) and the population coverage capacity by a worker per day.

The MDA campaign mobilized 14,796 people mostly from the community and was conducted over an average of 6 days. The average population coverage capacity of one MDA staff member was 84 people per day (Table 5).

The total cost to screen and treat 9,057,427 people was 11,696,333 United States Dollars (USD). Cost per 100,000 population = 129,135 USD or 1.29 USD/person (Table 6).

## Discussion

This is the first study from Africa describing the large-scale implementation of a mass drug administration campaign for scabies conducted in an average of 6 days, reaching 9 million people and costing about 1.29 USD per person. Regional scabies prevalence was 9.7% and reached 39.2 % in one zone. Close to 15 thousand people were mobilized for MDA implementation, mostly from the community.

This experience is unique in terms of coverage and important as it shows a possible way forward in implementing large scale scabies control, a key to achieving the SDG target of eliminating scabies by 2030 [12].

A study strength is that we integrated a robust monitoring and evaluation system, included a monitoring and evaluation officer and supervised data-related issues at central level (region). Furthermore, there were strict definitions for scabies cases and contacts and we thus believe our data is robust. Finally, this study addresses an identified NTD operational research priority in Ethiopia and may impact policy.

The main limitation of the study is that at the community level information was documented paper based and transfer of the paper based data in to Excel sheet was done in district health offices. And in the process entering the paper based information to Excel, the data management group had to clean up some illegible and missed information. This resulted in some incomplete data (i.e. number of treated, treatment category and number of campaign staff used).

The study findings highlight several policy and practice implications. First, conducting a campaign that managed to mobilize almost 15,000 workers and reach over nine million people in about a week is a mammoth task. This campaign would not have been possible if the strategy was to rely on health workers within health facilities (15,634 available in the region) [18]. The rapid and large-scale MDA campaign was feasible, thanks to ensuring the prior engagement of community leaders and the community including HEWs. Except for a driver, a finance officer and a monitoring officer, all other members of the implementation team were from the community. In Ethiopia, community-based HEWs

include groups like the "Women Health Development Army" who played a vital role in the success of campaigns. Such groups constitute a stable network that can catalyse community participation geared to improving community health [19]. The global polio eradication campaign has reported a similar experience of success [20].

Second, the three neighbouring zones of Gondar had the highest scabies prevalence and constituted more than two-thirds of all cases. Importantly, the average contact-to-case ratio in those zones was just 1.1 on average, implying that intense scabies transmission had already occurred, and almost all potential contacts were already infected. In such a scenario, investing much time and resources in an individual screening before initiating scabies treatment does not make sense in public health. It is likely to be more cost-effective to embark on mass drug administration, without screening.

The beneficial spin-off of this approach would be that, with ivermectin as treatment option soil transmitted helminths, ecto-parasites (pediculosis), onchocerciasis and filariasis would all be treated at the same time as "a one shot approach".

As ivermectin is known to be safe and is already being used in the MDA strategy for onchocerciasis and filariasis control, this would be an opportunity and a logical step forward [21-23].

Finally, although children aged two to five years were eligible to receive Ivermectin according to the scabies guideline, about 30% of cases and contacts received drugs other than ivermectin. There were no reported ivermectin stock out and the reason for this finding is unclear. A possible explanation would be the existing incoherence with the national onchocerciasis guideline which contrary to the scabies guideline, does not recommend ivermectin for children under five years. This difference in guidelines might have confused health workers and needs to be further discussed at the national level.

## Conclusion

In Ethiopia, it was feasible to conduct a rapid MDA campaign covering over nine million people. This experience of conducting a rapid large-scale scabies campaign implementation could be useful to scale up similar interventions and "stop the itch" in other regions of Ethiopia and beyond.

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### References

1. World Health Organization (2017) 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. Accessed 17 March 2018.
2. Global Burden of Disease (GBD) 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.
3. Engelman D, Kiang K, Chosidow O, McCarthy J, Fuller C, Lammie P, Hay R, Steer A, Members Of The International Alliance For The Control Of Scabies (2013) Toward the global control of human scabies: introducing the International Alliance for the Control of Scabies. PLoS Neglect Trop Dis 7: e2167.
4. Worth C, Heukelbach J, Fengler G, Walter B, Liesenfeld O, Hengge UR, Feldmeier H (2012) Acute morbidity associated with scabies and other ectoparasitoses rapidly improves after treatment with ivermectin. Pediatr Dermatol 4: 430-436 .
5. 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. The Lancet. Infect Dise 17: 1247–1254.
6. Feldmeier H (2009) Epidermal parasitic skin diseases: a neglected category of poverty-associated plagues. Bull World Health Organ 87: 152–159.
7. Romani, L, Steer AC, Whitfeld MJ, Kaldor JM (2015) Prevalence of scabies and impetigo worldwide: A systematic review. Lancet Infect Dis 15: 960–967.

8. Enbiale W, Ayalew A (2018) Investigation of a scabies outbreak in drought-affected areas in Ethiopia. Tropical medicine and infectious disease 3: 114.
9. 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.
10. Romani L, Whitfeld MJ, Koroivueta J, Kama M, Wand H, Tikoduadua L, Tuicakau M, Koroi A, Ritova R, Andrews R, Kaldor JM, Steer AC (2017) The epidemiology of scabies and impetigo in relation to demographic and residential characteristics: Baseline findings from the skin health intervention Fiji trial. Am j Trop Med Hyg 97: 845–850.
11. Engelman D, Steer AC (2018). Control strategies for scabies. Trop Med Infect Dis 3: 98.
12. United Nations (2015) Transforming our world: the 2030 agenda for sustainable development. Available: http://sustainabledevelopment.un.org/post2015/transformingourworld. Accessed: 18 September 2018.
13. 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. Accessed: 3 May 2019.
14. World Health Organization (WHO) (2018) World health statistics 2018: monitoring health for the SDGs, sustainable development goals. World Health Organization. Available: http://www.who.int/iris/handle/10665/272596. License: CC BY-NC-SA 3.0 IGO. Accessed: 3 May 2019
15. 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 and Vectors 5: 240.
16. Amhara National Regional State, Bureau of Finance & Economic Development (BoFED) (2011) Amhara information. Available: http://www.amharabofed.gov.et/anrs/geography_climate.html. Accessed: Accessed 4 May 2018.
17. Amhara Public Health Institution, Ethiopia (2018) Guideline for scabies control. Bahir Dar, Ethiopia. 2018: 39.
18. Federal Democratic Republic of Ethiopia Ministry of Health (2018) Human resource information system annual report, Addis Ababa Ethiopia 52p.
19. Federal Democratic Republic of Ethiopia Ministry of Health (2015) Health Sector Transformation Plan (HSTP) Addis Ababa, Ethiopia: 2015. Available https://ehia.gov.et/sites/default/files/Resources/HSTP%20Final%20Print%202015-11-27%20Print%20size.pdf . Accessed: 26 March 2020.
20. WHO Expert Committee on the Selection and Use of Essential Medicines (2018) Application for inclusion of ivermectin on the WHO Model List of Essential Medicines (EML) and Model List of Essential Medicines for Children (EMLc) for the indication of Scabies Submitted: December 2018. Available: https://www.who.int/selection_medicines/committees/expert/22/applications/s6.6_ivermectin.pdf?ua=1. Accessed: 4 May 2019.
21. Majiyagbe J (2004) The volunteers' contribution to polio eradication. WHO Bull 82: 2.
22. Federal Democratic Republic of Ethiopia Ministry of Health (2016) Second Edition of Ethiopia National Master Plan For Neglected Tropical Diseases. Addis Ababa, Ethiopia. Available: https://www.afro.who.int/publications/second-edition-national-neglected-tropical-diseases-master-plan-ethiopia-2016. Accessed: 24 March 2020.
23. World Health Organization (2016). Onchocerciasis - river blindness. Geneva: World Health Organization; 2016. Available: http://www.who.int/mediacentre/factsheets/fs095/en/. Accessed: 22 April 2018.

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