



Factors Associated with Non-compliance with Community Directed Treatment with Ivermectin for Elimination of Human Onchocerciasis in a Diediesa Rural District of Ethiopia

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ABSTRACT

Introduction: The strategy of current efforts to halt the transmission of human onchocerciasis is community-directed treatment with ivermectin (CDTI). To interrupt transmission, it is thought that a high level of adherence and dedication to CDTI is necessary. However, refusals and absenteeism are to be expected among the group of individuals who are eligible for treatment. These would undermine efforts to interrupt transmission in endemic areas. Consequently, this study is aimed at exploring potential factors associated with non-compliance with community-directed treatment with ivermectin for interruption of transmission of onchocerciasis in the Diediesa rural district of Ethiopia.

Methods: A cross-sectional survey dealt with the socio-demographic characteristics, knowledge, and behavior of people towards non-compliance with CDTI, collected using a closed-ended, structured questionnaire. Detailed information on treatment seeking behavior, population movement, and similar information was gathered using focus group discussions and in-depth interviews.

Result: Therapeutic coverage has shown that there were people who did not comply with CDTI or failed to take ivermectin treatment. Out of the total participants interviewed, 12.8% had never received ivermectin treatment since CDTI started in their locality. 15.3% had been absent from ivermectin treatment at least once in the last 5 years. In this study area, we observed that being male [P=0.009, OR=2.063, 95% CI, 1.196-3.557], having completed high school or college education [P=0.001, OR=0.247, 95% CI, 0.110-0.556], and being married [P=0.026, OR=0.256, 95% CI, 0.077-0.850] are significantly associated with non-compliance with CDTI. And a qualitative survey also revealed that population movement was negatively affecting therapeutic coverage because of the internally displaced people's movement between their place of origin and new settlement areas.

Conclusion: The main difficulties in a CDTI in attaining the targeted objective in a sizable number of implementation units were non-compliance which includes absenteeism and refusal. They were the primary causes of the CDTI's inadequate therapeutic coverage. In addition to this, one factor contributing to the inadequate therapeutic coverage of CDTI is population movement within and around the transmission zone. As a result, transmission can continue after the time limit for interruption is supposed to end. Therefore, it is advised to employ current tools appropriately and build a suitable approach to address the aforementioned concerns.

Keywords: Onchocerciasis; Non-compliance; Refusal; Absenteeism; Therapeutic coverage

Received:	01-August-2023	Manuscript No:	IPJHCC-23-16732
Editor assigned:	03-August-2023	PreQC No:	IPJHCC-23-16732 (PQ)
Reviewed:	17-August-2023	QC No:	IPJHCC-23-16732
Revised:	22-August-2023	Manuscript No:	IPJHCC-23-16732 (R)
Published:	29-August-2023	DOI:	10.36846/2472-1654-8.4.8037

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Citation Meribo K, Kebede T, Sisay F, Abera A (2023) Factors Associated with Non-compliance with Community Directed Treatment with Ivermectin for Elimination of Human Onchocerciasis in a Diediesa Rural District of Ethiopia. J Healthc Commun. 8:8037.

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INTRODUCTION

The filarial parasite *Onchocerca volvulus*, which causes human onchocerciasis, is spread by the infected *Simulium damnosum* black flies, which spawn in rapidly moving rivers and streams. A reliable and effective micro-filaricide for *Onchocerca volvulus* is ivermectin. Therefore, the preferred approach for the interruption of transmission of onchocerciasis is community-directed treatment with ivermectin (CDTI). Even though it is thought that high CDTI adherence is necessary to reach elimination goals, it would be affected by non-compliance factors such as age, gender, and perceptions of the effectiveness of community-directed distributors and programme organizations [1-3]. One of the challenges to effective disease treatment is non-compliance with prescribed medications. It is typical of pharmaceuticals given at regular intervals and is frequently influenced by undesirable human health-seeking behaviors, which increase morbidity, cause treatment failure, result in drug resistance, etc., [4,5].

Therefore, non-compliance significantly affects the specified elimination timeframes for diseases that are treated frequently to interrupt transmission. In a few CDTI implementation units in Ethiopia, therapeutic coverage varies between 73% and 78% when considering zonal therapeutic coverage [6,7]. This implies that a few people in the endemic areas did not receive ivermectin treatment, which resulted in the detection of continuous transmission of the disease [8]. Despite the fact that ivermectin is provided without charge, the low therapeutic coverage suggests that a few individuals have not followed the recommended treatment schedule [9].

Health education and social mobilization will help to reduce the number of people who do not comply with CDTI practices for interruption of disease transmission in endemic areas [1]. To meet elimination targets *via* the interruption of disease transmission, it is essential to address the issues of refusal and absenteeism through innovative public health approaches [10]. Thus, the purpose of this study was to identify factors associated with non-compliance with community-directed ivermectin treatment for interruption of transmission of onchocerciasis in a Diediesa rural district of Ethiopia.

MATERIALS AND METHODS

Study Area

With an altitude of 1929 meters above sea level and a humid tropical climate, the Diediesa district is located in the Buno Bedele administrative zone of central-western Ethiopia. The district's geographic coordinates are 8.074596 in the North and 36.462181 in the East. There are two rainy seasons: The primary one lasts from June to September, while the secondary one lasts from March to April months of the year. The Diediesa, Gela and Molde rivers are examples of permanent rivers. The district has a total population of 1,20,538 in 2020, per the Central Statistics Agency's demographic projection [11]. Of the total villages in the district, Garado, Gega, Sobo, Gesa (Gela), Yembero, Kemache, Geshe (Neshe), Sineso, Chelo, and Dingo are included in this study.

Study Design and Sampling

A cross-sectional survey using both quantitative and qualitative methods was carried out to identify the factors linked to non-compliance with community-directed treatment with ivermectin. Using the single population proportion calculation, a sample size of 577 individuals was determined by taking into account the 50% prevalence, 5% desired precision, and a 95% confidence interval (CI) with a design effect of 1.5. A two-stage sampling process was used to conduct the survey. The first step was to select villages for the study, and the second was to choose participants using the village record. Random number sampling of the lottery method was used to choose the participants of the study per selected household. Participants who had worked and lived in the selected areas for the last two years ranged in age from 18 to 60 years old.

Four focus group discussions and nine in-depth interviews were conducted as part of the qualitative survey. Each group's discussants shared a similar social position, and they had all been carefully chosen from the study communities. Community-directed distributors, community leaders, farmers, and housewives were constituted as the four focus group discussants. The FGDs included anywhere between 6 and 10 participants. Before the discussion began, each participant received a unique identifying number. The FGD guide and questions were used to investigate the possible causes of non-compliance with CDTI. The discussions were held in Afan Oromo, the regional tongue, and translated into English with the use of audio recordings and written notes. For in-depth interviews, nine respondents who had participated in the community-directed treatment with ivermectin and had been socially active were chosen. The community, health post, health center, district health office, and zonal health department all contributed to the selection of participants. Each participant in the in-depth interview received an identity number before the session began. Afan Oromo and Amharic languages were used for the interview, and notes were made based on the interview guide and the questions created for an in-depth interview.

Data Analysis

SPSS Version 25 of the statistical analysis of descriptive statistics (frequency) was used to determine the frequency percentage of dependent variables. Regression was used to find factors linked to the non-compliance with community-directed treatment with ivermectin. To highlight the discrepancy between desired and reported therapeutic coverage, therapeutic coverage data was analyzed. The quoting served as a basis for the analysis of the qualitative data, and it was deliberate to preserve the compelling points of view of the selected informants, which were backed by an audio recording to provide a detailed summary. Generally speaking, the obtained data were cleaned, arranged, and classified appropriately to determine whether the results from both approaches are consistent, contradictory, or complementary.

Ethical Consideration

The Ethiopian Public Health Institute's Institutional Review Board approved the study [Protocol number EPHI-IRB 250-2020]. In addition to the ethical clearance, letters of support

were obtained from the Ministry of Health and the Regional Health Bureau to conduct a study in the selected district. Written informed consent was obtained from each individual who participated in the study.

RESULTS

Socio-Demographic Characteristics

Ten communities in the district that were identified for the study resulted in the selection of 577 participants in total. Participants' mean age was 34.82 years, and 51.8% of them were female. More than half of the participants have completed their primary education, and 18% have completed their high school education or higher. 90.1% of the participants were married. In terms of occupation, farmers, housewives, and others made up 62%, 29.3%, and 8.7% respectively.

Therapeutic Coverage

The villages of Gela, Gepa, Yembero, Geshe [Neshe], Kemache, and Sineso reported having high therapeutic coverage. The average therapeutic coverage for 10 villages was 81.2% in the first round of 2015. The reports have shown a gap between the desired and actual therapeutic coverage. The lowest therapeutic coverage at the village level was 60%. The following participant who took part in an in-depth interview offered an

explanation for the low therapeutic coverage:

"... 2019 saw 100% geographic coverage, although some areas only had limited therapeutic coverage. The process of addressing this issue strengthened social mobilization and health education. Additional treatment days were allotted during the ivermectin course of treatment [In-depth interview ID number 01]."

Another interviewee similarly described the low therapeutic coverage and the individuals who did not receive ivermectin treatment as follows:

"...In spite of the fact that there were villages in the district with inadequate therapeutic coverage, according to the 2019 summarized district report, 79 people did not receive ivermectin treatment. For instance, Chelo is one of the communities having a low therapeutic coverage rate [In-depth interview ID number 04]."

Onchocerciasis

The participants in the study have defined onchocerciasis on the basis of the signs and symptoms of the disease. In other words, the majority [70%] of respondents said that onchocerciasis is itching. The rest reported that it is an intense itching with nodules, a type of skin disease, and a type of scabies, which accounted for 15%, 12%, and 3%, respectively (Figure 1).

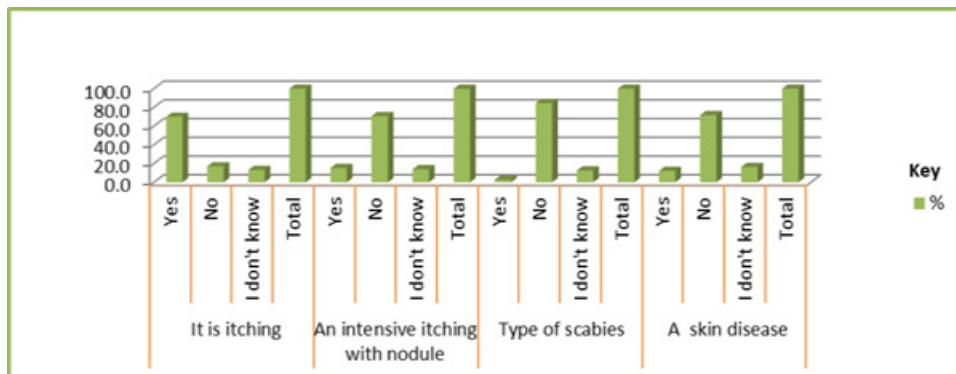


Figure 1: What is Onchocerciasis?

The majority [46.8%] of respondents believed that onchocerciasis is a communicable disease that is spread by the bite of infected black flies. The remaining evidence suggested

that through contact with fast-moving water, the biting of mosquitoes and communal livings were accounted 8.7%, 20.5%, and 24.1% respectively (Figure 2).

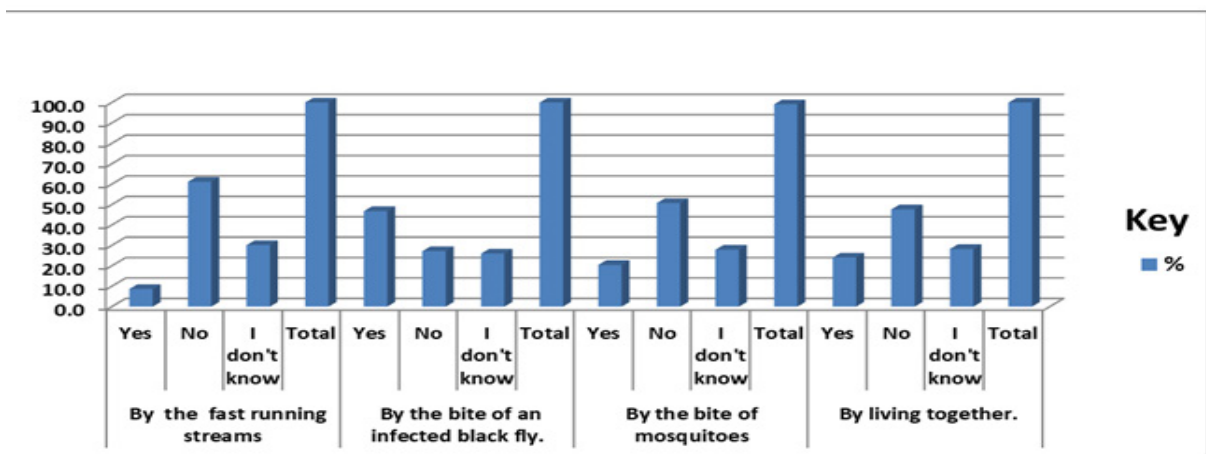


Figure 2: Mode of transmission

One of the participants in the focus group discussion with the community leader said the following:

“...Fast-moving river environments are home to black flies, which can spread onchocerciasis by biting an infected person, then a healthy person [Geshe village, 45 year old male].”

The following discussion participant from the farmer’s focus group had similarly stated:

“According to the health professionals’ health education, a black fly can transmit onchocerciasis in fast-moving river settings, although I didn’t actually see one [Yembero village, 52 year old male].”

Ivermectin was named as a drug that almost all responders, 96.2% had known since ivermectin treatment started in their villages (Figure 3).

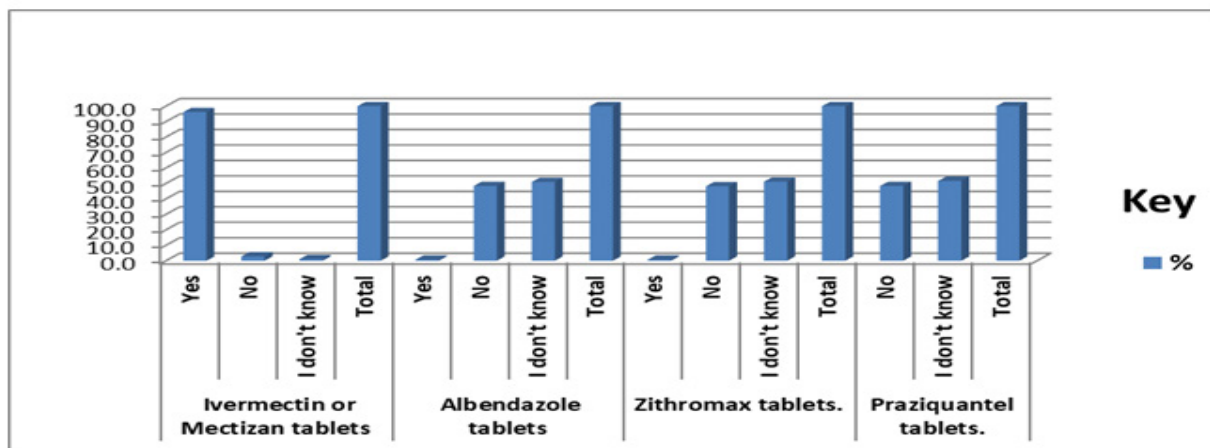


Figure 3: Drug of choice for onchocerciasis treatment

“...According to health workers’ health education, ivermectin is a preferred drug for the prevention and elimination of onchocerciasis. Onchocerciasis transmission in our area could be halted if all eligible people received ivermectin treatment in all rounds of treatment [Gepa village, 36 year-old female].”

Refusal

12.8% [95% C.I., 6.12-19.48] of the total participants had never received ivermectin treatment since the treatment’s launch in their local areas. Of the total number of persons who did not comply with CDTI, males and females were 52 and 22 respectively. Being male is significantly associated with non-compliance with community-directed treatment with ivermectin [P=0.009, OR=2.063, 95% C.I., 1.196-3.557], in addition, having completed

high school or college education, [P=0.001, OR=0.247, 95% C.I., 0.110-0.556] and being married [P=0.026, OR=0.256, 95% C.I., 0.077-0.850] are significantly associated with non-compliance with CDTI. In this study, no other factors were associated with CDTI non-compliance.

Of the total, 13.3% [95% C.I., 6.5-20.1] of participants said they had heard or seen someone refuse to take ivermectin while undergoing treatment. Rumours regarding the inconvenience of the site, the drug being distributed by non-health professionals, and a lack of information accounted for 1.7%, 9.9%, and 9.9% respectively. The rest distributed over the treatment facility was uncomfortable, there was fear of the drug’s side effects, there were other causes, and there was religious influence (Figure 4).

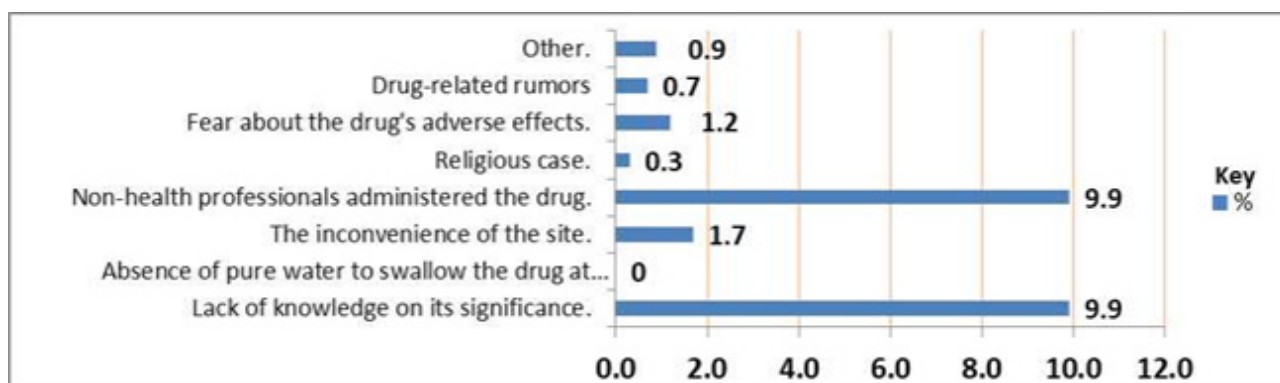


Figure 4: Causes for refusals

Similarly, 14.7% [95% C.I., 7.7-21.7] of participants reported hearing misinformation about community-directed ivermectin treatment, and they believed that the following factors were the primary causes of these rumours: Other causes of rumor than those mentioned in indicative sentences were mentioned by 10.7% of respondents. A limited number of respondents

reported that onchocerciasis is the poorest disease, ivermectin is an unknown drug, and CDDs are political in nature, with rates of 2.8%, 1%, and 0.3%, respectively. The majority reported that CDDs were not health workers, which accounted 13.2% (Figure 5).

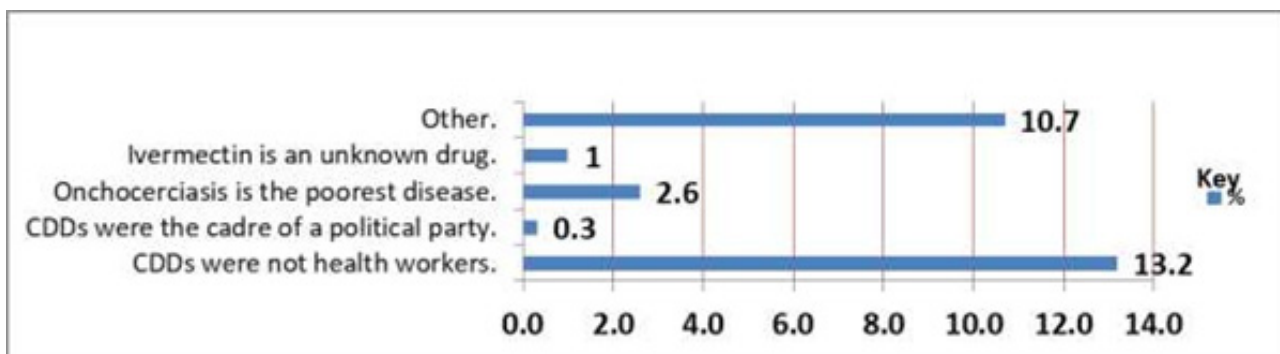


Figure 5: Causes for rumour related to the CDTI

Absenteeism

15.3% [95% C.I., 8.1-22.5] of all individuals had missed at least one ivermectin treatment session over the past 5 years. The numbers of males and females who failed to comply with CDTI were 52 and 36 respectively. Statistically, there was no significant difference between males and females who were absent from ivermectin treatment [P-value=0.149]. Similar to this, 10.9% of the participants reported knowing or hearing about the person who missed the ivermectin treatment for the elimination of onchocerciasis. 59.8% of respondents suggested health education to reduce absenteeism, especially at the beginning of treatment. 53.2% of respondents reported that, possibly as a result of the concerted reason that required them to miss treatment days, this would be done on the following

treatment days. Only 6.2% of respondents suggested that recurrent treatment might be the reason for absenteeism.

Attitude

Participants in the study were instructed to choose their responses judiciously because all indicative statements contradict CDTI. Of these sentences: “I do not have the itching to take Ivermectin treatment with our neighbors who suffer from it; I do not like to take medicine that everybody takes without getting sick from disease; and It is not a problem if I do not take Ivermectin sometimes in rounds of treatment,” purposely said 76.1%, 77.8%, and 76.1% of study participants, respectively, strongly disagreed with indicative sentences that contradicted CDTI (Table 1).

Table 1: Attitude of participants towards CDTI

Indicative Sentence	Category	Descriptive Frequency Percentages (%)			
		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
1. I do not have the itching to take Ivermectin treatment with our neighbors who suffer from it.	Strongly agree	1	0.2	0.2	0.2
	Agree	1	0.2	0.17	0.35
	Neutral	8	1.4	1.4	1.7
	Disagree	128	22.2	22.2	23.9
	Strongly disagree	439	76.1	76.1	100
	Total	577	100	100	
2. I do not like to take medicine that everybody takes without getting sick from disease.	Strongly agree	1	0.2	0.2	0.2
	Agree	3	0.5	0.5	0.7
	Neutral	6	1	1	1.7
	Disagree	118	20.5	20.45	22.18
	Strongly disagree	449	77.8	77.8	100
	Total	577	100	100	
3. It is not a problem if I intentionally do not take Ivermectin during treatment rounds.	Strongly agree	3	0.5	0.5	0.5
	Agree	1	0.2	0.2	0.7
	Neutral	1	0.2	0.2	0.9
	Disagree	133	23.1	23.05	23.92
	Strongly disagree	439	76.1	76.1	100
	Total	577	100	100	
4. Refusal is the best way to avoid the side effects of drugs in Ivermectin treatment.	Strongly agree	1	0.2	0.2	0.2
	Agree	1	0.2	0.2	0.3
	Neutral	2	0.3	0.3	0.7
	Disagree	166	28.8	28.8	29.5
	Strongly disagree	407	70.5	70.5	100
	Total	577	100	100	

	Strongly agree	3	0.5	0.5	0.5
	Agree	2	0.3	0.3	0.9
5. Preventive chemotherapeutic therapies for neglected tropical diseases would be refilled if treatment was missed by other medications.	Neutral	2	0.3	0.3	1.2
	Disagree	136	23.6	23.57	24.78
	Strongly disagree	434	75.2	75.2	100
	Total	577	100	100	
	Strongly agree	1	0.2	0.2	0.2
	Agree	2	0.3	0.35	0.52
6. Being absent one time from ivermectin treatment is not harmful.	Neutral	5	0.9	0.9	1.4
	Disagree	199	34.5	34.5	35.9
	Strongly disagree	370	64.1	64.1	100
	Total	577	100	100	
	Strongly agree	1	0.2	0.2	0.2
	Agree	4	0.7	0.7	0.9
7. Being absent sometimes during the treatment course does not affect the overall Ivermectin treatment.	Neutral	1	0.2	0.2	1
	Disagree	204	35.4	35.36	36.4
	Strongly disagree	367	63.6	63.6	100
	Total	577	100	100	
	Strongly agree	1	0.2	0.2	0.2
	Agree	2	0.3	0.35	0.52
8. Being absent for the planned next round of treatments is not bad.	Neutral	1	0.2	0.2	0.7
	Disagree	176	30.5	30.5	31.2
	Strongly disagree	397	68.8	68.8	100
	Total	577	100	100	
	Strongly agree	3	0.5	0.5	0.5
	Agree	5	0.9	0.9	1.4
9. A person who is absent during ivermectin treatment may collect drugs from the health post at any time.	Neutral	4	0.7	0.7	2.1
	Disagree	154	26.7	26.69	28.77
	Strongly disagree	411	71.2	71.2	100
	Total	577	100	100	

Population Movement

According to interviewees, population mobility includes workers in development corridors, such as daily workers in cash crop areas and plantation workers in onchocerciasis endemic areas. Internally displaced people [IDP] were from regions of the country where onchocerciasis was either endemic or non-endemic. The following is how one of those who participated in in-depth interviews had put it:

"...Internally displaced persons have been going back and forth between their original homes and where they are now residing. Additionally, unemployed youths from our district go to plantations and cash crop areas during the harvest season [In-depth interview ID number 01]."

One of the study villages in the catchment area of the Yembero Health Centre was Yembero village. In-depth interview respondents in this area provided the following information regarding internally displaced persons and whether or not their movement has affected therapeutic coverage:

"...There are 285 people who were displaced from Harargie zones in the village of Yembero, which is in our catchment area. The interruption of disease transmission could be delayed

because internally displaced people were unstable and the movement had a negative impact on therapeutic coverage [In-depth interview ID number 08]."

DISCUSSION

Therapeutic or epidemiological coverage is calculated as the ratio of those taking preventive chemotherapy medications at the implementation unit level for a particular disease to those who need preventive chemotherapy at the implementation unit level in an endemic implementation unit [12,13]. The result showed that there are gaps between the therapeutic coverage that has been recorded and what is desired. Strengthened awareness and motivation at the implementation level are believed to improve the therapeutic coverage of CDTI [14]. However, there were untreated people in a few of the study's villages. This conclusion is substantially similar to therapeutic coverage and is consistent with the therapeutic coverage of the Itang special district in the Gambella regional state and significantly similar to the therapeutic coverage described in the CDTI zones of North Gondar and Kafa [7,15]. This has made it clear that there is absenteeism and refusal in the CDTI [3,8,13].

Participants were asked to respond to questions about what

onchocerciasis is, whether it is communicable or not, how it is transmitted, and the recommended drug for treatment based on their level of knowledge. On the basis of the disease's symptoms and signs, 70% of respondents stated that onchocerciasis is itching. And similarly, in study done in Ogun State, southwest Nigeria, 62% of the study participants identified severe itching as a symptom of the disease [16]. Onchocerciasis is a communicable disease spread by the bite of infected black flies, according to the majority of survey participants (46%). This finding is slightly consistent with the findings of a study conducted in the Bench Maji Zone of south-western Ethiopia, in which 36.5% of respondents stated that onchocerciasis can be transmitted [17], and another study done in Bioko Island, in Equatorial Guinea, 19.3% of respondents highlighted the bite of a blackfly as the main mode of transmission [18].

According to the findings of this study, 12.9% of all participants had never received the ivermectin treatment since it started in their area. The study finding is in line with a study carried out in three Cameroon regions, in which 9.8% of participants said that they did not take ivermectin treatment during past treatments, and in a study conducted in Oyo state, Nigeria, 13.7% of participants reported that they had not received ivermectin treatment in the past year or years of treatment [19,20], while a study done in the western region of Cameroon found that 7.4% of individuals reported that they had not received ivermectin treatment in the last 5 years of ivermectin treatment, even though the number of females was greater than males [1]. In this study, in order to lower absenteeism, particularly at the start of treatment, 59.8% of respondents supported health education.

Regarding attitudes towards CDTI, even though the majority rejects the idea that it contradicts CDTI, there are a few reluctant individuals who contradict CDTI. This finding is consistent with a study conducted in the Quara district of north western Ethiopia [21].

Population movement includes internally displaced individuals looking for land or escaping regional ethnic violence, which leads individuals to cross domestic and international borders [22,23]. One of the interviewers had provided the following explanation:

"... More than 16,000 individuals were estimated to be internally displaced, and all IDP communities in the Diediesa district received ivermectin treatment. Yes, it had an impact on therapeutic coverage, and it would also have an impact on the process of stopping disease spread [In-depth interview ID number 04]."

The interviewee asserts that population movement between endemic and non-endemic areas has a dual negative effect on the program, causing disease to spread to the new areas and facilitating disease recrudescence.

CONCLUSION

The district chosen for the study has seen a consistent rise in the village's therapeutic coverage performance of community directed treatment with ivermectin. The low therapeutic coverage at the district level was, however, a result of a few communities' poor achievements. Therefore, reducing the

number of people who systematically hide themselves in the community and do not comply with or fail to receive ivermectin treatment requires door-to-door treatment, strengthening health education, and social mobilization. The study also found that population movement is a factor in inadequate therapeutic coverage and, consequently, in the persistence of disease transmission. As a result, it is advised to make proper use of current tools and develop a suitable strategy to solve the above-mentioned difficulties.

AUTHORS CONTRIBUTION

Conceptualization: Kadu Meribo, Tadesse Kebede, Adugna Abera, and Fetene Sisay, Data Curation: Kadu Meribo, Adugna Abera, and Tadesse Kebede, Data Entering and Cleaning: Kadu Meribo, Formal Analysis: Kadu Meribo, and Tadesse Kebede, Investigation: Kadu Meribo, Adugna Abera, Tadesse Kebede, and Fetene Sisay, Methodology: Kadu Meribo, Tadesse Kebede, and Adugna Abera, Project Administration: Adugna Abera, and Kadu Meribo, Supervision: Kadu Meribo, Adugna Abera, Tadesse Kebede, and Fetene Sisay, Visualization: Kadu Meribo, Validation: Adugna Abera, Tadesse Kebede, and Kadu Meribo, Writing-Original Draft: Kadu Meribo, Writing-Review and Editing: Kadu Meribo, Tadesse Kebede, Adugna Abera, and Fetene Sisay.

DECLARATION

Authorship Right

All investigators have a right to authorship according to their contribution.

Data Availability

The authors confirm that all the data underlying the findings are fully available without restriction.

ACKNOWLEDGEMENT

This publication was supported by a grant from the United States Agency for International Development (USAID) and UK aid from the British people (UK aid) through the Coalition for Operational Research on Neglected Tropical Diseases (COR-NTD) and administered by the African Research Network for Neglected Tropical Diseases (ARNTD). Its contents are solely the responsibility of the author(s) and do not necessarily represent the views of USAID, UK aid, COR-NTD or the ARNTD.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this study.

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