

Household Coverage of Ivermectin Distribution in Birnin Kudu Local Government Area of Jigawa State, Nigeria

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ABSTRACT

Purpose: To assess the coverage of Community-Directed Treatment with Ivermectin (CDTI) in Onchocerciasis-endemic communities in Birnin Kudu Local Government Area (LGA) of Jigawa state.

Methods: This was a community-based multi-staged cross-sectional survey based on probability proportional to size. The study involved administration of questionnaire on 2021 respondents from 207 households. Also, 30 Community Leaders and Community Directed Distributors (CDDs) were purposively selected for interview from the communities visited.

Results: Overall, 2021 respondents from 2031 sampled population took part in the study giving a response rate of 99.6%. 1130(55.9%) were males. The geographic and therapeutic coverage of mass drug administration of Ivermectin achieved in the LGA was 100% and 79.9%, respectively. The key factors affecting coverage includes unavailability of drugs (48.8%), absenteeism of some of the household members (31%), inadequate incentives to the CDDs by the Government and poor record keeping by the CDDs.

Conclusion: This study found that the minimum geographic and therapeutic coverage of Ivermectin distribution was achieved by CDD as recommended by WHO for control of Onchocerciasis. For this to be sustained and to achieve elimination there must be adequate supply of Ivermectin, training of CDDs, retraining of CDDs, adequate supervision in record keeping and health education to the community.

Keywords: Onchocerciasis, Ivermectin, CDTI, CDD, NEC

INTRODUCTION

Onchocerciasis, a neglected tropical disease, is a parasitic disease of man, affecting the skin and eye leading to visual impairment and blindness. It is caused by a filarial nematode worm (*Onchocerca volvulus*). It is transmitted from person to person by the bite of various subspecies of the black fly *Simulium damnosum* in Sub-Saharan Africa. It occurs in the communities near fast-flowing rivers, hence the name river blindness [1].

Over 20 million people are projected to be infected; 1 million are blind and 70 million at risk of infection worldwide. Nigeria accounts for one third of these estimates. The disease is found in all States of Nigeria with varying degrees of endemicity and severity of clinical manifestations [2]. Both the savannah type that is associated with severe eye disorders and blindness and the forest type which causes more skin damage are present and responsible for the divergent clinic – epidemiologic picture [2-4].

One of the major reasons the north of Nigeria is reported to have higher blindness rates than the southern part is owing

to the widespread distribution of savannah species of *O. volvulus*. In the south the forest species that cause mostly skin diseases abound as widely reported by some areas with forest savannah mosaic vegetation known to have both forms [5].

Furthermore, Onchocerciasis causes dermatological problems like debilitating itching, depigmentation and disfiguring lesions [6,7] that can lead to secondary skin

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infections [8].

Stigmatization occurs with individuals who have skin disfigurement especially in finding a marriage partner [9-11].

Populations at risk include farmers, fishermen, ferrymen and hunters who live and spend most time around the breeding sites [12,13].

Onchocerciasis is the second leading cause of preventable blindness in the world [6]. People who have high load of *Onchocerca volvulus* have been found to have shorter life span [14]. They also possess psychosocial distress from either blindness or severe itching preventing them from work, thereby retarding their economic status [15]. Children living in households headed by an individual suffering from Onchocerciasis are two times more likely to drop out of school than those living in households headed by a guardian who does not have this disease [16].

The management of Onchocerciasis is challenging. The best approach has been described in four stages: the first stage should be carried at both individual and community levels; the second stage involves measures against the vector, the Simuliidae species. Thirdly, the ideal treatment of the infected individual should be directed at both the adult worm and the microfilaria and finally, treatment has to be directed at both skin and ocular disease [17].

The activities of Onchocerciasis-Control Programme (OCP) commenced in 1974, and eleven West-African countries benefitted from this programme [18]. It adopted an aerial larviciding method in order to eliminate vectors and ultimately eliminate the disease as a public health problem in endemic countries [19].

The African Programme for Onchocerciasis Control (APOC) began in 1995 and expanded upon the efforts, knowledge and experience of OCP to eliminate onchocerciasis (as a public health problem) from Africa by the year 2007 [6,19]. APOC was coordinated under the World Health Organization (WHO). The programme was active in 19 countries and depended on the involvement of Ministries of Health, Local and International Non-Governmental Organizations (NGOs) [20].

Community-Directed Treatment with Ivermectin (CDTI) was the primary strategy adopted by APOC to address the menace of Onchocerciasis [6,19] while vector control (a cost effective method of control) was used in isolated and small communities where the vectors can be eliminated within a short period of time [20]. Community-Directed treatment with Ivermectin (CDTI) operates by the participation of community whereby the meso-endemic or hyper-endemic communities/villages design and implement the treatment of their residents, by using the Community-Directed Distributors (CDD) [21,22]. The selected community members are chosen to be the CDD by Community Health Workers (CHW) or community and are trained to provide

treatment and education to the community on Onchocerciasis [23]. APOC countries have implemented annual CDTI whereas Onchocerciasis Elimination Programme for Americas (OEPA) countries have used semi-annual (twice yearly) or multi-annual (up to 8 times yearly) CDTI [24,25].

Ivermectin (Mectizan[®]) is a microfilaricidal drug that has been donated by Merck & Co (Mectizan) since 1987 for the mass treatment of Onchocerciasis. This drug kills the microfilaria and reduces the risk of developing eye and skin diseases associated with the infestation [26]. Ivermectin is indicated for the treatment of Onchocerciasis caused by *Onchocerca volvulus* and for the treatment of microfilaremia caused by infection with *Wuchereria bancrofti*, the causative agent of lymphatic filariasis in Africa [27]. If the bodyweight is used as the dosing criteria, those weighing less than 15kg are ineligible for treatment; while if height is used, those less than 90 cm tall are ineligible. Also, others ineligible for treatment with Ivermectin are pregnant women, women breast-feeding infants' less than one week old, individuals with serious illnesses of an acute or chronic nature and individuals with serious hypersensitivity response to Ivermectin [28].

The aim of this study is to assess the coverage of CDTI in Onchocerciasis-endemic communities in Birnin Kudu Local Government Area (LGA) of Jigawa state and to identify the key factors influencing Ivermectin coverage.

Ivermectin treatment for Onchocerciasis control should be monitored regularly to improve geographic and therapeutic coverage which is an essential component of sustainability of Community-Directed Treatment with Ivermectin (CDTI) [29]. It is important to note that a large number of people who require Ivermectin treatment reside in poor rural communities beyond the end of the road in the bush [30].

Jigawa state has been carrying out mass distribution of Ivermectin in Onchocerciasis-endemic areas of Birnin Kudu Local Government Area for the past 20 years through CDTI strategy. However, no survey has been conducted to assess the household coverage of this treatment in this LGA. Factors that will facilitate adequate coverage or poor coverage in the community need to be identified to improve on the successes recorded and for communities with poor coverage to adopt similar methods to reach all eligible persons.

SUBJECTS AND METHODS

This is a community-based cross-sectional survey that took place from March 2015 to April 2015 in all the districts of Birnin Kudu LGA, Jigawa state, Northwest Nigeria.

Inclusion criteria

Household members aged 5 years and above resident in Birnin Kudu Community for at least 1 year.

Exclusion criteria

A person not currently enlisted for annual Ivermectin treatment as a result of chronic debilitating disease.

Sample size

Using the Cochran formula, we estimated sample size of 2030.

A systematic sampling technique was used to select the study population and we estimated a sample of 50 households in each of 40 clusters.

A Cluster is a collection of households within a single Onchocercal Community.

A household is a group of persons who live under the same roof and eat from a common pot.

Team training and fieldwork

There was two days training of the research team and a pilot study was conducted in a community outside the enumerated clusters to help research team get acquainted with the research instrument. A two-stage cluster random sampling was used, with probability- proportional-to-size; we selected 40 clusters using systematic selection. In each cluster, 50 households were selected using compact segment sampling. In each household, the head of household or his representative listed the names of other eligible household members. The head of household also answered for the absentees and any under-aged child who were not able to answer. We sought information on when last treatment was received, how many tablets were given, why was tablets not received, was tablet given the year before the last distribution, the heights of the eligible respondent was measured using a dosing pole and compared with the number of tablets given by the CDD to ascertain if number of drugs given is corresponds with the height of respondents. The community leaders and community drug distributors were interviewed in 30 purposively selected clusters using semi structured questionnaire to sought information on how many CDDs were present in the village, how many female CDDs (if none what are the reasons?), how were the CDDs selected, why were they selected, involvement of CDDs in other health activities, shortage of drug, record keeping, availability of register and community contribution to support the programme.

ETHICAL CONSIDERATIONS

Ethics and Research Committees of National Eye Centre Kaduna granted approval for the Study. The Jigawa State Ministry of Health and Birinin Kudu Local Government Health Department granted administrative permit. Verbal consent was obtained by the Research Assistant from each adult in a language he or she understood and parents/guardians assented for their wards.

DATA MANAGEMENT

All data entered into IBM SPSS version 22. Data analysis involved running descriptive statistics of all variables. A general description of participants was done by calculating mean and standard deviation for continuous variables and frequencies and percentages for categorical data.

The district geographical coverage level was determined by the number of eligible communities that received Ivermectin as a proportion of the total number of communities in the district. Therapeutic coverage level was analysed as the total number of individuals in the community that took Ivermectin divided by the total number of eligible individuals.

Analysis of Variance (ANOVA) was used to test the relationship between age distribution and districts. Chi square test (X^2) was used to determine the proportionate differences in uptake of Ivermectin. Also, Chi square was used to determine if there is any difference in uptake of Ivermectin between 2013 and 2014. A frequency of factors influencing Ivermectin coverage was run. The maximum margin for error (alpha) in the statistical tests was set at 5% (0.05) level of significance. Any statistical test with p value less than 0.05 were considered statistically significant.

RESULTS

The results are presented as:

1. Findings from the household survey within the districts.
2. Overview of the key themes from structured interviews from the community leaders and CDDs.

Findings from the household survey within the districts

Overall, 6 districts were covered in this survey with 41 communities. 2030 people were enumerated out of which 2021 (response rate of 99.6%) granted the interview (**Table 1**).

Table 1. Distribution of participants across communities in various districts.

Districts	Number of community frequency (%)	Number of household's frequency (%)	Number of respondent's frequency (%)
Bamaina	5 (12.2)	27 (13.0)	183 (9.1)
Birnin Kudu	16 (39.0)	40 (19.4)	918 (45.4)
Iggi	4 (9.8)	25 (12.1)	180 (8.9)
Sundimina	7 (17.1)	22 (10.6)	280 (13.8)
Wurno	3 (7.3)	12 (5.8)	130 (6.4)
Yalwan Damai	6 (14.6)	81 (39.1)	330 (16.4)
Total	41 (1000)	207 (100.0)	2021 (100.0)

The total number of male and female respondents were 1130 (55.9%) and 891 (44.1%), respectively.

The male respondents were significantly older than the females (23.9 ± 17 years and 22.07 ± 14 , respectively), $t=2.6$, $p=0.01$.

The overall mean age for all respondents was 23.08 ± 15.7 ; Yalwan Damai had the smallest mean age of 21.62 ± 14.732 years and Wurno had the Highest mean age of $25.53 \pm$

17.229 years; Birnin Kudu, Iggi and Sundimina had a mean age of 23 years and Bamaina had a mean age of 22.6 ± 17.2 years.

Analysis of variance (ANOVA)

There was no statistically significant difference in the age groups in all the different districts $F=1.294$, $p=0.26$ (Table 2).

Table 2. Proportion of those that took drugs in each district the year 2013 and 2014 distribution.

District	Response	Frequency	Percent	Frequency	Percent
		2013		2014	
Bamaina	Yes	121	79.1	122	79.7
	No	32	20.9	31	20.3
Birnin Kudu	Yes	697	78.6	676	76.2
	No	190	21.4	211	23.8
Iggi	Yes	171	85.5	169	84.5
	No	29	14.5	31	15.5
Sundimina	Yes	275	83.1	291	87.9
	No	56	16.9	40	12.1
Wurno	Yes	137	91.3	134	89.3
	No	13	8.7	16	10.7
Yalwan Damai	Yes	217	72.3	222	74.0
	No	83	27.7	78	26.0

Among the respondents, 1618 (80.1%) received Ivermectin tablets in 2013 distribution and only 403 (19.9%) did not receive tablets, giving a therapeutic coverage of 80.1%.

Among the respondents, 1614 (79.9%) received Ivermectin tablets during the 2014 MDA while 407 (20.1%) did not receive tablets. The geographic coverage is 100% for period 2013/2014 (Figure 1).

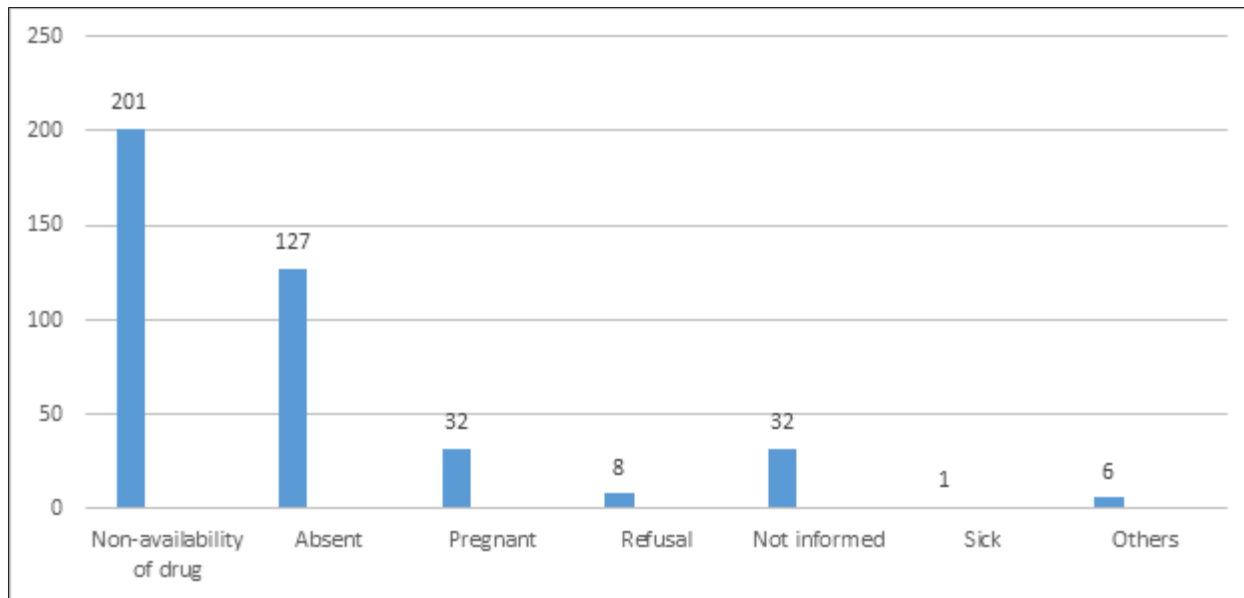


Figure 1. Reasons why tablets were not received by individuals in the year 2014 distribution.

Among those that did not receive Ivermectin tablets, about half of them 201 (49.5%) did not receive drug because it was not available. This was closely followed by being absent at the time of distribution 127 (31.2%). Only one person did not receive the drug because he was sick.

There was a statistically significant association between the number of correct drugs given to the respondents and the age, $X^2=18.309$, $df=3$, $p<0.000$. Majority 777 (57.6%) of

the respondents who received the correct doses of drug were within the age group of 5 and 24 years and majority of those that received incorrect dosages were also within the age group of 5 and 24 years.

There was no statistically significant relationship between sex of the respondents and the number of correct tablets given $X^2=1.847$, $df=1$, $p=0.174$ (Table 3).

Table 3. Community participation and ownership.

Variables	Frequency	Percent
Why did you choose these persons as CDDs?		
Good human relationship	12	40.0
Good human relationship and educated	2	6.7
Good human relationship and competence	13	43.3
Educated and competent	3	10.0
Any community decision on how the drug should be collected from collection point?		
Yes	18	60.0
No	12	40.0

All the community leaders that were interviewed, said the timing (month/season) for distribution and mode of distribution and the persons selected were decided at the village meeting. They also decided that the mode of distribution will be house-to-house (Table 4).

Table 4. Gender issues and minority groups.

	Number of community leaders	Percent	Number of CDD
How many CDD in this village are distributing the drug?			
	11	36.7	1
	11	36.7	2
	1	3.3	3
	5	16.7	4
	1	3.3	6
	1	3.3	7
Do women in this community attend General community meeting?			
Yes	10	33.3	
No	20	66.7	
Total	30	100.0	

All the CDDs were reported to be males. The reason for non-participation of women was because it was not culturally and religiously acceptable.

Training, monitoring and supervision

Twenty-eight of the Community leaders reported that the CDDs have received training. All those who were trained were reported to have been trained by a health staff. Most of them were trained before the first distribution. Only two Community Leaders reported CDDs were not trained. All the Community Leaders responded yes to supervision of the CDDs in their community.

CDD responses

Community participation and ownership: Among the CDDs, 21 (70%) reported that the time for distribution is decided at the community meeting while 9 (30%) reported that it is decided by the health worker. In terms of distribution, 28 (93.3%) reported that house-to-house strategy was used to distribute the drugs.

Forty percent (40%) of the CDDs have had to be replaced mainly because the incumbents left to seek further education, but some because they migrated from the area. Only 2 (6.7%) CDD reported that 4 CDDs have stopped working in their community, 6 (20%) CDDs reported that one CDD has stopped working in their community. All but one CDD reported they will be willing to continue as CDD.

Record keeping and availability of register: For record keeping, only 2 (6.7%) reported problems with keeping records. All CDDs claimed they have an updated register; however, only 2 were sighted. The total population found in the register was 4764.

Drug distribution to absentees, refusals and pregnant women after delivery: When asked what they do about individuals who were absent during normal distribution period, the CDDs responded that they tended to revisit, except one who did not give any response. Majority (96.7%) of the CDDs said they counseled those who refused treatment. For those that refuse treatment, 26 (86.7%) of CDDs also said they tended to revisit initial refusals. For women who were pregnant, 23 (76.7) percent of them were treated after delivery.

Sustainability of programme, challenges to work and how to improve programme: Twenty-nine out of 30 CDDs reported active community participation in the CDTI exercise. Seventeen of the CDDs felt the programme may be sustained over a long period by increasing community awareness, while 20 of them thought supporting the CDDs would help achieve the programme goal.

DISCUSSION

All eligible persons in a community must receive Ivermectin treatment for 15 years for Onchocerciasis to be eliminated, and there must be sustainable geographic drug coverage of at least 90% as recommended by World Health Organization [1]. It therefore implies that a high geographical and therapeutic coverage must be maintained throughout Ivermectin distribution.

The geographic coverage recorded in this study is 100%, while the therapeutic coverage varied across the 6 districts; with the least coverage of 74% and the highest coverage of 89.3%, which is consistent with the findings elsewhere [31,32]. The therapeutic coverage in the year before the last distribution of Ivermectin was better in all the districts except in Yelwan Damai district. However, all the districts

met the minimum therapeutic coverage of 65% as recommended by WHO for control in two proceeding cycles. Lower levels of female coverage compared to that of male were noted in this study. This was also observed in a similar study carried out in Oyo State, Nigeria, where a greater proportion of eligible males took Ivermectin than eligible females [31]. The reason could be due to exclusion of pregnant women and breastfeeding mothers from ingestion of Ivermectin.

One of the major barriers identified by the respondents affecting adequate coverage of Ivermectin MDAs in this study is shortage of drugs. This was reported by 73% of the key informants and 80% of CDDs. The large proportion (49.5%) of non-treated individuals at the household level was due to inadequacy of drugs. This finding is consistent with the findings in Niger state where 92.7% of non-treated individuals were due to unavailability of drugs [33]. Absenteeism is another factor affecting the distribution of Ivermectin. Over thirty percent (31.3%) of respondents that did not receive the drug were absent at the time of distribution. This is similar to what was observed in the study done in Oyo state, Nigeria, where 34.9% of respondents who did not receive the drug were reported to be absent during drug distribution [31].

Pregnancy and lack of information ranked as the third reasons why Ivermectin was not given which is also similar to what was found in Niger state [33] and elsewhere [32,34]. However, in this study, we recorded a higher number of pregnant women who did not receive Ivermectin when compared to the study done in Niger state. Not informed as a reason for not taking the drug is slightly higher in our study when compared to what is obtained elsewhere [32]. This could be due to lack of adequate community awareness through routine channels such as town announcer, messages in religious institutions, radio jingles among others.

The refusal rate reported in this study is extremely low, as only 9 (1.9%) people refused drug. This could mean that the Ivermectin is accepted in most communities visited, and the CDDs are diligent to counsel those who refused drugs as reported by 26 CDDs. This is similar to what is obtained in Niger state where only 1(0.3%) person refused the drug. The finding differs from the one done in a multi-site study in 5 APOC sponsored projects in Nigeria and Cameroon in the year 2011 where 20.5% refused ivermectin [32]. The reason for this higher value could be attributed to the higher sample size when compared to our study and that of Niger state. It could also be due to the increased awareness in the intervening period and the observation of benefit to those who accepted to be dosed.

The interview response of CDDs revealed poor record keeping. Only two villages had registers and most of the information was incomplete. This could be due to inadequate training as only 50% of the CDDs interviewed had training on record keeping. This was the case of a previous study

[33]. Research has shown that training of CDDs is essential for the planning, evaluation and success of the programme and that record keeping makes the whole system transparent [21,31].

The year 2014 distribution of Ivermectin was in the period of rainy season, because there was delay with supply of medications from state coordinator. This might have affected the coverage of drugs that year because the occupation of majority of the respondents and CDDs is farming. When compared to the distribution done the year before in the dry season higher coverage was recorded in the local government.

The ratio of the CDD to population in most of the studied communities was grossly inadequate. As recommended by WHO/APOC treatment protocol, it should be a ratio of 1 CDD to 100 people [35]. Seventy-three percent of the key informants said they have two or less CDDs in their community, which implies that the duration of the treatment will be prolonged, making it difficult to give all members of the community drugs within a short period of time. However, those who were initially absent can be found.

The CDDs interviewed in all the districts said they do not have female CDDs because it is culturally and religiously unacceptable to do such work. This finding is similar to what is obtained in Niger State [33], even though it was noticed that 33.3% of the key informants said women attend general community meeting. A study has shown that where there is a female CDD in the village, the community recorded a higher coverage of Ivermectin distribution compared to communities without any female CDD [31].

The CDDs interviewed are all willing to continue to serve in that capacity, even though not all of them enjoy incentives from the community. In this study, only one CDD does not enjoy any form of incentive, while in the study done in Niger state, 3 out of the 6 CDDs do not enjoy any form of incentives [33]. These incentives enjoyed by most of the CDDs could be responsible for better coverage of Ivermectin in this study compare to that of Niger State.

Suggestions were made on how to improve annual and long-term compliance during interview of CDDs. From the findings, health education to the community ranked the highest, followed by support for CDDs and lastly adequate provision of drugs. This finding is similar to what is obtained in a study done in Abia state, Nigeria where health education/enlightenment ranked very high, followed by awareness through church/school, house-to-house distribution and support of CDDs [36].

CONCLUSION

The therapeutic and geographic coverage of Ivermectin distribution in Birinin Kudu LGA is high being above the 65% minimum level by WHO. The major challenges that need to be overcome to ensure effective Onchocerciasis

control include: enhancing CDDs motivation, breaking cultural and religious barriers to ensure female gender participation in drug distribution.

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