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Article

Effects of Five Years of Treatment of Onchocerciasis with Ivermectin under Community Guidelines in Resurgent Areas of Burkina Faso: A before-and-after Analysis

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Abstract: Background: Almost the entire country of Burkina Faso was endemic to onchocerciasis. Onchocerciasis control efforts thus brought the prevalence of *O. volvulus* to a level where the disease was no longer a public health problem and a national onchocerciasis control program was set up in 1991 to ensure surveillance and maintain the gains made. A resurgence of onchocerciasis cases has been observed in two regions (Comoé, South West) located around several river basins in the 2010-2011. In accordance with WHO guidelines, for the management of resurgent cases, CDTI was implemented in the affected areas of Comoé and Sud-Ouest regions. **Methodology:** We conducted an extensive analysis to determine the effects of CDTI on parasitological indices of onchocerciasis in these two areas and we also analyzed the data in relation to the location of the village in relation to the river to see if this was a factor in the decrease in prevalence. **Results:** A total of 43 villages in 6 health districts, i.e., 100% of the villages that participated in the epidemiological surveys before and after the implementation of CDTI in the Southwest and Cascade regions were included in the study. The key findings were that standardized microfilaria prevalence and CMFL decreased significantly after the implementation of CDTI in both regions. For the average of the two regions, the results for standardized microfilaria prevalence were -5.91 with a 95% confidence interval of (-9.67; -2.16) and for CMFL were -0.29 with a 95% confidence interval of (-0.57; -0.01). Our results showed also a decline in standardized microfilaria prevalence and CMFL in all villages involved in the study. Moreover, the drop in the trajectory of the curve representing the predicted standardized microfilaria prevalence of villages located within 5 km of the streams was greater than that of villages located more than 5 km from the streams. **Conclusion:** Our results thus show that the implementation of effective CDTI could stop the transmission of *O. volvulus* in these two regions. The main challenge for stopping transmission could be the migration of populations to neighboring countries and migration of the vector from one country to another, as Burkina Faso shares some river basins with neighboring countries.

Keywords: onchocerciasis; ivermectin; resurgent areas; microfilarodermia; community microfilarial load; standardized prevalence; community guidelines; Burkina Faso

1. Introduction

Onchocerciasis, a parasitic infection caused by the nematode *Onchocerca volvulus* and transmitted by the small biting fly *Simulium*, is a major public health problem due to the irreversible complications (blindness, debilitating itching) that result [1]. It is one of the 20 neglected tropical

diseases (NTDs) to be eliminated by 2030 [1,2]. According to the World Health Organization (WHO)[4], the vast majority of the 26 million people infected with onchocerciasis worldwide (99%) live in sub-Saharan Africa [3,4].

The advent of vector control programs implemented since 1974 in West Africa, and later associated with mass treatment campaigns with Ivermectin implemented in the 1990s, have improved the socio-economic conditions of populations through the elimination of the disease as a public health problem in some countries [4,5]. This ivermectin-based treatment initially provided by mobile teams is now led by the community in an approach called community-directed treatment (CDTI) [4].

However, some experts believe that it will not be possible to eliminate onchocerciasis in Africa with mass treatment with Ivermectin alone because of the more complex epidemiology in this region compared with Latin America [6]. Indeed, the outbreaks in Latin America were localized with low to moderate endemicity and the vectors were less effective in transmitting infection compared to those in Africa. This could explain why the results of several years of CDTI appear more effective in sub-Saharan Africa. For example, studies in Niger, Senegal, Nigeria and Ethiopia have shown that at least 15 years of mass treatment with Ivermectin were required to interrupt *O. volvulus* transmission and achieve prevalence rates of zero [7–9]. Similarly, other studies, in Cameroon and Togo, showed that more than 15 years of CDTI failed to interrupt onchocerciasis transmission[10–13]. Several hypotheses have been put forward, including insufficient coverage of the population eligible for CDTI and maintenance of the infectious focus through human or vector migration.

Almost the entire country of Burkina Faso was endemic to onchocerciasis, with a prevalence of 60-80%, except for the extreme north. [14]. Onchocerciasis control was mainly based, as elsewhere in West Africa, on vector control using larvicides from 1974 until the 1990s. Ivermectin treatment was used in the Bougouriba basin in 1996 and in the Nakambé and Sissili basins from 1992 to 1998 with the aim of controlling resurgence [4,14]. Onchocerciasis control efforts thus brought the prevalence of *O. volvulus* to a level where the disease was no longer a public health problem and a national onchocerciasis control program was set up in 1991 to maintain the gains made. In addition, starting in 2000, Burkina Faso implemented mass distribution of Ivermectin to control lymphatic filariasis which was scaled up starting in 2004 [14], covering all health districts in the country.

A resurgence of onchocerciasis cases has been observed in two regions (Comoé, South West) located around several river basins in the 2010s [14–16]. In accordance with WHO guidelines, for the management of resurgent cases, CDTI was implemented in the affected areas of Comoé and Sud-Ouest regions [17–19]. Five years after the start of CDTI in these regions, epidemiological surveys were conducted to assess progress in controlling the resurgence of the disease. Taking advantage of the pre-CDTI survey and the last epidemiological survey, the objective of this study was to evaluate the effects of five years of CDTI on the parasitological indices of onchocerciasis. The study is unique in that it concerns CDTI conducted in the context of resurgence control, unlike other studies conducted in other sub-Saharan African countries that were based on initial disease control interventions [8,17,18]. Furthermore, this resurgence occurred despite the use of Ivermectin for lymphatic filariasis control and therefore the efficacy of CDTI in this context is questionable.

2. Methods

2.1. Study Design

This was a before-and-after intervention study without control groups in the Cascades region (before, 2011, and after, 2016) and the Southwest region (before, 2013, and after, 2018) of Burkina Faso.

2.2. Study Setting

Burkina Faso, a country located in West Africa, borders Côte d'Ivoire, Mali, Ghana, Togo, Benin and Niger (see **Figure 1**). It had a population of 20,487,979 in 2019, of which more than three-quarters

live in rural areas and 40% below the poverty line [20]. In addition, 56.2% of the population are farmers and/or skilled workers in agriculture, forestry or fishing [21].

Climatically, Burkina Faso is divided into 3 zones: a Sahelian zone which is located in the north of the country, a Sudanese-Sahelian zone running from the east to the north and including the center of the country and a Sudanese zone located in the southwest [22]. The vegetation is much more abundant in the Sudanian zone of the country where the two onchocerciasis endemic regions are located.

The country is made up of numerous rivers, the main ones being the Mouhoun, Nakambé and Nazinon. River Mouhoun, the main tributary of the Volta River, has a total area of 91,036 km² which runs through Burkina Faso. Its main tributaries include the Poni, Bougouriba, Grand Balé, Vranso and Sourou rivers. River Nakanbé is also a tributary of the Volta River with 81,932 km² of its basin surface area in Burkina Faso. Its main tributaries are the Sissili, Nazinon, Pendjari and Nouhao rivers. Other perennial rivers exist in Burkina Faso, including the river Comoé, which extends over Mali, Burkina Faso and Côte d'Ivoire. The Burkina Faso portion of the riverbasin spreads over the provinces of Comoé, Léraba, Houet, Kénédougou and Poni. It includes five sub-basins: Lerabah, Comoé, Kodoun, Baoué and Iringou.

Onchocerciasis endemic regions are crossed by some of these tributaries and basins. In the South-West region, the districts where onchocerciasis are endemic are crossed by the Mouhoun (Bas Mouhoun) and Bougouriba rivers. As for the Cascades region, the 2 endemic districts are crossed by the Comoe river.

Only the South-West and Cascades regions out of the 13 regions of the country are endemic to onchocerciasis with districts having an endemicity threshold above 5% [23]. The endemic districts are those of Gaoua, Batié, Diébougou and Dano (South-West region) and Banfora and Mangodara (Cascades region).



Figure 1. Geographic location of Burkina Faso in Africa.

2.3. Specific Framework

2.3.1. Implementation of the CDTI by the National Program for the fight against NTDs in Burkina Faso

Implementation of treatment for onchocerciasis under community guidelines began in 2011 and 2013 for the Cascades and Southwest regions respectively (see **Figure 2**).

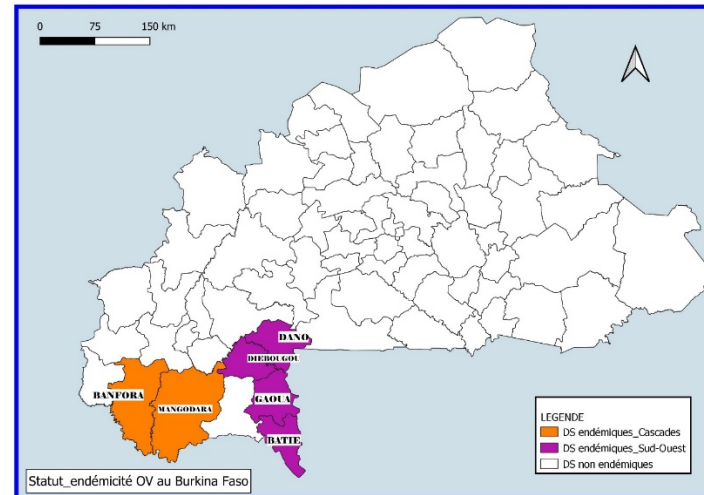


Figure 2. Regions covered by CDTI in Burkina Faso.

In accordance with WHO guidelines, the primary strategy for onchocerciasis control is to interrupt the cycle of disease transmission by distributing ivermectin under community guidelines to individuals at risk of *Onchocerca volvulus* infection. Administered orally, once or twice a year, ivermectin can reduce the burden of *Onchocerca volvulus* microfilariae to levels below those required for effective transmission by the black fly *Simulium* [24].

Implementation of the CDTI was resumed in 2011 and 2013 in the Cascades and South-West regions respectively. After the 2010 (Cascades region) and 2011 (South-West region) epidemiological assessments showed a high prevalence of the disease, the CDTI was repeated in 2011 for the Cascades and in 2013 for the South-West region. CDTI is implemented biannually in both regions except in the years when an epidemiological survey is conducted (2016 for the Cascades and 2018 for the Southwest). For the study periods, 10 and 9 rounds of CDTI were conducted respectively in the endemic districts of the Cascades region and the Southwest region by the NTDP of the Ministry of Health.

The CDTI is a strategy implemented by communities and evaluated by community monitors. During CDTI campaigns, community-based distributors are responsible for administering treatment by name in all onchocerciasis-endemic villages. Experience has shown that this method works best if the communities themselves choose how they want to deliver the treatment and who will be responsible for it. Prior to the implementation of each CDTI campaign, the actors are trained in a cascade from the regional level to the community distributors (CDs). The administration of ivermectin is carried out by the CDs under the supervision of those responsible at the health facilities, the districts and the regional teams. Social mobilization is carried out at the regional, health district and community levels in order to encourage greater support from the population.

2.3.2. Epidemiological Surveys Implemented in the Framework of Onchocerciasis Surveillance

Epidemiological surveys are descriptive cross-sectional surveys that aim to determine the prevalence of onchocerciasis in communities. The diagnostic methods used to measure prevalence are direct observation of microfilaria in skin tissue (bloodless skin biopsy) and the search for parasite antigens using the *Onchocerca volvulus* OV-16 antigen antibody test (OV-16). The use of rapid tests in

epidemiological investigations is a component of the new WHO guidelines for the elimination of onchocerciasis as a public health problem [24].

In the epidemiological surveys conducted before the resumption of CDTI in both regions in 2011 and 2013, the method used for the assessment of onchocerciasis prevalence was just the examination of exsanguinated skin biopsies. After the implementation of CDTI in both regions, both diagnostic methods (skin biopsy and antigen-antibody tests) were used in the epidemiological surveys.

The method for exsanguinated skin biopsy examination is as follows. A 1-2 mg skin flap is taken with Holtz forceps, including the superficial layers of the dermis, and is placed in distilled or physiological water. The emitted microfilariae are observed fresh under the microscope or with a binocular microscope. The reading of the biopsies with a magnifying glass is done 30 minutes after incubation in distilled water. The populations from whom skin biopsies are taken are from villages involved in the surveys with a sample size of 250-300. People are selected in order of arrival until the sample size is reached.

OV16 tests are performed in children aged 2 to 9 years. These tests are based on the detection of IgG4 antibodies reacting against the OV16 parasite antigen in a drop of blood taken from a fingertip. The OV16 tests are read after 20 minutes and again after 24 hours. A sample size of 3000 children are tested for OV16 in the entire region. This sample size is distributed among the villages in the survey area.

Using these methodologies, a total of four epidemiological surveys were implemented, two (one in each region) before the resumption of the CDTI and two after five years of CDTI implementation (2016 in Cascades and 2018 in the South West). The general objective of these surveys was to determine the epidemiological situation of onchocerciasis in the endemic villages.

2.4. Data Sources

Aggregate village data were extracted from the national database of epidemiological surveys conducted by the PNMTN in endemic districts. The variables sex and age were excluded from the database because they were not uniformly collected during the baseline epidemiological survey (before the intervention). Also, given that treatment coverage data by village was not available, district therapeutic coverage was attributed to the study villages. To ensure data quality, only data collected according to the official CDTI reporting template set up by the PNMTN were considered for therapeutic coverage.

2.5. Study Population

Inhabitants (aged ≥ 5 years) residing in endemic villages in the health districts of Banfora (20/23 villages) and Mangodara (5/6) in the Cascades region and Batié (8/10), Gaoua (2/4), Dano (3/6), and Diébougou (5/9) in the Southwest region constituted our study population. Thus, a total of 43 villages were involved in the study. The villages that were selected were those that participated in the epidemiological surveys before the implementation of CDTI (in 2010 and 2011) and after five years of treatment.

2.6. Study Variables

Variables included those of exposure to the intervention taking the value 0 for the period before and 1 for the period after the implementation of CDTI, number of CDTI rounds, average treatment coverage during the 5 years of treatment, distance between the village and the river (coded 1 if the distance < 5 km and 0 if ≥ 5 km). The number of CDTI rounds was the number of CDTI rounds conducted in each area between the two epidemiological surveys. Average treatment coverage was the average treatment coverage of the different CDTI rounds in each district. The epidemiological survey databases provided information by village on the number of people surveyed, the prevalence of microfilariodermia, the standardized prevalence and the microfilaria burden in the community.

2.7. Data Analysis

Data in Excel format (version 2019) were processed and then imported into Stata V.15.2 software (Stata Corporation, CollegeStation, TX, USA) for analysis. We first plotted the observed trajectories of all villages. We then used whisker boxes to examine the observed pre- and post-CDTI prevalence and community microfilarial load (CMFLs) for the entire sample, by region, and by village distances from streams. To assess the effects of CDTI on the prevalence and the community microfilaria burden, we first used a paired t-test. We considered the effects to be different across regions and village distances to rivers. To test these interactions, we used linear random-effects models, which allowed us to adjust standard errors for the dependence of within-village observations. The structure of the residual covariances between the two periods was modeled using unstructured covariance. The analysis was conducted with the mixed command of Stata V.15.2 (StataCorp) and the Kroger method was used to account for the small sample size. Although the interactions were not significant, we presented the results unstratified and stratified by region and then by distance of villages from rivers because this lack of statistical significance could be explained by a lack of statistical power. Finally, we graphically presented the predicted estimates with 95% confidence intervals (CI).

2.8. Ethical Considerations

This study was a secondary analysis of data from the NTDP's CDTI implementation activities. The data used were anonymized and did not include information that would allow for the identification of respondents. In addition, for all studies related to the elimination of onchocerciasis, the PNMTN had approval from the National Health Research Ethics Committee, signed in 2009. This approval has also been used for the publication of other studies [25]. However, prior to the implementation of the surveys, the teams sensitized the populations on onchocerciasis and its consequences and on the need to monitor its endemicity. Following this, the participants in the survey gave oral or written consent prior to sampling. The database was kept on the principal investigator's password-protected computer.

3. Results

3.1. Characteristics of the Villages Surveyed

A total of 43 villages in 6 health districts, i.e., 100% of the villages that participated in the epidemiological surveys before and after the implementation of CDTI in the Southwest and Cascade regions were included in the study. More than half (57%) of the villages were located in the districts of Banfora and Mangodara in the Cascades region. The Banfora district alone accounted for 47% of the villages surveyed.

3.2. Standardized Microfilarodermia Prevalence Rates after Five Years of Treatment in the Study Villages

Standardized microfilarodermia prevalence rates by village decreased during the period between treatment resumption and after five years of annual and/or biannual CDTI implementation. The trajectories in the figure below (**Figure 3**) showed a significant decline for some villages.

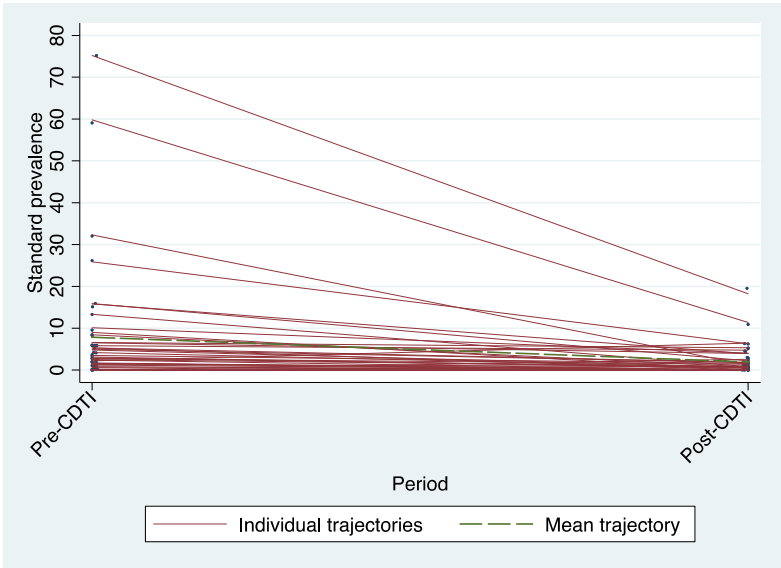


Figure 3. Standardized microfilariodermia prevalence trajectories of the 43 villages that benefited from CDTI in the two regions, Burkina Faso.

3.3. Distribution of Standardized Microfilaria Prevalence Rates after 5 Years of CDTI by Region

The decline in standardized microfilaria prevalence was also observed in each of the study regions. The distribution of standardised prevalence in villages in each region between the pre-CDTI period and after five years of CDTI implementation also declined significantly (**Figures 4 and 5**).

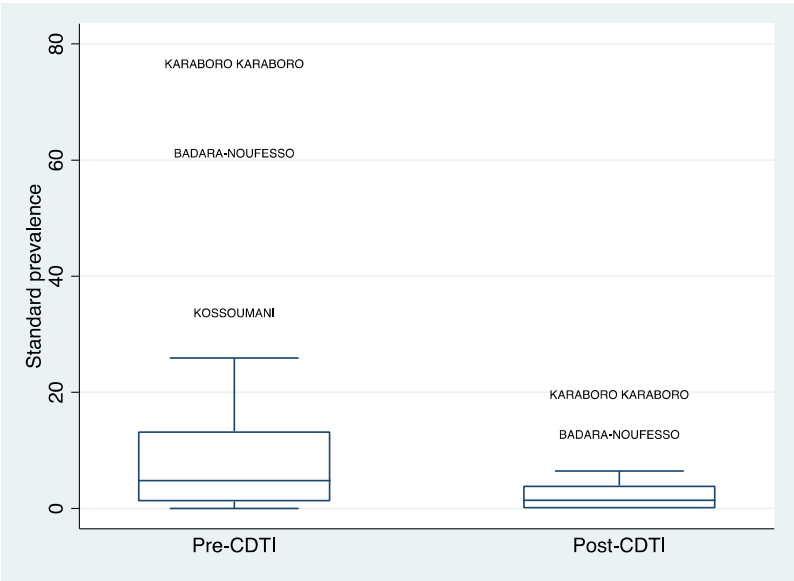


Figure 4. Distribution of standardized pre- and post-CDTI microfilaria prevalence rates in the Cascades region, Burkina Faso.

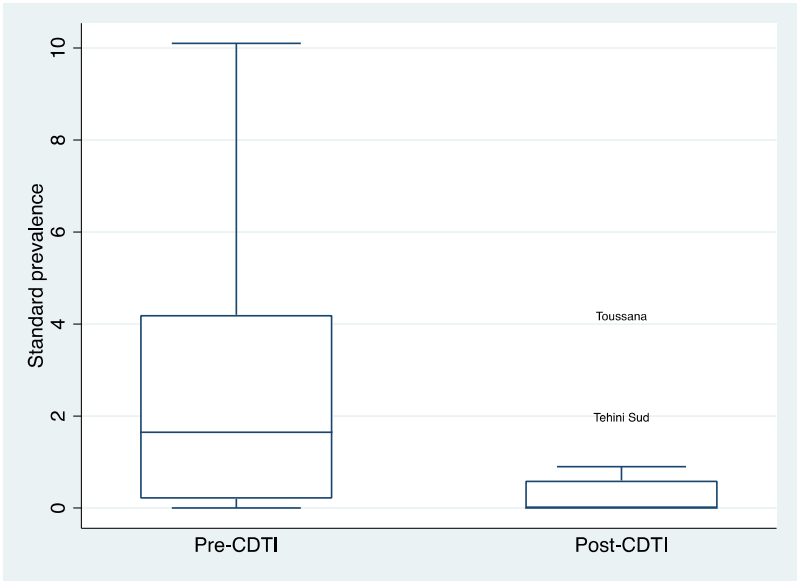


Figure 5. Distribution of standardized pre- and post-CDTI microfilaria prevalence rates in the South West region, Burkina Faso.

3.4. *Distribution of Community Microfilarial Load (CMFL) after 5 Years of CDTI*

Similar to the standardized microfilaria prevalence rates, the distribution of the Community Microfilarial Load (CMFL) decreased after the implementation of CDTI (see **Figure 6**). This decline was observed in both the Cascades and Southwest regions.

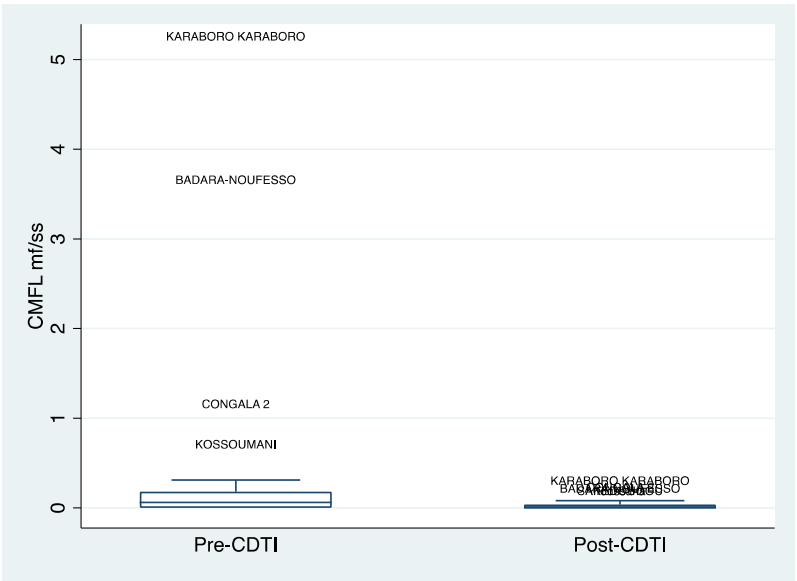


Figure 6. Distribution of pre- and post-CDTI microfilaria loads for villages in the Cascades and Southwest regions, Bukina Faso.

3.5. *Parasitological Indices after 5 Years of CDTI Implementation*

For all the villages involved in the study, a decrease in the prevalence of standardized and CMFL was observed. However, there was a high standard deviation for villages in the Cascade region and villages that were less than 5 km from rivers, indicating a wide variation in prevalence rates between villages, especially for the baseline survey (**Table 1**).

Table 1. Prevalence rates and community microfilarial load (mf per biopsy) before and after CDTI, Burkina Faso.

		Number of villages	Pre-CDTI period		Post-CDTI period	
			Standardized prevalence (SD)	CMFL (SD)	Standardized prevalence (SD)	CMFL (SD)
Cascades	and	43	7,85 (15,07)	0,32 (0,94)	1,94 (3,48)	0,028 (0,047)
Southwest						
Waterfalls		25	11,56 (18,88)	0,49 (1,21)	2,97 (4,22)	0,04 (0,06)
Southwest		18	2,69 (3,05)	0,076 (0,090)	0,51 (0,99)	0,011 (0,025)
Less than 5 km from		32	9,87 (17,02)	0,41 (1,08)	2,25 (3,91)	0,032 (0,053)
river						
5 km and more from		11	1,99 (2,13)	0,049 (0,057)	1,03 (1,46)	0,015 (0,020)
river						

CDTI=community directed treatment ; SD= standard deviation.

3.6. The Effects of CDTI on Standardized Microfilaria Prevalence and CMFL

The evaluation of the effects of CDTI showed that the significant reduction in standardized prevalence and CMFL could be attributed to the five years of CDTI implementation in both regions. This Cleduction in parasitological indices was observed independently of the distance between the village and the river and was significant. For the average of the two regions, the results for standardized microfilaria prevalence were -5.91 with a 95% confidence interval of (-9.67; -2.16) and for CMFL were -0.29 with a 95% confidence interval of (-0.57; -0.01) (see **Table 2**).

Table 2. Effects of CDTI on standardized prevalence rates and community microfilarial load (paired t-test), Burkina Faso.

	Number of villages	Standardized prevalence (95%CI)			CMFL (95%CI) (microfilaria/skin slice)		
		Pre-CDTI	Post-CDTI	Difference	Pre-CDTI	Post-CDTI	Difference
The two regions	43	7,85 (3,21-12,49)	1,94 (0,87-3,01)	-5,91 (-9,67-2,16)	0,32 (0,03-0,61)	0,03 (0,01-0,04)	-0,29 (-0,57-0,01)
Cascades	25	11,56 (3,77-19,36)	2,97 (1,23-4,71)	-8,59 (-14,96-2,23)	0,49 (-0,01-0,99)	0,04 (0,02-0,06)	-0,45 (-0,93-0,03)
Southwest	18	2,69 (1,18-4,21)	0,51 (0,01-1,00)	-2,19 (-3,46-0,92)	0,08 (0,03-0,12)	0,01 (-0,002-0,02)	-0,07 (-0,10-0,03)
<5 km from river	32	9,87 (3,73 - 16,00)	2,25 (0,84 - 3,66)	-7,62 (-12,57-2,66)	0,41 (0,02-0,80)	0,03 (0,01-0,05)	-0,38 (-0,75-0,002)
≥5 km from river	11	1,99 (0,56-3,42)	1,03 (0,05-2,01)	-0,96 (-2,15-0,23)	0,05 (0,01-0,09)	0,02 (0,002-0,03)	-0,03 (-0,07-0,003)

*paired t-test ; CDTI= community directed treatment ; CI=confidence intervals.

Figures 7 and 8, which are predictions adjusted to a 95% confidence interval, also illustrate the decline in biopsy microfilaria prevalence after 5 years of CDTI for all regions and by region, respectively.

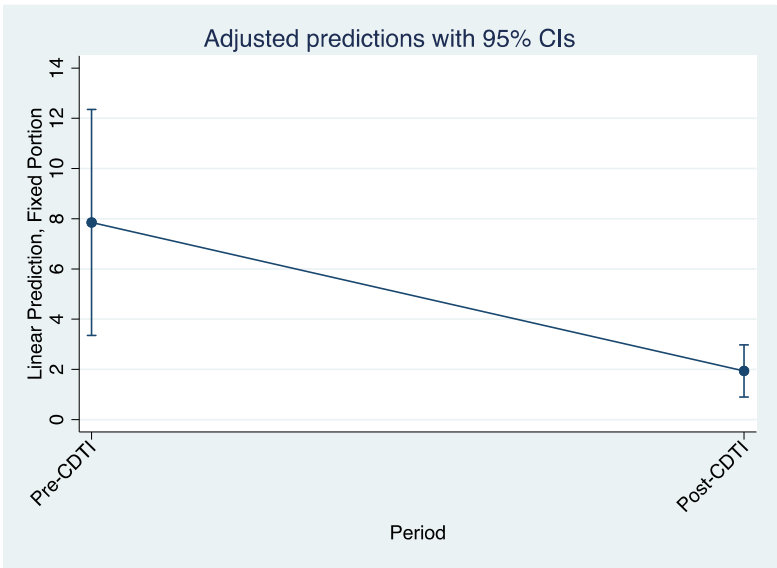


Figure 7. Predicted standardized prevalence of microfilaria for the two regions, Burkina Faso.

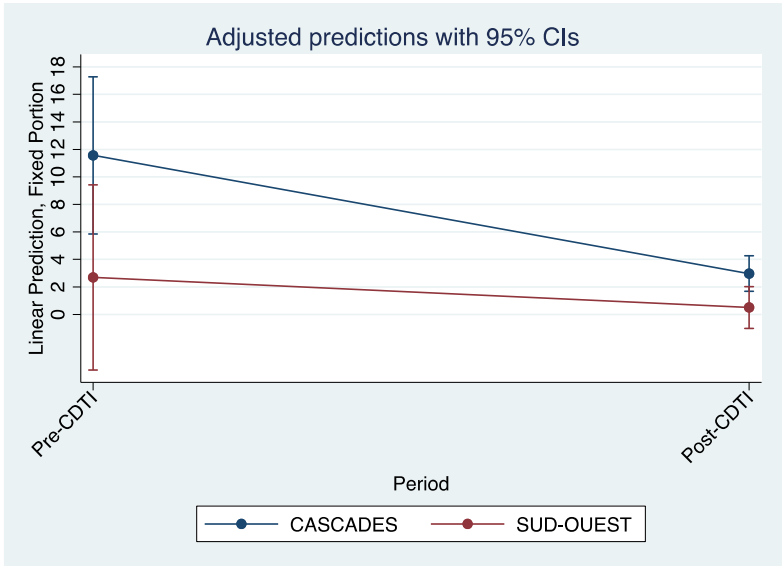


Figure 8. Predicted standardized prevalence of microfilaria for the Cascades and Southwest regions, Burkina Faso.

In addition, the drop in the trajectory of the curve representing the predicted standardized microfilaria prevalence of villages located within 5 km of the streams was greater than that of villages located more than 5 km from the streams (**Figure 9**).

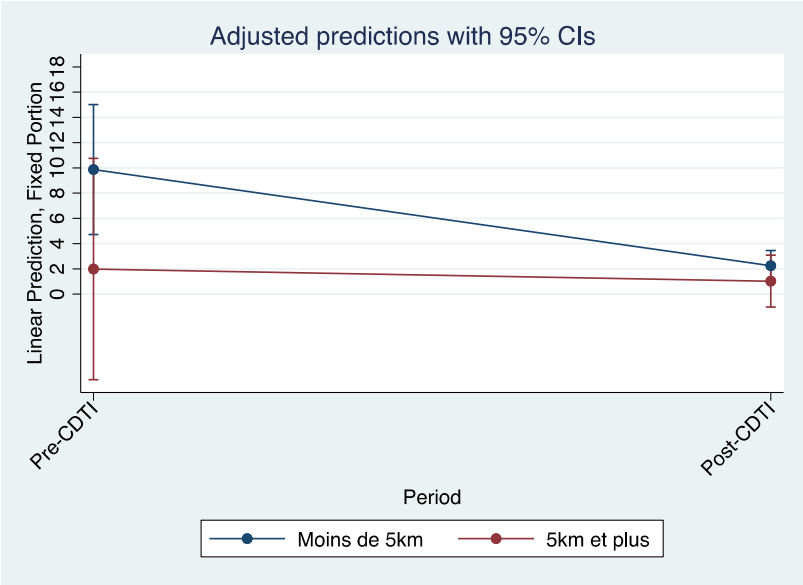


Figure 9. Predicted standardized prevalence of microfilaria according to village distances to rivers, Burkina Faso.

4. Discussion

This study was conducted to analyse the effects of CDTI implementation on changes in the prevalence of *O. Volvulus* in two regions in Burkina Faso that had seen a recrudescence.

The key findings were that standardized microfilaria prevalence, skin biopsy prevalence and CMFL decreased significantly after the implementation of CDTI in both regions. There was no significant difference between the decline in parasitological data within the two regions. A greater decline in the trajectory of prevalence was observed for villages located less than 5 km from the watercourse compared to villages located more than 5 km from the watercourse.

We conducted an extensive analysis to determine the effects of CDTI on parasitological indices of onchocerciasis in these two areas and we also analyzed the data in relation to the location of the village in relation to the river to see if this was a factor in the decrease in prevalence. This in-depth analysis allowed us to obtain satisfactory results despite the small size of our sample as one of the limitations of our study was the small sample. We were unable to obtain individual data from the epidemiological studies and had to work on the basis of villages as our unit of measure. In addition, we had to assign district therapeutic coverage rates to villages due to the lack of coverage data at the village level.

Our results showed a decline in standardized microfilaria prevalence and CMFL in all villages involved in the study. This was shown by the trajectories and the distribution by villages before the implementation of CDTI and after five years of treatment. In addition, the reduction in standard microfilaria prevalence and CMFL could be attributed to the effects of CDTI. For example, for standardized prevalence, the reduction was nearly -6 with a 95% confidence interval of [-9.6 to -2.2]. Previous research has found that Ivermectin is an effective treatment for onchocerciasis microfilariae to stop the transmission of onchocerciasis. This discovery allowed vector control for the elimination of onchocerciasis to be suspended in order to strengthen efforts to implement Ivermectin treatment [26]. The findings also support the view that mass treatment with Ivermectin is better in several respects compared to vector control. It has an impact on morbidity and it helps to reduce disease transmission [27]. The significant decline in prevalence after five years of treatment in the two regions of Burkina Faso suggests that the implementation of CDTI could lead to a cessation of onchocerciasis transmission within the 15-year time frame recommended in the studies. Indeed, according to mathematical models, in the event of a resurgence, CDTI conducted for 15 years with a coverage rate of at least 65% would be sufficient to stop the recrudescence and spread of onchocerciasis [4].

Although the decline in standard and biopsy prevalence rates and CMFL appeared to be greater in the Cascades region than in the Southwest region, this was not statistically significant. This could be due to the small sample size which did not allow for statistical power. Studies have shown area differences in the time taken to total elimination of onchocerciasis but these were usually done at the country level with large samples. For example, in Abu Hamed, Sudan, onchocerciasis was declared eliminated after 14 years of annual and then biannual treatment with Ivermectin [28]. In Geba Valley, Guinea-Bissau, it took just six years of treatment [4]. In our study we dealt with two regions of the same country that were located in the same geographical area. These two regions have the same type of climate and vegetation with people who have the same habits in terms of professional activities (mainly agriculture, livestock and fishing), culture and migration. This could also explain the lack of significant difference in the decline in prevalence. In addition, the implementation of CDTI in both regions was coordinated by the same team at the national level. The strategies used to achieve adherence and treatment goals were probably the same in both regions, as evidenced by the satisfactory treatment coverage.

We also did not observe a significant difference in the decrease in standardized prevalence and CMFL of villages located less than 5 km from the rivers and those located more than 5 km away. However, we know that the amount of dermal microfilariae is a function of the number of adult filariae and hence the number of infective larvae transmitted to the subject by the bites of infective female simuliid black flies [27]. The proximity of villages to watercourses leads to greater simuliid nuisance and hence higher transmission.

The small size of our sample was a limitation of our study. It did not allow us to demonstrate the effect of proximity to waterways on the reduction in the prevalence of onchocerciasis, despite extensive analysis. Another limitation was the absence of data on the therapeutic coverage of the villages concerned by the study, which obliged us to attribute the therapeutic coverage of the districts to the villages.

However, the results obtained show that the implementation of CDTI in the two regions has produced satisfactory results, and the reduction in the endemicity of onchocerciasis will certainly lead to other programmatic decisions such as the implementation of preSTop and full stop surveys in these two regions.

5. Conclusion

Our study showed the effects of CDTI on the decrease of standardized microfilaria prevalence, biopsy prevalence and CMFL in all the villages concerned. CDTI was implemented for at least five years between the first and second epidemiological assessments, with satisfactory treatment coverage in all districts. Our results thus show that the implementation of effective CDTI could stop the transmission of *O. volvulus* in these two regions. The main challenge for stopping transmission could be the migration of populations to neighboring countries. It was observed that most of the people who tested positive during the epidemiological surveys after the five years of treatment had stayed outside Burkina Faso for a longer or shorter period of time. Effective strategies should be put in place to track these individuals as soon as they return to the country in order to prevent them from transmitting onchocerciasis to populations that are regularly treated. In addition to population migration, migration of the vector from one country to another (as Burkina Faso shares some river basins with neighboring countries) may also delay the cessation of transmission. Future studies are needed to assess the impact of these migration patterns on preventing *O. Volvulus* transmission.

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