

Performance of predictors: Evaluating sustainability in community-directed treatment projects of the African programme for onchocerciasis control

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Abstract

The predictors of sustainability of community-directed treatment with ivermectin (CDTI) at four implementation levels were evaluated in 41 African Programme for Onchocerciasis Control (APOC) projects, encompassing 492 communities in 10 countries. A model protocol provided information on indicators corresponding to nine aspects of a project that is likely to be sustainable at community level after the cessation of external support. Six of the nine aspects had components of community ownership as predictors of project sustainability. Quantitative and qualitative assessments were used to obtain individual community scores and an overall sustainability score for each project graded on a scale of 0–4. Of the 41 projects evaluated, 70% scored “satisfactorily” to “highly sustainable” at the community level. We found variations among countries and that health system weaknesses could hamper community efforts in sustaining a project, such as when ivermectin was delivered late. Community ownership was of primary importance to the community score, and the community-level scores correlated with overall project sustainability. The therapeutic coverage achieved in each project correlated with the ratio of volunteer ivermectin distributors per population served. Surprisingly, the performance of these distributors was not affected by the direct incentives offered, and coverage appeared to be highest when cash or in-kind compensation was not given at all. Although further research is required, anecdotal evidence pointed to diverse indirect benefits for distributors—political goodwill, personal satisfaction and altruistic fulfillment. The results demonstrate that community ownership is among the important determining factors of sustainability of community-based programmes.

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Introduction

Victims of onchocerciasis (river blindness) suffer a variety of problems even beyond the primary dermatologic and ocular clinical symptoms. The disease’s outward manifestations carry a social stigma (Amazigo, 1994; Brieger, Oshiname, & Ososanya, 1998; World Health Organization,

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1995). The reactive skin lesions and persistent itching are associated with diminished income-generating capacity, spelling discomfort for those infected and disaster for their families. In households headed by an onchocercal patient, children are two times more likely to drop out of school than those from other homes (Benton, 1998; Oladepo et al., 1997). This constellation of problems amounts to a massive development obstacle in much of sub-Saharan Africa, where some 75 million people are at risk and where 99% of those infected live (Okeibunor et al., 2004; Remme, 2004).

To fight the disease, the African Programme for Onchocerciasis Control (APOC) adopted the CDTI strategy, meaning community-directed treatment with ivermectin (Okeibunor et al., 2004; TDR, 1996). This approach is consistent with the objective of the primary health care (PHC) provision with an emphasis on active community participation (Korte, Richter, Merkle, & Gorgen, 1992; WHO, 2003a, 2003b, 2003c, 2003d).

Over 33 million people are treated annually with ivermectin in the APOC countries. The CDTI strategy was used by 95,000 communities in 16 sub-Saharan countries to distribute more than 98 million ivermectin tablets in 2005. Some of the communities have successfully conducted seven or more rounds of treatment since APOC's inception in 1995 (African Programme for Onchocerciasis, 2006). However, in 1999, the Centre 3 CDTI project in Centre Province, Cameroon reported the first 25 cases of serious adverse events (SAEs) and deaths following treatment with ivermectin during mass distribution (Twum-Danso, 2003). Consequently, some community members refused ivermectin and treatment coverage of the national control programme suffered a setback. Recently, more cases have been reported in the Democratic Republic of Congo (DRC) though not in the areas of the evaluated projects.

The sustainability of the CDTI strategy is essential because ivermectin must be taken annually for at least 15 years to eliminate onchocerciasis as a disease of public health and socioeconomic importance (Borsboom et al., 2003; Tielsch & Beeche, 2004). Thus, the key question is 'can communities sustain treatment with ivermectin?'

APOC hoped that increasing community involvement would lead to better and more sustainable disease control—consistent drug delivery, sufficiently high coverage and adequate record keeping. Accordingly, CDTI is built on a structural partici-

pation paradigm in which communities play a direct role in planning, leading, and managing (Oakley, 1990). CDTI empowers communities to select their community-directed distributors (CDDs), choose the timing and method of treatment administration and resolve distribution-related problems. The CDTI projects benefit from donor financing during the initial 5 years of implementation.

Following the year 2000 external evaluation of APOC (World Health Organization, 2000) a protocol for evaluating CDTI project sustainability and the performance of all partners, including communities was developed. Sustainability is defined as: *“The ability of a project to continue to function effectively, for the foreseeable future, with high treatment coverage, integrated into available health care services, with strong community ownership using resources mobilized by the community and government”* (World Health Organization, 2002).

Between 2002 and 2003, APOC conducted participatory sustainability evaluations of 41 projects in 10 countries: Cameroon, Chad, Congo (Brazzaville), Congo (Kinshasa), Ethiopia, Malawi, Nigeria, Sudan, Tanzania and Uganda. The evaluations focused on the projects as the main unit of analysis and looked at the difference between implementation levels and countries to ascertain the effect of a project's environment on its sustainability performance.

This article examines the performance of communities on the predictors of CDTI project sustainability. Of particular interest was to see whether community participation and ownership truly existed in the CDTI projects, as was intended by APOC. The data collected covered the life of the project to the year of evaluation, i.e., 3–5 years of operations using the CDTI strategy and the predictive role of community ownership in long-term project sustainability. We defined community ownership as: *“evidence of the ability of the community to own and manage CDTI; participation of community members and their leadership in decision-making; initiating and supporting CDTI implementation”*.

Evaluation design and methodology

Study population

APOC was launched in 1995, and the first set of projects was approved in 1997. Projects are based on countries (e.g., Chad), or states/provinces (e.g.,

Nigeria or Cameroon), or groups of districts (e.g., Uganda). The Ministry of Health and a partner Non-Governmental Development Organization (NGDO) support each project. When the present evaluation took place, there were 41 projects in 10 countries that had distributed ivermectin between three and five times. All 41 projects were included in the study.

Indicators

To assess each project, the performance of communities and health care providers were rated using qualitative and quantitative indicators predicting sustainability. The indicators were designed by researchers with expertise in sustainability issues and managers of CDTI projects. Indicators corresponded to aspects of sustainability at each of the four implementation levels: the central,¹ the district or local government area (LGA), sub-district or front-line health facility (FLHF) and community.

A set of nine community-level sustainability indicators was field tested and refined. Five of the indicators assessed the *routine project activities and processes*: Planning, Leadership, Monitoring and Supervision, Mectizan[®] (ivermectin) Supply & Distribution; and Training/Health Education/Sensitization/Advocacy/Mobilization (TRHSAM). Three of the indicators assessed *resources available to projects*: Financing, Human Resources, and Transport and Material Resources. The output indicator, 'Coverage' assessed the therapeutic coverage—65% being the threshold required to achieve control within 15 years (Winnen, Plaisier, Alley, et al., 2002).

Evaluation instrument and data collection

Evaluation instruments were developed to measure each indicator at each level. The instruments were initially tested in 2002 in four projects in Nigeria and revised. Following the evaluation of additional projects in four countries including Nigeria, the instrument was pre-tested a second time and revised in 2003.

The community-level instrument focused on the attributes of community ownership (Table 1) and CDTI performance. Coverage: the proportion of eligible community members who had received

ivermectin in a given year. Planning: were CDDs and community authorities planning and managing CDTI? Leadership: were community leaders managing problems associated with distribution and was the larger community involved in key decisions? Monitoring and Supervision: were CDDs reporting complete and accurate distribution data? Mectizan[®] Supply and Distribution: was the drug obtained and managed effectively by the community? Human Resources: were community members willing to help? Material Resources: did the community provide transport for Mectizan[®] collection (at a point agreed upon with the health system)? Financing: did the community support CDDs and CDTI? The Finance indicator evaluated how communities dealt with the expenses of CDTI—transport, buying treatment record books and pencils, and how communities supported their CDDs (moral support, support in cash or in kind).

To better understand if incentives affected the performance of a CDTI project, we compared treatment coverage between communities that provided monetary or in-kind incentives with other communities that did not. Out of 492 communities, 238 had information on incentives.

Much of the information about the community level was collected in situ during semi-structured interviews with community members, CDDs of ivermectin and their leaders, and from direct observation. But some information was collected at higher levels, including health facility support indicators such as CDD training practices and the availability of ivermectin at the agreed-upon relay sites.

For each country, evaluation teams were formed with both internal and external members, including the CDTI project coordinators from the regional and/or district levels of the health system, research scientists from onchocerciasis endemic countries, specialists from the NGDO coalition, and representatives from the donors. This professional diversity was reflected in members' prior experiences and formal training, which ranged widely in the social and biomedical sciences. Once formed, the team reviewed the evaluation's objectives and was trained to use the instruments. Project evaluation took 14 days.

Sampling and data collection

A multi-stage sampling technique, involving random sampling of LGAs/districts, sub-districts/

¹The central level represents the national/state/regional/provincial level of the different health systems in the 10 countries.

Table 1
Characteristics of indicators

Three of the indicators of activities and processes			Result achieved—indicator
Leadership	Mectizan [®] supply and distribution	Human Resources	Treatment coverage (Treatment coverage rate = TCR)
This indicator assesses whether the programme is <i>effective</i> , and whether the community is taking <i>ownership</i> of it	This indicator assesses whether the programme is <i>effective</i> . If the right amounts of drug are received it will foster <i>community ownership</i> , which is good for sustainability	This indicator assesses whether the project can mobilize the <i>resources</i> it needs, and whether the <i>community</i> has taken <i>ownership</i> of the programme	This indicator assesses whether the programme is <i>effective</i> —if the coverage rate is poor the project is clearly struggling, and less sustainable
<i>Characteristics of indicator</i>			
<ul style="list-style-type: none"> Indicator: community leadership is managing problems with the distribution. Community at large has been involved in taking decisions on the distribution process. Community members value and accept long-term annual treatment. 	<ul style="list-style-type: none"> The CDDs or community members themselves fetch the yearly supply of Mectizan[®] The right amount of Mectizan[®] is received 	<ul style="list-style-type: none"> There is a satisfactory ratio of CDDs to households All CDDs have received appropriate training CDDs are willing to continue their work in CDTI 	<ul style="list-style-type: none"> TCR for communities sampled should be 65% or higher These rates should be stable or increasing The rates provided by the treatment register/FLHF management must be confirmed by other observations and sources
<i>Description of Indicator in operational terms</i>			
Community have taken responsibility for decisions such as:			
<ul style="list-style-type: none"> Selection/ changing of CDDs The timing and mode of distribution The kind of support they wish to give to their CDDs Members of the community are involved in self-monitoring of their CDTI project 	<p>(a) All community members who were eligible for treatment got it, and some Mectizan was left over for absentees and those who were temporarily non-eligible</p> <p>(b) The quality of the census data in the CDDs' records must be good enough for an accurate calculation to be made, of the amount of Mectizan that needs to be ordered</p>	CDDs should express willingness to continue with distribution in the long term, given the conditions which prevail in the community Few CDDs in this community have dropped out from the distribution work	Communities being evaluated have a satisfactory therapeutic coverage rate (TCR) The denominator for calculating the TCR is the total population in the community
			<i>Grading of result on coverage</i> Fully (TCR is ≥65% stable or increasing) Highly (TCR is 60-64%) Moderately (TCR is 55-59%) Negligibly (TCR is <50%)

FLHFs and communities, was used to select 12 communities from each CDTI project. For example, in the Edo, Nigeria CDTI project area, three of 12 hyper/meso-endemic LGAs were randomly selected. Two FLHFs were selected from each sampled LGA, giving a total of six FLHFs. From each of these FLHFs, two communities were then randomly selected, yielding a total of 12 communities from the project. This procedure was repeated in 41 projects in 10 countries and 492 communities were included in the evaluation. In each community, the leader and at most

two CDDs were interviewed. Reported treatment coverage was verified with CDD treatment registers and compared with FLHF drug delivery records.

We interviewed the district health management teams, FLHF staff members, treasurers, pharmacists, and political leaders and administrators to assess the support communities received from the health systems. The financial records and CDD treatment registers were carefully checked for health facility support indicators (World Health Organization, 2002).

Data analysis and project scoring

The evaluation team convened to discuss the findings, indicator by indicator, after data collection from 12 communities in a project. Each individual presented the data he/she collected—by interview, document review or direct observation. The chairperson used a blank copy of the instrument to collate all data. The discussion and analyses yielded a community performance score for each indicator, graded on a scale of 0–4 (worst–best). A zero was given if there was no progress toward sustainability; where there was progress it was graded from 1 point (slight) to 4 points (full). The numeric scores were useful to encapsulate and present complex findings so they could be easily understood and compared.

The 0–4 grading process was applied to each of the nine indicators. The ‘numerical value’ was a tool to achieve an ordinal ranking and for the evaluation team and those who received the report to see at a glance where the successes and problems are. It shows the indicators on which the project is performing well and those which are not. Projects evaluated in the third or fifth year which are not making progress are scheduled to be re-evaluated in the fifth and eighth year, respectively. Numerical ranking makes it possible to look at a trend and compare results of future evaluations with the earlier ones.

The average sustainability score for each group of indicators at each operational level is calculated. Subsequently, an average of the four mean scores for the four operational levels is calculated to obtain the overall project sustainability score for the quantitative assessment. For the community level assessment, the scores for the nine indicators were then averaged to produce an overall sustainability score attained by each project at the community. Projects, which score at least 2.5 overall on a 4.0-point scale, were graded as making satisfactory progress towards sustainability.

The evaluators defined 2.5 on a 4.0-point scale as the minimum indicative of satisfactory progress towards sustainability based on the range of 65–85% annual therapeutic coverage a CDTI project should achieve to control onchocerciasis within 15–20 years. This scoring methodology was pre-tested in four projects to prove its consistency and reliability. Comparing the scores with qualitative data gave further confirmation.

Results

Performance of CDTI projects at the community level

At the community level, over 70% of projects received satisfactory sustainability scores—2.5 or more on the 4-point scale. However, there were variations among countries. In seven of the ten countries, all the communities (100%) had sustainability scores of 2.5 or more. In Nigeria, with 20 projects, 80% of communities reached this benchmark. In Cameroon and Malawi, half of the communities reached the 2.5-point threshold.

Fig. 1 shows treatment coverage in four countries with multiple projects: Cameroon (6), Nigeria (20), Tanzania (4) and Uganda (4). Tanzania recorded the highest median treatment score, followed by Uganda, Nigeria and Cameroon.

The observed within-country variance was unexpected. With the same number of projects (4), Tanzania had more than twice the coverage variation of Uganda due to the poor performance of the Mahenge CDTI project. Although communities in Uganda had a higher overall average coverage score than those in Nigeria or Cameroon, Uganda’s best community coverage score was 3.5 which was lower than 4.0 achieved by some communities in Nigeria and Cameroon. Nigeria with most projects (20) had lower mean variance than Cameroon with 6 projects. Nigeria also had greater absolute variance and the lowest-rated projects which scored less than 1. It is important to note also that where variation was very high in the first year or two (Cameroon, Tanzania), it narrowed as projects gained more experience.

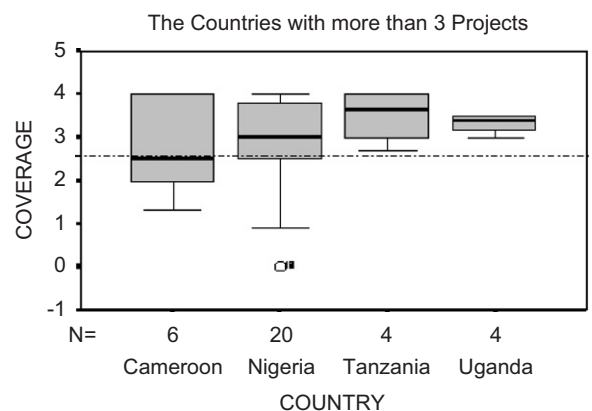


Fig. 1. Coverage at the community level.

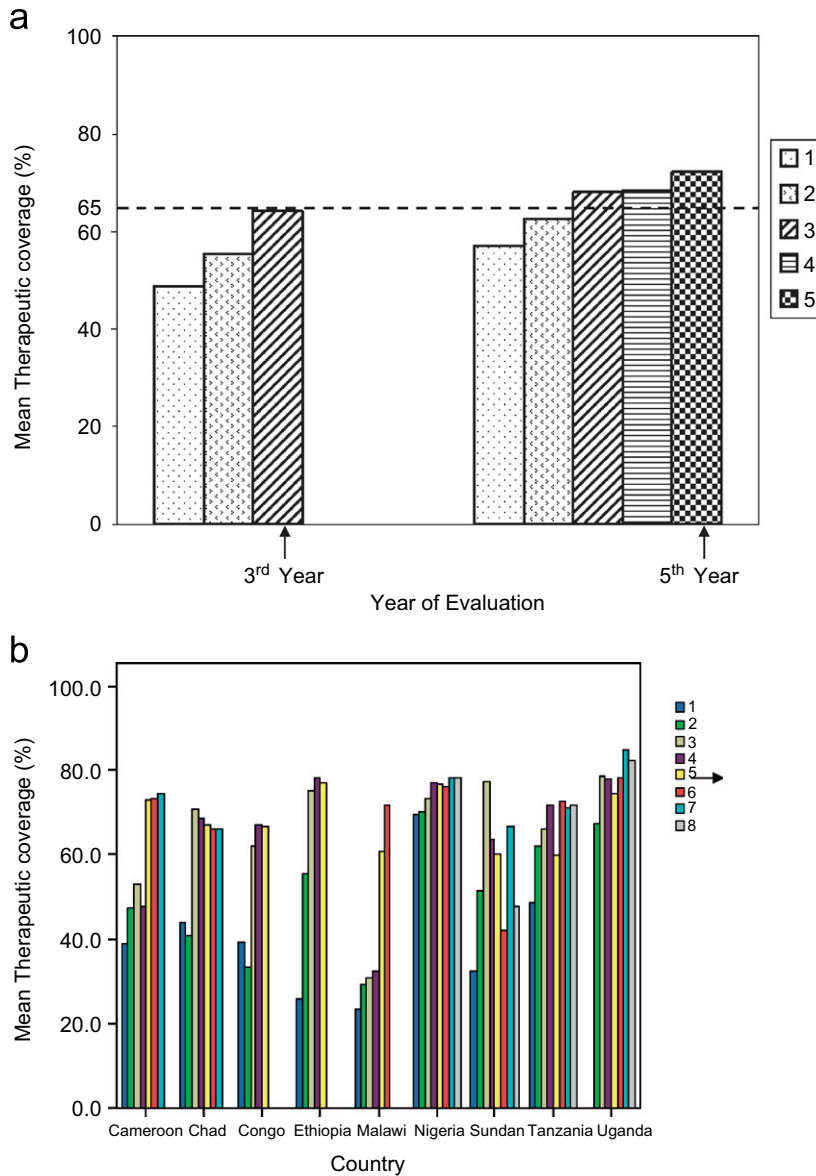


Fig. 2. (a) Trends in treatment coverage by year of implementation of CDTI projects evaluated at their third and fifth year. (b) Trends in treatment coverage by year of implementation of CDTI projects evaluated by country.

Just as variation diminished with project experience, treatment coverage was found to trend upward with each successive distribution round. Figs. 2(a) and (b) show the mean treatment coverage by country and year of implementation. Projects that were evaluated in their third year have used community-directed treatment with ivermectin strategy for three rounds of treatment and those evaluated in their fifth year for five treatments. The yearly averages therefore include all projects through year three or five. Fig. 2(b) shows variation

within each country and across country programmes.

Fig. 3 shows that sustainability indicators are highest when communities have the most control: Planning, Leadership, Human Resources, Monitoring and Supervision, Mectizan[®] Supply and Distribution, and Therapeutic Coverage. By contrast, many communities scored below 2.0 points on TRHSAM, and Transport and Material Resources—indicators where communities depended on government health systems. Despite these

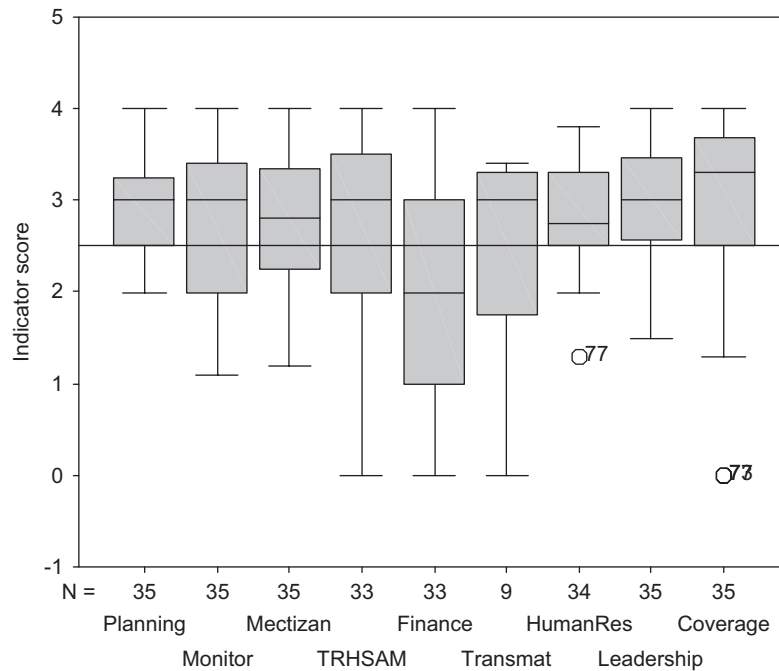


Fig. 3. CDTI at the community level: aggregated performance of sustainability indicators (41 projects).

external shortcomings, community strengths kept median scores above the 2.5-point sustainability threshold.

Among communities scoring 3.0 overall, all planned their own distribution activities, but there were outcome differences corresponding to uneven support from the health systems, especially the timeliness of Mectizan[®] delivery to peripheral health facilities.

Finance, incentives and treatment coverage

The average Finance Indicator score was 2.0, below the 2.5-point cut off. But over two-thirds (69.2%) of communities for which data was available (468) were making financial and/or non-financial contributions to CDTI activities. This revealed a possible methodological flaw in the finance instrument.

Observed forms of community support to CDTI included cash and in-kind transfers, and volunteered labor for collecting and distributing drugs and the attendant tasks such as record-keeping and dosage calculation with a height-measuring stick.

Out of the 238 communities for which information on incentives was available, 172 provided cash incentives, 48 gave in-kind support, and 18 offered

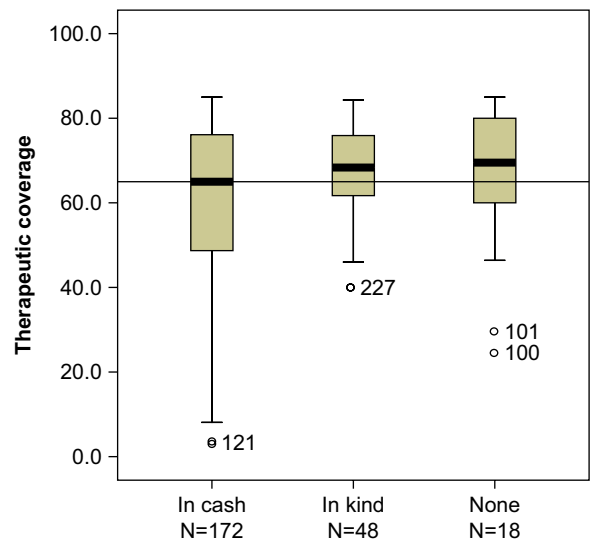


Fig. 4. Provision of incentives and treatment coverage.

no incentive (Fig. 4). The communities supplying nothing had the highest treatment coverage (72%), followed by those giving in-kind (70%), and then by those using cash incentives (66%). These differences are not statistically significant, and could be due to the small sample sizes.

Human Resource indicator

Communities scored very high on the Human Resource indicator; more than 75% reached or exceeded the 2.5-point benchmark (Fig. 5). Explaining their willingness to serve, CDDs often cited altruistic or religious reasons. A male CDD in Tanzania commented, “I love the job...because I want to help my people” (World Health Organization, 2003b).

Our data, summarized graphically in Fig. 5, show a statistically significant association ($p < 0.03$) between the number of CDDs per population and the

treatment coverage of a project. Communities with higher ratios of CDDs achieved higher ivermectin coverage.

Community performance and sustainability of project

The data show that the overall project sustainability score is dependent on the community-level score (Figs. 6 and 7). Although not every country followed this rule, the overall project sustainability score and the community-level score were similar in Cameroon, Congo (Brazzaville), Ethiopia, Malawi, Tanzania, and Uganda. The results from these

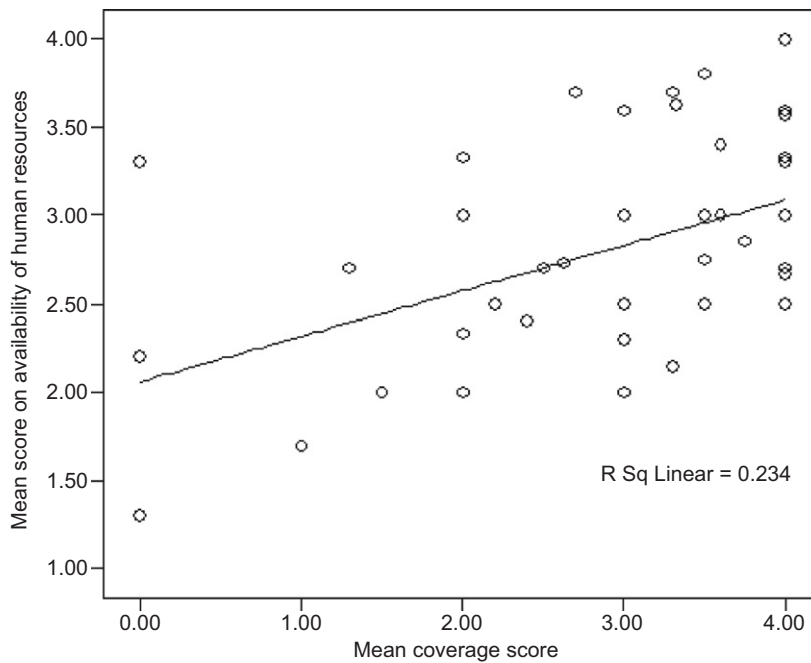


Fig. 5. Correlation of number of human resources for CDTI work and treatment coverage at community-level.

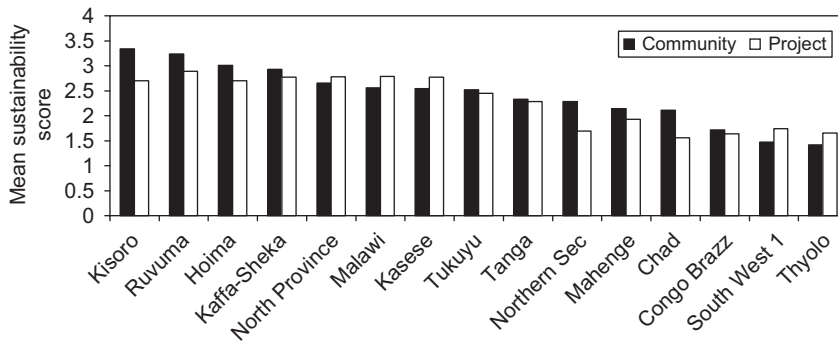


Fig. 6. Mean sustainability performance score for communities in Cameroon, Chad, Congo Brazzaville, Ethiopia, Malawi, Tanzania Uganda and their overall projects in descending order of performance.

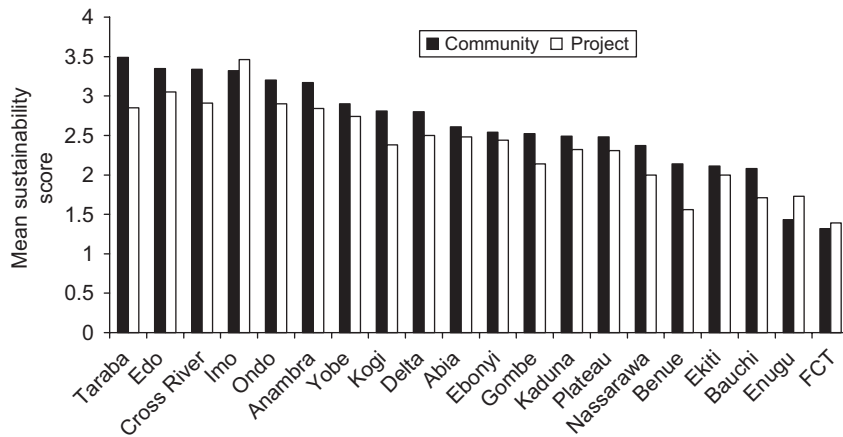


Fig. 7. Nigeria: mean sustainability performance score for communities and their overall projects in descending order of performance.

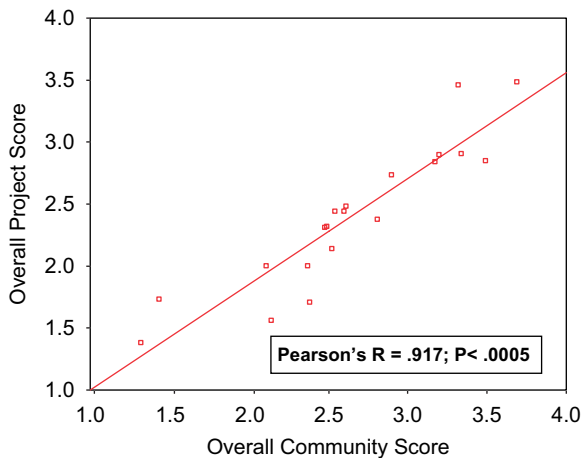


Fig. 8. Correlation of overall community score and overall project score.

countries largely confirm this hypothesis (Fig. 6). In projects with overall scores above 2.5 as in Kisoro and Hoima in Uganda, Kaffa-Shekka in Ethiopia, and in Ruvuma, Tanzania, the community score was also above 2.5. Conversely, in projects where the community score was less than 2.5, the overall project score was also low (<2.5), for example, Chad, Congo (Brazzaville), Southwest 1 in Cameroon, Thyolo in Malawi and in Enugu and Federal Capital Territory (FCT) in Nigeria.

An assessment of Nigeria’s 20 projects further supports this finding (Fig. 7). With only one exception (in Kogi), all of the Nigerian projects with community scores >2.5 also had overall project sustainability scores >2.5. The reverse,

where community scores were <2.5, was without exception in projects rated <2.5 overall. From this evidence we take the lesson that the community is the best level at which to measure the sustainability of the whole, many-leveled project.

Fig. 8 shows that a unit increase in the sustainability score of the community was associated with a unit increase in the overall project sustainability score. This implies that there is a direct association between the sustainability performance of the community and the overall project performance. The correlation between the community scores and the overall project sustainability score is statistically significant at $p < 0.0005$ and a Pearson’s r of 0.917.

Logistic regression was conducted to see the predictability of the sustainability of the entire project using the community level performance on the sustainability indicators. The variables in the model are the mean score of the project level on the sustainability indicators as the dependent variable and the means score of the community level on the sustainability indicators. The score at the community level was converted into a categorical variable which takes up the value of 1 if the mean performance score is 2.5 and above, and 0 otherwise.

Table 2 show that the R-square which measures the explained variance, is 22.0%. Thus, 22.0% of the project sustainability performance is explained by the community level performance on the sustainability indicators. A unit increase in the performance of the community level sustainability indicators will bring about 0.612 increase in the project performance. This association is significant

Table 2
Logistic regression analysis of projects' sustainability with community level sustainability performance

Variable	Mean	Coefficient	Std. error	<i>t</i>	<i>P</i> > <i>t</i>
Project sustainability performance	3.772				
Constant	—	2.202	0.141	15.609	0.000
Community performance	0.4267	0.612	0.166	3.679	0.001

$R = 0.469$; R^2 change = 0.220; F -change = 13.538; $P = 0.001$.

at 0.001 level. Community level performance is positively associated with the overall project sustainability.

Discussion

Onchocerciasis control can be achieved through several years of high treatment coverage by maximizing community involvement. According to Fenerstein and Lovell (1985), community involvement entails “the identification of health needs locally, analysis of the social structure of the community, self-help, the utilization of indigenous technical knowledge, local leadership, and local people”. Edozien (1993) defended the use of existing community structures when he attested to their effectiveness in ensuring full-scale community participation in health.

Thus, the key to sustaining CDTI lies in fostering and strengthening full community participation and in integrating the process within the formal health system. This helps to improve the responsiveness of the health sector and gives communities the genuine chance to manage their own health priorities.

There is evidence to suggest that CDTI can be sustained at the community level in many project sites. According to evaluators of the Ruvuma, Tanzania project in 2003, “*CDTI at the village level is sustainable, provided appropriate and adequate support continue to be provided by the higher levels*” (World Health Organization, 2003b).

Coverage

To eliminate onchocerciasis as a public health problem at least 15 years of annual treatment are required, with a minimum therapeutic coverage of 65% in meso- or hyper-endemic communities (Remme, De Sole, Dadzie, et al., 1990). The present evaluation showed that this coverage threshold was achieved in about two-thirds (330) of the 492 surveyed communities. In Cameroon only 50% of

communities reached the 65% coverage threshold. This and the high mean variation between years of implementation may be due to SAEs linked to the co-endemicity of onchocerciasis and *Loa loa*. Ivermectin treatment may be associated with severe adverse events in some patients co-infected with *Onchocerca volvulus* and *L. loa* (Pion et al., 2006; Twum-Danso, 2003). Where this reaction is experienced or feared, people sometimes refuse ivermectin treatment. This problem was overcome when health education, sensitization, and mobilization activities were implemented to explain the risks of ivermectin and to provide extra support in areas where *L. loa* was found.

Treatment coverage and the ratio of CDDs to population

Treatment coverage correlated with the ratio of CDDs to the population served. APOC recommends at least 2 CDDs/250 persons, but wide variation was found. Some communities had 6 CDDs/250 population and some had far less. Some villages had only 1 CDD serving 800 people. Overall, the CDD ratio to population ranged from 1 to 6 CDDs to 120–800 people.

One important lesson is that communities should be encouraged to train more CDDs, since the higher ratios of CDDs to population treated were associated with better coverage. Too few CDDs was strongly correlated with underperformance in the almost 15% of communities that scored below 2.5 points on the Coverage indicator (Fig. 5).

In these low-scoring communities, several reasons were given for the paucity of CDDs. Ignorance of options was one. Community leaders in Cameroon said, “we [were]...only directed to select one person to be trained as CDD”. But in other cases justifications were offered for a low number of CDDs, “too many CDDs could spoil the work”, noted a village leader in Mpingi, Tanzania. Others cited resource constraints, arguing that their villages could not

afford more CDDs, “*having more CDDs would imply exempting more people from communal labor*”, said several village leaders in Nigeria, Tanzania and Uganda.

Despite some disagreement over the appropriate number of CDDs, the Leadership Indicator scores were high. We found that community leaders were fully aware of the benefits of the drug and took advantage of its availability. Where leaders were not fully engaged—even if they were aware—poor project performance was observed. In South West 1 in Cameroon, a project with a low sustainability score, a community leader noted:

We were not told anything. For the first and second years we did not know what to contribute. The CDDs we selected were just working with the health people and the families were asked to pay for the drugs (World Health Organization, 2003c).

Community ownership

Most CDTI ownership issues depend on community involvement. Katarawa, Mutabazi, and Richards (2000) reported an association between the involvement of communities in CDTI and the success of the project ($p \leq 0.05$). Braide, Obono, and Bassey (1990) earlier demonstrated the important role of community perception of and participation in the sustainability of the Onchocerciasis Control Programme.

The quality and sustainability of participation is affected by several factors, one of which is the perceived benefits from the programme. Community participation and ownership is enhanced when community leaders show appreciation for the drug and perceive the drug as very effective against their eye and skin problems. Literature has shown that a major strength in CDTI is that once villagers recognize the benefits of ivermectin treatment, they are willing to support the process and to take the drug for a prolonged period (Amazigo et al., 2002; Clemmons et al., 2002).

However, community strengths cannot overcome some of the weaknesses further up in the health system. When communities cannot obtain the drug, their plans may be seriously undermined. Although leaders identify and often attempt to solve the problems of ivermectin distribution, they lack control over the timing of distribution when ivermectin is not made available promptly by the

health system. Some leaders were ignorant of their right to decide, but the most typical problem was that health care personnel did not adhere to mutually agreed times and places where Mectizan[®] stocks were to be given to CDDs. As a village leader in Tanzania lamented,

even if we decide to take the drug in October, it is whenever the drug comes that we must take it.

In some areas, delivery delays were associated with attempts to combine distribution with other activities. In many cases, distribution was planned to coincide with census updates, which health officials said would ensure an appropriate allotment of tablets. But the difficulty of planning and executing the two activities together caused both to suffer. Performance was better in areas where these two complicated tasks were not combined (Pearson’s $R = 0.449$; $p = 0.001$).

For problems more directly under community control, flexibility in the CDTI method enabled helpful adaptations. For instance, given a Mectizan[®] supply, most communities decided on a house-to-house distribution method, meaning that CDDs visit all households and treat the eligible occupants. However, in parts of Cameroon, Nigeria, and Tanzania where households were far apart, community leaders arranged a central point scheme. Local adaptations were a sign of sound leadership, as evaluators noted in Cameroon’s SW1 project,

the existence of the dialogue structure in many communities provides an ideal structure from which leadership for CDTI activities in the communities could take off.

Community SUPPORT for CDTI implementation and ivermectin distributors

The CDTI strategy emphasizes the liberty of communities to decide how to compensate their own CDDs. Our findings show that this remuneration decision should remain entirely with communities. Communities should also retain control over the other non-CDD costs of CDTI, as are incurred collecting ivermectin or obtaining stationery supplies (writing instruments, treatment registers, measuring sticks, etc.).

In this study, 69.2% of 468 communities showed support to CDTI by making financial and/or non-financial contributions to Mectizan collection and distribution, and/or to record keeping and report-

ing. In some communities, for instance, the village leader allows CDDs to use his bicycle when collecting ivermectin or submitting reports. These contributions were evident in evaluators' reports:

Northern Sudan: In Sudan, community support for CDDs is [the] provision of meals in some areas, when CDDs are on distribution rounds... materials and to collect the Mectizan®.

Abia State, Nigeria: In all cases, the communities provide treatment registers and writing materials.

Taken in the context of the end-of-the-road communities where onchocerciasis co-exists with extreme poverty, this is a remarkable demonstration of ownership and commitment. Non-cash forms of support appear to be very common, although they often go unreported and reliable data are not available.

There is also a small minority of communities that do not provide any support. These communities expect that CDTI implementation support will come from external sources along with the free drugs. When questioned, leaders claimed to be unaware of any responsibilities of their own or of their community. In these cases, evaluators found that sensitization and education could overcome initial apathy and generate community support for CDTI.

The expectation of external support and minimal community involvement has been created by disease intervention programs that use donor funds to hire local helpers. Participation in these external programs is akin to what Oakley (1990) identified as "marginal", or at best "substantive": communities identify their needs but lack power to influence subsequent decision making or implementation. These lesser forms of participation may lead to unsustainable development. For instance, in some Vitamin A supplementation and mass immunization schemes, community members are paid to participate by the intervention agents. This approach may create enthusiasm for cash. In contrast, CDTI promotes ownership and enhances sustainability by maximizing community participation. Some communities implement monitoring schemes, as in Imo, Nigeria:

the communities have monitoring committees made up of the Eze (community leader) and his Nzes (council members) for monitoring (ivermectin) distribution" (World Health Organization, 2003d).

The contributions made by a community in support of CDDs were found to be a positive sign of ownership and therefore sustainability. However, it was also found that CDDs received many indirect benefits from serving and therefore did not require motivation from cash or in-kind incentives. Thus, it was important that communities contribute an incentive, but it was not important that a CDD receive a direct incentive. CDDs were willing to do their work because, as they noted in many instances, they are happy serving their people and derive non-pecuniary benefits. For instance, in Uganda there are political benefits. CDDs noted that when they serve their people well they will receive votes in future elections. This was mentioned by an elected councilor who was previously a CDD and continued to distribute the drug while in office because he had his eyes on higher political positions.

Conclusion

Through their performance in CDTI, communities have demonstrated their ability to own and manage health interventions, and augment the health system by monitoring drug distributors and providing treatment reports. Although ivermectin and training are given at no direct cost to communities, many of them support their own CDDs and submit treatment registers to the FLHFs at their own expense. Strong leadership, adequate planning, and sufficient human resources are all critical aspects of community ownership in a sustainable project. The communities evaluated here have demonstrated each of these qualities. Community leaders were fully involved in promoting local participation. It must be stressed, however, that although these factors are necessary for successful disease control, they alone are not sufficient. Communities remain vulnerable to weaknesses in the formal health system.

These studies have shown that most CDTI projects manifest substantial community ownership and have good potential to sustain local ivermectin distribution. It is also evident from the evaluation that the community level is a suitable proxy for measuring the overall sustainability of community-based programmes.

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