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Indoor Residual Spraying Community-Based Delivery Model and Community Empowerment for Malaria Elimination. Lessons Learnt, Best Practices and Approach Methods in Zambia

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Abstract

Background: Integrating Indoor Residual Spraying (IRS) into institutionalized community health system is more efficient than the traditional District-Based IRS Delivery Model. This study explored experiences, best practices and approach methods for the implementation of the Community-Based IRS Delivery Model.

Methods: The study was descriptive and analysed research reports on community action cycle for community mobilization, empowerment, collaboration, PHC system, spray coverage, quality and time, environmental compliance, comparative analysis, gender disparities, cost analysis, efficiency, capacity building and sustainability.

Results: Studies carried out in Ethiopia, Northern Tanzania and Sinazongwe district of Zambia indicate that the model meets IRS challenges in malaria "hot spots", hard-to –reach areas, high absenteeism and refusal rates. The model merits were; community ownership, maximization of coverage, leveraging leadership web of influence and mobilizing the villages. High acceptance, trust, reduced operational costs, increased awareness and coverage were reported. However, demerits of initial high cost on increased number of SOPs and cost of PPEs, training, spray teams, data management were challenges without close supervision.

Conclusion: The approach success is linked to strong relationship of the community action cycle for community mobilization. Capacity building, is a key ingredient in redressing social exclusion, inequality and vulnerability. The Model is appropriate regards the desired outcome to intervene IRS community challenges.

We recommend that

- To get a good outcome there must be a strategic district operational plan
- Begin with community action cycle
- Facilitate removal of barriers that prevent people from participating in IRS
- Provide collaborative leadership
- Integrate PHC system into the model approach

Keywords: CB-IRS delivery model; Community empowerment; Community action cycle; Community mobilization; PHC

Background

Indoor Residual Spraying (IRS) has been an effective strategy to control malaria and ultimately eliminating the disease. The move from morbidity control to interruption of transmission and achievement of malaria elimination requires novel advanced innovative technologies aimed at reducing the infection reservoir or reducing the rate at which infections spread. This must be done by an innovative research portfolio that has to be expanded such as Community-Based IRS Delivery Model. The concept of Community-Based Indoor Residual Spraying is to shift accountability, management and operations of IRS activities closer toward and within communities targeted for IRS activities. It involves the hiring or using community members to spray their own communities. The spray operators are identified within the community, recruited and trained within their localities. The IRS intervention has been the most effective tool in preventing transmission of malaria after mosquito feeding [1]. This underscores the critical need for IRS coverage at community level for individual protection from mosquito bites. An effective IRS campaign on the average, regardless of the size of the operation requires 30-35 days and takes place once or twice in one year based on the transmission of malaria season and the efficacy of the insecticide used at that particular time [2]. IRS has been found to be a complex operation that requires a good number of human resources and approaches: technical and support staff, short term employees and strong community engagement and subsequently existence of community empowerment through Primary Health Care structures [3].

Principles of primary health care (PPHC) and indoor residual spraying campaign

In order to successfully implement Community –Based IRS Delivery Model, it has to be known that many communities have similar patterns of social economic problems. These problems in one way or another promote failure or success of the planned intervention [4]. It has been also found useful to understand primary health care core principles and the variable set of basic actions in relation to IRS tasks of significance in promoting PHC for the success of indoor residual spraying campaign models. Community–Based IRS Delivery Model must follow the principles of universal coverage (UHC) through increasing the number of households receiving IRS as close as possible and ensuring 80% and above of each community population has been protected. This has to be achieved through the way implementers explore their experience and their passage through the local community health system. The approach has to be achieved through total community participation and empowerment. Commitment to health equity and quality assurance for IRS must be part of development oriented to social justice. The advantages of community approach in implementing primary health care (PHC) have been: a) community participation approach that leads to a cost effective way that extends a health care system to the geographical and social periphery of a country b) communities that begin to understand their health status in an objective manner rather than fatalistically c) communities that invest labour, time, money, and materials in health promoting activities and are more committed to the use and maintenance of their products such as food, water supplies and human resources and own environment d) health education and has been effective in the context of village activities; and all community health workers, if are well chosen, have the confidence of the people and are able to change their lifestyles [5]. CB-IRS Delivery Model is about Intersect oral action oriented. The ministries of health have been requested by WHO to engage in Intersect oral action for community health in order to improve health equity [6]. The objective of CB-IRS Delivery Model is to reach every HHs wherever people live in eligible structures. In the 21st century, new however, fresh opportunities have been gradually emerging. New initiatives are trickling in as health stands high on the international agenda to extend health-enabling environment and quality of care for universal coverage of populations. However, this literature review explores how the values and practices of PHC have adapted to realities of today`s complex community health landscape that might provide a basis for the improvement of the Community-Based IRS Delivery Model campaign for high disease burdened communities. It reviewed basic ideas about Community-Based IRS Delivery Model and classified the concept of the development of community health empowerment systems that must typically be based on primary health care concepts and principles. In addition, the implementation of Community –Based IRS Delivery Model has to be piloted and continuously evaluated [7]. The implementers must continue to strive for performance quality improvement and ensure strong universal coverage by the community itself through its own human and material resources under close support supervision.

Community based work force for the implementation of the community-Based IRS delivery model

Importantly, meeting urgent community health challenges while laying stronger foundations for model systems requires strong leadership and supervision from the District Health Offices (DHO) or Rural Health Centre (RHC). This facilitates the improvement of the CBVs workforce in terms of training levels and skill categories. To achieve the goals associated with the health systems driven by PHC, new options for the community education and capacity building are required so as to ensure that CBVs are more closely tuned to community malaria elimination needs by every country [8]. To sustain the CBVs or other alternative community care providers has been found difficult [9].

There have been strategies found to be effective and successful. The training of more CBVs requires that the current CBVs are valued for their distinctive contribution rather than treated as second class health providers [10].

District stewardship, community involvement, participation and empowerment towards the model

Admittedly, responsible District Health Management Teams must provide oversight and pro-equity commitment to the District, RHCs and the community they serve. The community leadership has been essential to building and maintaining CB IRS Delivery Model based on primary health care concepts and principles. However, health authorities must engage with and respond to RHCs Advisory Committees in two ways if they are to perform their stewardship role effectively. Community involvement together with dimensions of participation, ownership and empowerment have been found to be key demand side components of the community-based health system. This has been found necessary to promote effectiveness and accountability to initiatives for quality performance of community programs like the Community Based IRS Delivery Model [11]. Therefore, the importance of community consultation, involvement, participation, collaboration and empowerment were acknowledged by the Alma-Ata Declaration that affirmed that people have a duty and right to individually and collectively participate in the planning and implementation of interventions for their health care. The concept of community participation, however has not been easy to practice. Community health interventions become successful when the right structures are in place, effective governance and vigorous community involvement and support of each other [12].

In that case, realizing genuine community involvement, participation, collaboration and empowerment requires overcoming numerous community obstacles. There have been two constraining issues. Firstly, communities such as the rural poor have been found to be unaware of the mechanisms of community involvement. Secondly, those who are relatively wealthy and more influential social groups have been found to dominate political processes at community level more specifically in rural areas of the developing world [9]. When the better-off have been allowed to "represent" the whole community in planning for situational analysis and implementation discussions, relatively affluent groups have been found to absorb benefits at the expense of poor groups in the community. Undoubtedly, the affluent patterns restrict the capacity of poor people to participate fully in the designed process to foster community involvement in CB IRS implementation systems. Implementation of local policies and use of Memorandum of Understanding (MOU) are key aspects to overcoming the obstacles of local leadership stewardship in community health activities. The resolute to CB IRS Delivery Model values of equity, universal coverage to care, community engagement, consultation, participation, collaboration, empowerment and Intersect oral action have been found to be more of value than ever before. The sociology of the community has to be fully understood.

What is a community in the context of the CB- IRS delivery model?

In particular, like all social institutions around the world, the community cannot be regarded as human beings, it cannot eat, think, indulge or play golf and therefore we must anthropomorphize it if we want to be accurate in understanding it, and through predicting its actions [13]. A community has in contrast been a scientific model and sometimes people anthropomorphize the community (think of it and talk about it as if it was human being). As the Community–Based IRS is being introduced in any community and people mobilize the community, facilitators have to be careful to consider communities as if a community has been an individual and human beings thinking. No one must slip into that kind of thinking [14].

The concept of community-based indoor residual spraying delivery model

Indeed, Community-Based IRS Delivery Model has been a new model organized within mini operational sites established as a "downstream intervention" in a district more especially in malicious areas described as "hot spots". The Community Health Workers (CHWs and CHAs) serve as IRS team leaders and assume responsibility for managing store rooms, wash rooms, Spray Operators, and data collection and reporting process for the communities they serve. The spray operators are hired from the same communities they serve and do not require transport and camping facilities. Instead they go home at end of each spray day. The model lies upon capacity building, a key ingredient in redressing social exclusion, inequality and vulnerability in the community including spray quality assurance by SOPs.

Good planning by the implementing urgency helps communities to shape and exercise control over their social, physical, economic and cultural environment. The implementer must begin with community action cycle for the community mobilization. This helps communities to shape and exercise control over their social, physical, economic and cultural environment. It has been about the community members taking the lead and deciding how they want their community to be and how to make it a better place to live. CB-IRS –Delivery Model is the most appropriate model regards the desired outcome to intervene to IRS community challenges. Unquestionably, countries are implementing the model as a paradigm shift from the expensive traditional model to less expensive delivery model with concepts of universal

coverage of HHs in the communities. The approach involves incorporating planning, capacity building and execution of the operation into primary health care system. There have been main reasons for the paradigm shift such as: a) Increase in spray coverage b) Increase in community participation and ownership of the program; and c) Reduced running costs (camping, transportation, meals and other needs) and makes IRS more sustainable. Where IRS is integrated into the health systems, community health workers fulfil the complete role and responsibilities of the team leader. The CHWs manage all IRS processes at the village level which usually lasts for 1-2 months each year in some communities. With CB-IRS-Delivery Model, the period of camping reduces to almost half or less 10 days of implementation making it very cost-effective exercise. The number of selected SOPs remain bigger than the technically required number of staff so that after ratification by technical health workers from the district and RHC, the number comes to the original number required. For example, if 10 SOPs are technically required ask the community to choose 20 then the number of SOPs after screening through interviews must come back to the 10 required (Quality assurance at selection). The community Health Workers select spray operators together with the NHCs to train and conduct the spraying with approval of the Community Executive Committee. CHWs assume the responsibility for mobilizing the community: managing store rooms and insecticide stocks, washers and operators: and overseeing the data collection and reporting processes for their team into the data system. The CHWs in each village are trained on IRS techniques and management and operate in own villages. However, in order to avoid any disruption with routine health system activities, only one (1) CHW per village leads the spray team during the spray operation while the other CHWs carry routine health system duties. In the CB IRS Delivery Model, SOPs and Team leaders are hired from resident communities in which they operate. There has been no need for transport for SOPs camping facilities as required for traditional District-Based Indoor Residual Spraying. However, it has been found imperative for DHMTs to strategically continue planning for CB IRS Delivery Model activities and give oversight leadership to Model approach, allocate resources and supervise the spraying operations and members of the spray teams. Countries like Ethiopia and Tanzania that have used the model in Africa have never systematically evaluated it and recommend for its implementation. Zambia has piloted the model at a small scale in Sinazongwe district but no date has yet been released though remote perspective gives good results and outcome of the approach of the model.

The organization of the community-based IRS delivery model

For the most part, the CHWs are usually assigned at the RHC and Health Post and the CBVs from the two institutions lead the spray team. If they are more than one, they must share a lot of responsibilities; one for IRS and one for routine activities. The demonstration in the organogram below; one CHW acting as a team lead for the four spray operators and one porter selected from the community have been responsible for planning and implementing IRS in the community. The District Malaria Focal Point and the DEHO of each district must closely supervise the operation and provide technical back-up when need arises. The District Health Information Officer (DHIO) or any one must work as a Clerk for daily data entry and reporting together with Environmental Health Technologist (EHT) at the facility or zone EHT (Figure 1-3).

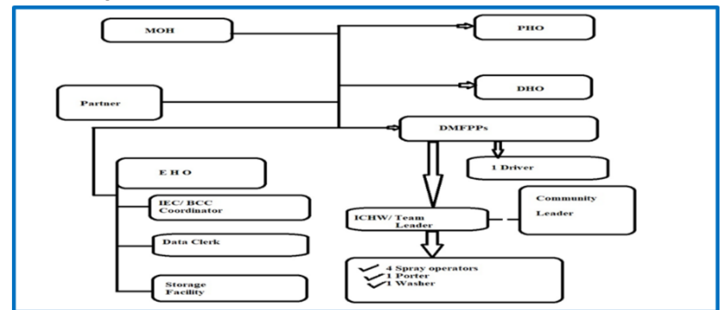

Figure 1: *Organogram for community Based–IRS delivery model (Ethiopia).*

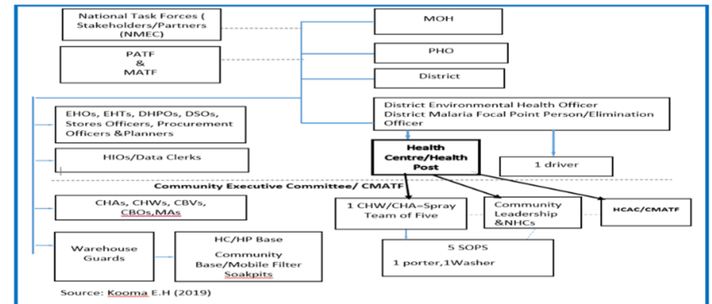

Figure 2: *Organization of CB-IRS-delivery model (Zambia).*

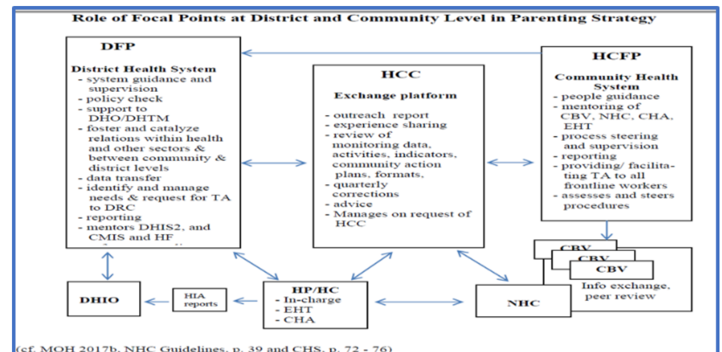

Figure 3: *Primary health care community organization structure.*

Capacity building of district staff and lower levels (Cascade Training)

Therefore, during the Training of Trainers (TOT) for District IRS, DEHOs and other EHTs are oriented on how to train CHWs to serve as leaders of spray teams and assist communities with selection of spray operators from targeted communities, messaging and communication skills, data recording and reporting. The District Malaria FPPs and other staff have to mentor the CHWs/Community Health Assistants (CHAs) on their role as team leaders on their responsibilities and training of the spray operators chosen from the community by the community to implement and manage IRS in their respective communities. In Ethiopia, where CB-IRS Delivery Model has been piloted and fully implemented since 2010, and in 20 targeted communities, CHWs recruited 100 spray operators with full engagement of the community leadership and NHCs(five from each community) and taught them for a period of six days on IRS operation in their communities with less support from the district. The issue of community participation, involvement and ownership subsequently empowerment have been described as vital for the generation of support to the community and stimulating the community capacity ownership for activities that are preventable in nature. Therefore, community actions have to be strengthened and communities must have concrete and effective involvement in the decision making and implementation of their community affairs. It has been strongly emphasized that only through this approach people are able to control their own health. The health institution must draw on existing human and material resources in the community to support the community and individuals in strengthening public participation in the direction of health matters [15]. Through capacity building of the providers of CB-IRS Delivery Model and community empowerment, targeted investments are made to allow the community and providers reflect, scale up and build efficient CB-IRS Delivery Model systems as well as growing inspiring and accountable structural culture [16,17]. Every community has been endorsed with various resources and talents that can feed into its overall development to eliminate any disease such as malaria. Environmental and personal safety have been borne in mind by the implementing urgency.

Environmental compliance for community-based IRS delivery model campaign

Absolutely, it has been a trend that soak pits are built at a health facility and for CB IRS Delivery Model, the soak pits have to be built at a health post prior to the campaign season where no health post then at the RHC. All sites must have soak pits to manage effluent waste and storeroom to keep PPEs, IRS equipment and insecticide stocks. Storeroom/base (10km apart from each base) must be sited away from homes and have double locking system to ensure safety of the community. All left over chemicals in the pumps from the field must be disposed of at the operations site in the drums provided. PPEs and pumps must be cleaned daily and must not be carried home. A builder has to be contracted to build two-meter soak pits with one-meter depth within the communities. The District MEOs closely supervises the whole process with technical guidance from the District Environmental Health Officer and any representative from the Environmental Management Sector. The environmental compliance has been meant to further protect soil from chemical contamination and wash areas have to be covered with polyethylene sheets. Bathrooms for both sexes have to be constructed as well and water supply has to be adequate enough for the operation including sanitation of the toilets. Obviously, it has been proven a successful approach to provide new spray pumps that do not require maintenance at all. It was also found imperative for future CB-IRS Delivery Model to enhance the knowledge of SOPs and provide them better skills to manage and repair used spray pumps. However, CB-IRS Delivery Model remains with its own particular problems in its implementation.

Problems with implementation of community-based IRS delivery model

As a consequence, the general implementation of CB-IRS Delivery Model has many problems. Firstly, Indoor Residual Spraying itself has been complex in operation involving hundreds of personnel. The CB-IRS Delivery Model needs a big number of SOPs as well as team leaders of the five SOPs within a short time of the campaign being observed. The model requires strong community involvement, engagement, participation, consultations, collaborative leadership and ultimately community empowerment through social-cultural structures and the PHC system structures. Another disadvantage of this approach is that district-level spray teams often are transported from other parts of the district and only available within a particular community for 1 or 2 days, in order to efficiently move through pre-determined, sequentially-planned, district-managed, spray operation schedule. If households have not been properly sensitized and mobilized for that scheduled stop, many households will be missed for spray operations for that campaign. This is often the case as community mobilization efforts are not always adequately planned and because people go for farming in the morning and are only available in the afternoon for many of the same periods when IRS operations occur. This results in low coverage as well. Furthermore, if quality is not strictly followed, implementation of the model becomes a loss of resources such as chemicals and finances and increases environmental pollution detrimental to human life. It is quite difficult to implement the model with limited budgets. In the face of fiscal pressures improving the

efficiency of delivery of IRS is a means of increasing coverage without increasing resources needed. The purpose of the study was to discover the important factors; best practices and approach methods for CB-IRS Delivery Model and assist individual institutions that would like to implement the model with information for their planning, operations, environmental compliance, monitoring of "vector density" and logistical planning for later year planning. The comparison between the DB-IRS Delivery Model and CB-IRS Delivery Model approach performance remains critical to the future users to make a decision on the type of the model to use. The aim of the review study was to assess whether using CHWs and SOPs right at the ground level would reduce costs and increase community acceptance of IRS and promote sustainability of the operation with high maintenance of quality and compliance to environmental standards and safety at large.

Research Questions

In order to meet the aims of the study, the following research questions were formulated for investigation:

- What is Community-Based Indoor Residual Spraying Delivery Model campaign?
- What barriers and unique challenges exist that impede successful community empowerment for Community-Based IRS Delivery Model?
- What options are available for improving CB-IRS Delivery Model methods?
- What community empowerment strategies and approach methods can make CB-IRS Delivery Model succeed?
- How does CB-IRS Delivery Model contribute to malaria elimination?

Objectives

- To explore different views about CB – IRS Delivery Model performance
- To find out the approach methods to the implementation of CB-IRS Delivery Model
- To discover the lessons learned, best practices and approach methods for the successful implementation of the CB-IRS Delivery Model
- To review the processes that facilitate community empowerment for the successful implementation of CB-IRS Delivery Model
- To adopt the CB-IRS Delivery Model for use in communities for malaria elimination.

Methods

This was a descriptive and analytical study using documents that reviewed Community-Based IRS Delivery Models of countries that piloted it (Ethiopia, Tanzania and Zambia during responsive IRS in nine facility areas of Sinazongwe district with high incidence of malaria. The sources of data for the study topics were organized around community action cycle for community mobilization, community development, collaborative leadership, community empowerment, integration of primary health care system into the model approach, spray coverage status, quality of spraying, time spent period of spraying, environmental compliance comparative analysis of the two different models, compliance with standards, gender disparities, community structures, lessons learned, best practices, approach methods, cost analysis and efficiency of the two models. The review of the topics focused on community health needs, "bottom-up" or "grass roots" practice, strengths-based approach, inclusive practices, and investment in the community capacity and sustainability of the model.

Results

The findings for the successful implementation of the Community-Based IRS Delivery Model are presented in the comparative analysis. Clearly, learning from Ethiopia, the District Health Office and AIRS project closely monitored the preparations of the pilot program for CB-IRS Delivery Model campaign in one of their communities. They also kept accurate records of all the financial resources provided to support the piloted CB-IRS delivery model. The resource tracking was meant to analyse actual expenses to compare them with similar efforts required to implement traditional District Based IRS model and project the potential cost savings in the future IRS campaign activities.

Cost: The overall total cost for CB IRS Delivery Model was found to be slightly less than a similar sized activity implemented through the DB IRS Delivery Model. Some costs were however higher in the CB IRS Delivery Model, the reason being the operation year and certain capital investments were made for each community. The mentioned investment included construction of new soak pits, the supply of IRS logistics such as pumps, some spare parts, PPEs increased number of SOPs and training cost and other needs. These are not recurrent costs and did not appear during the next 2 to 3 years of IRS operations according to the study (Table 1).

Therefore, it has to be known that CB IRS Delivery Model requires approximately 15-20 SOPs the whole district on the average. The training cost has been found to be higher with CB IRS Delivery Model because the number of providers to be trained become higher. The wage payment to the SOPs provider becomes slightly lower in the CB IRS than the DB IRS Delivery Model. Even the number of actors becomes higher in CB IRS delivery model. The picture becomes so because CB IRS Delivery

Model operation takes short time to complete compared to DB model (Table 2).

Time: In the study conducted in Ethiopia, when compared on time spent on DB-IRS Delivery Model and CB-IRS Delivery Model, spray quality assessment showed that spray operation in the CB IRS Delivery Model in pilot districts took an average of 22 working days compared to 31 days used to complete an average traditional DB-IRS hired SOPs for each community and their total number often been twice larger than that which normally has been recruited for CB-IRS Delivery Model. The approach was found to be shorter (Benjamin J etal, 2016). The parameters used in the make spray time has been targeted structures for catchment area (Total structures to be sprayed per operation per day). Distance from the IRS base and time needed to reach the catchment area including clustering of structures for the catchment areas where spray teams must not just crowd are one catchment even when structures available only needed one team [18].

***Table 1:** Cost of IRS campaign in US dollars, by community delivery model in selected districts of Ethiopia, 2012-2014.*

Average per District					
Coverage Measure	2012	2013	2014	Difference (2013-2012)	Difference(2014-2013)
CB IRS districts (N=5)	**DB IRS**	**CB IRS**			
Total amortized costs	47163	52609	52930	5446(11.5%)	321(0.6%)
cost per structure sprayed	2.52	2.27	1.98	-0.25(-0.98%)	-0.29(-13.0%)
cost per person protected	0.88	0.87	0.86	-0.01(-1.3%)	-0.01(-1.0%)
DB IRS districts (N=5)	**DB IRS**				
Total amortized costs	N/A	48990	49665	N/A	675(1.3%)
cost per structure sprayed		2.47	2.47		0
cost per person protected		1	1.03		0.04(3.3%)
Abbreviations: CB IRS, community-based indoor residual spraying; DB IRS, district-based indoor residual spraying; IRS, indoor residual spraying					

***Table 2:** Indoor Residual spraying coverage by delivery models in selected districts of Ethiopia, 2012-2014.*

Average per District						
Coverage Measure	2012	2013	2014	Difference (2013-2012)	Difference(2014-2013)	Difference(2014-2012)
CB IRS districts (N=5)	**DB IRS**	**CB IRS**				
Number of eligible structures found by SOPs	19,085	22843	26568	3,758* (19.6%)	3,725 (14.0%)	7,483* (39.2%)
Number of eligible structures sprayed	18,958	22,809	26,365	3,851 * (20.3%)	3,556 (13.5%)	7,407* * (39.1%)
Spray coverage rate	99.30%	99.90%	99.20%	0.60%	—0.70%	—0.10%
Total population protected	54,902	59,551	60,765	4,649 (8.5%)	1,214 (2.0%)	5,863 (10.7%)
DB IRS districts (N=5)	**DB IRS**					
Number of eligible by SOPs structures found	18,797	20,322	20,396	1,525 (8.1%)	74555 (0.4%)	1,599" (8.5%)
Number of eligible structures sprayed	N/A	20,245	20,347	N/A	10255(0.5%)	N/A
Spray coverage rate	99.60%	99.80%	0.20%	N/A		
Total population protected	51,871	50,326	—1,545 (-3.0%)	N/A		
Abbreviations: CB IRS, community-based indoor residual spraying; DB IRS, district-based indoor residual spraying; IRS, indoor residual spraying; SOP, spray operator. The 5 CB IRS districts transitioned from DB IRS in 201 3; 2012 numbers refer to DB IRS coverage before CB IRS was implemented. * k.05 comparing 2013 with 2012; **k.01 comparing 2014 with 2012. + k.01 for difference in change between DB IRS and CB IRS comparing 2014 with 2012. " Pc .01 for difference in change between DB IRS and CB IRS comparing 2014 with 2013. P<.001 for difference in change between DB IRS and CB IRS comparing 2014 with 2013						

Quality: The piloted spray assessment showed that the spray operators learned well and that their spraying techniques and spraying quality were adequate. The wall Bioassay tests conducted 1-3 days after spraying showed mosquito mortality of 100%. These results were found to be the same with CD-IRS Delivery Quality Model Assessment test in other nearby areas. A

strong feedback was reviewed from SOPs, communities and district health workers that the overall quality of spraying in the piloted area was most likely even better than from CB –IRS Delivery Model areas.

In this regard, the reason was that in the DB-IRS Delivery Model, a large number of SOPs were trained by a few health workers at the district level. In the Community Based IRS two CHWs trained only five SOPs and this provided better interaction between the trainer and trainee. The SOPs were the CHWs/CHAs that felt sure of owning the program because of serving their own communities or villages. The community leaders were easily involved in the oversight of the operations and provided supervision more frequently to the SOPs on the ground. The trained SOPs were found to have performed the required steps with added diligence including peer supervision when spraying in their villages which increased the community's trust of the operators. Though there has been inadequate research to evaluate the peer-supervision effectiveness. A growing evidence exists to support the potential contributions of peer supervision for both the trainee and experienced councilors. Some of the benefits of peer-supervision include increased access/frequency of supervision, reciprocal learning through the sharing of experience, increased skills and responsibility for self-assessment and decreased dependency on expert supervisors [19]. Peer supervision has been found to play a valuable role in giving more people, more access to more supervision which in turn impacts on the quality of service to CB-IRS Delivery model. Not all are in favour of accepting peer supervision as a valid and credible alternative to expert led supervision that add enormous rigor to the process, if the group is using robust and well-designed supervision tools. Having the spray team take part in the supervision conversation must compensate for potential deficiencies in knowledge, adds another level of accountability and the high level thinking that results from being in the presence of diverse and colliding perspectives can result in superior supervision outcomes. In his book "The wisdom of Crowds" James Surowiecki states that "Under the right circumstances, groups be remarkably intelligent". The effective utilization of supervision has been to ensure the achievement of the objectives of CB-IRS Delivery Model. The effective supervision is a function of the supervisor and the role of the supervisor and acceptance of the model are responsible for the efficiency of the supervisor. In addition, the traditional mop up/call-back operations have been found to be important to increase coverage of spraying at a cost. With CHWs and SOPs stationed in the community, it was found to be much easier to undertake intensive mop-up operations for HHs that may not be available during the planned spray team visits. This was not possible with the traditional district model mobile team approach (Table 3,4).

Table 3: *IRS quality control test results by CB-IRS delivery model and type of wall surface, selected districts of Ethiopia 2014.*

Percent Mortality of Susceptible and Wild Mosquitoes				
IRS model	Dung (n=2 houses; 180 mosquitoes)	Mud (n=2 houses; 420 mosquitoes)	Painted (n=2 houses; 300 mosquitoes)	Total (N=6 houses; 900 mosquitoes)
CB IRS (2 districts)	100%	93.60%	100%	96.30%
DB IRS (2 districts)	100%	92.40%	100%	95.90%
Abbreviations: CB IRS, community-based indoor residual spraying; DB IRS, district based indoor residual spraying; IRS, indoor residual spraying.				

Table 4: *Compliance to environmental health and safety standards by IRS delivery model in selected districts of Ethiopia 2013 & 2014.*

Year	Overall	CB IRS sites	DB IRS Sites	Difference in Performance (DB IRS — CB IRS)
2013	84.10%	80.80%	91.60%	10.8 percentage points
2014	99.20%	98.50%	100%	1.5 percentage point
Abbreviations: AIRS, Africa Indoor Residual Spraying; CB IRS, community based indoor residual spraying; DB IRS; district based indoor residual spraying; IRS, indoor residual spraying. °Average compliance scores on a 13•item checklist. B Data are from 6 CB IRS districts and 30 DB IRS districts. Five operational sites (villages) from each of the 6 CB IRS districts (30 operational sites total) and 1 operational site from each of the 30 DB IRS districts (30 operational sites total) were selected for the compliance assessment. *** P<001.				

However, storage for insecticides and IRS equipment were found to be a problem at the village level. Health Posts/HCs were used to store insecticides and equipment during the operation period. In many cases, such space could not be used to store the items in between the spraying campaigns. Items were transported back to the district stores. In this situation, it has been important to build

mini-storage structures and IRS bases 10 km apart from each base in the communities selected for CB-IRS Delivery Model. When collaboration with the community has been well handled, it is another way of trying to solve the storage space problem [20].

The relationships of the four thematic areas in relation to the model

The relationships of the four thematic areas presented herein community action cycle for community mobilization, community-based development and community based service provision remain distinct community empowerment strategies for the model. Collaboration has been based on the concept of "Community practice". Community engagement must be conducted in a manner that has to be respectful of all partners and being mindful of their need to benefit from collaboration for the successful implementation of the model. Importantly, collaborative leadership for CB-IRS Delivery Model brings the community together through their traditional and political structures in a constructive way with good information about the model. The community leadership itself must create authentic strategies and visions for addressing the shared concerns of the health system and the community. The community must be brought together and the collaboration must remain inclusive and in a constructive-design of the processes that deal with different understanding of different community views, with varying degrees. This allows the health system process to encourage the community to work together towards a better outcome of the CB-IRS Delivery Model. Definitely, community empowerment increases the degree of community autonomy and self-determination in people and the community at large, in order to enable them to represent their interests in a responsible and self-determined way, acting on their own authority [21]. Community empowerment concepts have been widely examined in various disciplines and different professional fields and have been found to produce good results if well adhered to by implementers [22]. In this study, the review highlights the major definitions and conceptual issues regarding community empowerment within the context of CB-IRS Delivery Model. It also discusses the relationship of these issues to IRS practices and community empowerment for the successful implementation of Indoor Residual Spraying. Empowerment has been referred to as the ability of people to gain understanding and control over the social-economic development, personal and political forces in order to improve and take action for their own life situation [23]. Empowerment has been defined at various levels of analysis and practice; individuals, organization and the communities. Whereas, the individual empowerment combines efforts that the CB-IRS Delivery Model approach requires in terms of commitment for the long-time of financial and personal experience of resources [24]. There have been collection and analysis of extensive amounts of both quantitative and qualitative data used for its action in the evaluation purposes [25]. Just focusing on the community in the 21st century may not be effective in the long time in the context of today`s modern global world [26]. Given these points, everyone has to acknowledge that community engagement is a complex process that has to be accomplished over short term or has been panacea that once implemented will resolve long standing community inequalities and conflicts. There has been a need to recognize that the change process as development involve time and resources to enhance community empowerment and linking the community together for mutually beneficial community collaboration for a more local healthy community through malaria interventions like Indoor Residual Spraying. The concept of organization as both empowered and empowering has helped to provide the link between organization, community and individual levels of empowerment for the success of CB-IRS Delivery Model. For a community to be empowered must have individuals and organization technical skills, resources and efforts that are being applied collectively to meet their respective community. The individuals and implementing organization participation within an empowered community has been found to provide enhanced support for each other to address conflicts within the community. On the whole, empowerment at community level must be connected with individuals and the health system. Researchers still argue whether the three levels of empowerment and one level leads to the other. It is possible to develop a CB-IRS Delivery Model aimed at individual empowerment and this does not consider the context in which the individual has been embedded; such as the community or the organization with less likelihood to information. Equally important, a community empowerment model emphasizes on participation, sharing, caring for the mother responsibility to others and consents power as an expand commodity [27]. It has to be known that the process of empowering communities has been usually dynamic and of changing value for the community and its constituent individuals and PHC health systems. The community has to be empowered in some domains but not at others as indicated in some literature. It has to be known that community engagement cannot be achieved in a short period of time but has to take commitment to a process that is of long term [28]. In short, there have been wide evidence of stress and development of diverse psychological, physical and behavioural disorders of the community that incorporate factors such as control of poverty, stress and its health status. These factors guide health promotion approaches to community empowerment that facilitates successful CB-IRS Delivery Model as vector control interventions. However, evidence from research has indicated that stress has been related to physiological, psychological and behavioural outcomes. Psychological factors such as control have also been found to play an important role in modifying the levels of stress

and the way implications are designed; stress, health or the relationship between health and stress [29]. In addition, the stress process has been found to posit five major elements such as strenuous or psychological-environmental conditions that are conducive to individual community stress such as the death of a senior community citizen, problems with the health system approach to issues, bad health worker, powerlessness of some individuals, social economic status, bad nutrition, natural disasters and exposure to harmful environment. Individuals and communities enduring long term outcomes that stem from short term responses and perceptions such uprising alcoholism, poor harvest, community forced relocation and poor supportive relationships in the community, weak community problem solving abilities, community control and social economic status that negatively affect the implementation of CB-IRS Delivery Model [30]. In affront approach, individuals and communities must meet stress needs and enhance control of the community interventions, objectiveness and increase understanding of empowerment and the effects of interventions such as evaluation and research objectives. Subsequently, communities need Participatory Action Research (PAR) that involve cyclical problem solving diagnosing process, action planning and taking through evaluating and specifying the learning process [31]. The approach has characteristic of being a participatory approach, cooperative and co-learning process, reflective process, that involves conscientization and empowering process. It achieves a balance between action and research goals and objectives. The community based activities need to balance the efforts spent on the action with critical reflection that has been aimed at conscientization of the community in "hot spots" and "hard-to-reach" areas and areas of high refusal rate areas and areas of high absenteeism by the HHs owners [32].

Barriers to community empowerment for the successful implementation of CB-IRS delivery model

Conversely, there have been barriers observed to community engagement such as situations where community members` historical experience and other beliefs result in particular feelings that they have no influence with the health system such as quiescence and powerless and feel getting involved with IRS interventions would not be worthwhile. Just as important, there have been usually role-related community conflicts, tensions and differences that surface between community health promoters and community members around the issues of interests, values, skills, resources, political situations and control including cost within the community and individual research [33]. It has also been found difficult to measure or assess community empowerment and the ability to show the occurrence of change towards a newly introduced IRS different approach. There are also situations where health promoters do more widely understand the value of community approach. In the same way, provision of good information about the model has been found critical for evidence-based decision making through involvement of community leadership experts in the process, to inform the general community about it (http://www.tamarock.community.ca/). The traditional concept on general leadership has been that of heroic leader who has a vision, who asserts and personates the community and gain followers. When collaboration works, it builds and reproduces the characteristics of civil community allowing the community to deal with future issues in constructive arrays [34].

Essentials of collaboration for the successful implementation of CB-IRS delivery model

To summarize, collaboration has been found to demand engagement and dialogue instead of debate, inclusion and not excluding their need for shared power than instead of domination and control. There has been a need for mutual learning instead of rigid adherence to positions that are mutually exclusive. Collaborative efforts have been found to gain credibility and influence by insuring community inclusiveness, managing a constructive community learning engagement, by providing the necessary information for public health evidence-based decisions, building the coherence of the group and in helping to negotiate for agreements that lead to successful community health action [35]. In order for collaboration to work, each community member must have an opportunity to speak and must be heard and be able to shape decisions and more groups must dominate in the decisions. The health system must facilitate the management of community meetings that allow community groups to constructively work together. The system must work with stakeholders while remaining neutral about the content of its work. The community capacity must be built for the proposed CB-IRS Delivery Model and the principles and goals must be well understood by the health facilitator about the model.

Community empowerment in community-based indoor residual spraying delivery model

To begin with, before starting, community engagement towards community empowerment for the CB-IRS Delivery Model, the community capacity must be built. The health workers or facilitators must be clear about the purposes or goals of the engagement effort for the populations or the communities they want to engage. The facilitators must become knowledgeable about the community`s culture, economic conditions, social networks, political power structure norms, values, demographic and malaria disease trends. The history of each area and experience must be well known with efforts by outside groups to engage the community in Indoor Residual Spraying. In the first

place, the facilitators must learn the community perceptions of those initiating the community engagement activities. There must be a need to establish relationships, work with formal and informal leadership, build trust and seek commitment from organizations within the community and community leadership for the creation of community mobilization that lead to community empowerment. The literature review strongly supports the idea that problems and potential solutions must be defined by the community itself and this applies to CB-IRS-Delivery Model. Therefore, the communities and individuals need to "own" the health issues (malaria problems), community to name the problem, identify the action areas, and implement the strategies. The community must be able to evaluate the outcomes. There must be an atmosphere of partnering with the community in order to create behaviour change and improve the model outcomes. Community engagement must be based on improving the health of the community and respond to social, economic and political trends that have been found to negatively affect health and disparities within the community [36]. Also the community collaboration has been found to require long-term commitment by engaging the health system and its partners on the ground [37]. Everyone must remember that community engagement in relation to the CB-IRS Delivery Model has been a continues and its specifics have to be determined in response to the nature of one`s endeavour and the health system and community context in which it has been found to occur. Above all, the involvement of the community and the collaboration for its members have remained the cornerstone of the efforts to improve public health interventions in the community and levelling up the health status of the whole population. Community engagement and its mobilization and empowerment are essential in public health programs that have among others addressed the problems of conditions/diseases like smoking sensation, cancer, obesity, heart diseases and other diseases of public health concern [38]. The challenges faced by the health system in the 20th century are not too much different from those of the 21st century.

Mobilization cycle and community mobilization for CB-IRS-Delivery model

The process of community mobilization has been participatory and sustainable in order to improve the health status through prevention, elimination of malaria and improvement of capacity levels. There has been a need to enhance the overall standard of the community from suffering from malaria [39]. Indeed, community mobilization has been a strategy that has been found to organize the community across-sectors for long term change particularly in seeing the success of the model. It has been one way communities provide support for the community to make health choices. Preliminary research on community mobilization initiatives has been found to demonstrate success in a variety and critical pedagogy [40]. However, in 1970s, community mobilization emerged as a theory of community change from the literature of organizing the community, civil sociology and critical pedagogy [41]. The 1990s have seen the application of community mobilization in a more targeted context of public health interventions and with reasons of shifting from individual to community level approaches. Community mobilization has contended that individuals are more likely to make decisions that are healthful and accessible by all. Community level change must be supported by targeting interventions at the community by enabling long term, sustainable systems that promote shifts in social norm as key elements [42].

Benefits of community mobilization in implementing CB-IRS Delivery model

Strangely enough, community mobilization has offered numerous community benefits such as cohesion, systematic support and improved sustainability to community activities. It has been found to promote community cohesion by establishing new relationships and coalition where perhaps non-existed before. It infuses new problem-solving energy into community through helping to overcome denial to the model and apathy by the community and gain both buy in and support [42]. Community mobilization creates opportunities for new relationships and continue to generate initiatives and new ideas overtime for the model.

In this case, community mobilization ideally results in shifting in community social norms that allow the community to approach community-based IRS Delivery Model differently over long-term period. Community mobilization changes made remain in place overtime without being dependent on outside sources of funds [43]. Especially, the health system in terms of the Community-Based IRS Delivery Model has to provide the necessary resources (human, finances, machinery/equipment, staff-training) and networking opportunities helping each community where the model must be implemented and the community to be more involved through a structured community mobilization process.

Health stewardship structure for the implementation of CB-IRS delivery model

Above all, the District Health Leadership must offer stewardship to facility EHTs, and community CHAs, CBOs, CBVs and the community at large. The local leadership team must have local influence, capacity to recommend SOPs and CHWs and come up with wide implantable community-wide policy and practice change. Communities must be well-connected with deep and broad networks in the community. They must be willing to make commitments to the efforts by dedicating sufficient resources and time and have public health evidence-based decision of the Community-Based IRS Delivery Model. As a matter of fact, the

model implementing committee must structure rules for its functioning and communication across the community. A common vision has to be agreed and endorsed, a road map has to be drawn up by the community as a strategic action plan, implement planned tools and design an evaluation of the model with the common set of measures to monitor its implementation including tracking performance. A transition and sustainability plan has to be drawn based on the results of the community-wide assessments that reflect on any risk protective factors. Similarly, the health workers must promote community ownership of the model by drawing on community expertise and networks of community members. One writer pointed out that; "The entire concept of a format of integrating the community into policy development and environmental change is a key takeaway". "I may think I know the issues, but I can`t solve them; I need to facilitate, activate, educate, and motivate the community to be the solution in order to create sustainable change". Whereas, another staff member shared, "The community voice matters more than the model initiative". "Any initiative will be effective if you include precious prays". It has been found important to recognize that trust building is a time-intensive and essential part of the process. The health worker or facilitator must be transparent, open and honest in order to promote trust building with the community. There has been an emphasis on the importance of authenticity in each work openly disclosing the initiating of the project and grant from community members [44]. In any case, it has been found also important to establish street and open communication and be fine to follow them. A vision statement must be drafted with the community to allow community members with diverse philosophical perspectives on the model and find common ground yet also create strategies that reflect research and science. There are some questions that need exploration for community mobilization:

- What specific factors have been found to support effective community mobilization?
- What works in forming and sustaining community coalitions and community collaborations?
- What is the role of leadership in building and sustaining community wide efforts?
- What strategies will ensure that community leaders and residents remain engaged and active?
- What can we learn from research on health system capacity, leadership development, collaborative partnerships, and constituent participation in decision making, community coalition building and the evaluation of collaborative efforts [45].

These questions provide answers that will help CB-IRS Delivery Model and implementers at all levels to further refine their strategies and approaches to ensure the community has the skills, resources and opportunities to reduce or eliminate malaria and reach full potential with positive health outcomes.

Community mapping for CB-IRS delivery model

Meanwhile, the intervention mapping protocol describes the interactive path from problem identification to problem solving or mitigation. The malaria problem has to be assessed of its related behaviours and social perspectives of an at risk group or community and its problem and an effort to get to know or begin to understand the character of the community, its members and its strengths. In fact, community mapping as a Public Participatory Geographic Information System (PPGS) has been a tool that tells a story about what has been happening in the communities to allow the CB-IRS Delivery Model fit in well. During community mapping events, community members come together and collect field data. Community mobilization research has demonstrated success in a variety of public contexts [46]. In the 21st century there has been uprising and increasing interest in community mobilization. Community mobilization research has been described as community level efforts that address issues through actions that are organized [47]. Furthermore, it facilitates structural and social change in any community. It focuses on uniting communities around single health issues in order to create systematic and social change. Community mobilization contends that individuals have been found to be more likely to make healthful decisions supported by individual communities and resources that make decisions that are healthful. Moreover, community mobilization provides numerous benefits for the community such as cohesion, systematic support and improves sustainability. It promotes community relationships and establishing new coalitions where non perhaps existed before [48,49].

Discussion

This report brings together all known records of community action cycle for community mobilization in the thematic areas of successful Community -Based Indoor Residual Spraying model through: adequate preparations, good and adequate organization, exploration, adequate planning, acting and evaluating together with the community and finally adequate preparation to scale –up. The table below shows the mobilization cycle that leads to successful community empowerment for successful implementation of the model (Figure 4).

Prepare to mobilize for successful CB-IRS delivery model: The implementation of the CB-IRS Delivery Model in the communities has to be as close as possible to families and individuals. A team or committee has to be constituted for mobilizing the community towards the successful implementation of the CB-IRS Delivery Model. A "Community Executive

Committee” has to be developed from within the community for overseeing the implementation of the model.

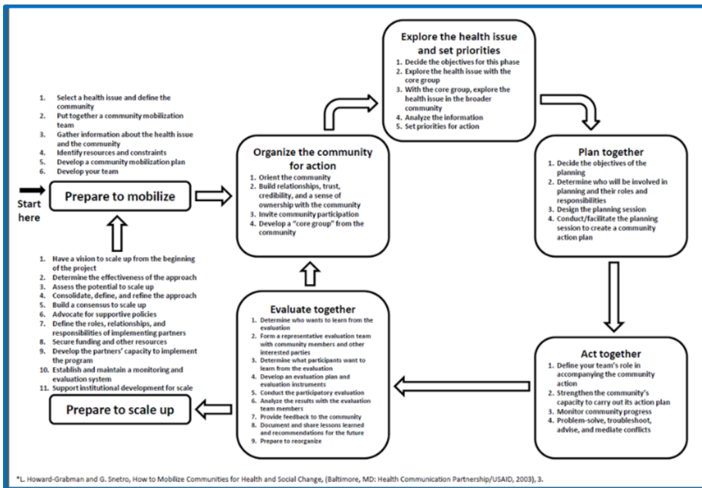

Figure 4: *Community action cycle for community mobilization for community IRS Model.*

The committee has to gather information about how best the model must be implemented in the community. The committee together with the community must identify the needed resources and constraints that exist in their area. The technical staff; the EHTs, and the community have to jointly develop a community mobilization plan and committee capacity has to be built on the way to implementation of CB-IRS Delivery Model.

Organize the community for action: The community has to be oriented and this time is for building relationships, credibility, trust and instilling a sense of ownership with the community. The community has to be consulted, involved, participate and totally engaged and finally empowered. The committee must be from the NHCs or community members. The approach to community mobilization has to be through the health promotion practice with IRS program and within the existing primary health care management systems [50].

Evaluate together with the Community: Determine with the committee those who must join to evaluate the progress of the CB-IRS Delivery Model. An evaluation team needs to be formed with community members and other interested parties. It has been important to know individuals who would want to learn from the performance of CB-IRS Delivery Model evaluation. An evaluation team has to be put in place including evaluation instruments.

The evaluation must take the mode of community participation. The end results of the spray campaign have to be analysed with the evaluation team members and a platform for feedback to the community that has to be made through public feedback meeting. All the progress of implementing the model has to be documented and all lessons learned, best practices to be shared including the recommendations for future improvement. The committee/group and community must prepare to re-organize to scale up the model.

Prepare to scale up the Community: Based IRS Delivery Model-A vision has to be shared for scaling up from the beginning of implementing the model. The effectiveness of the approach has to be determined and the potential for the model to scale up has to be assessed. The team and the community have to consolidate, define and refine the approach through building consensus to scale up the model together with the community. Supportive policies must be advocated such as gender strengthening to implementation.

Explore the health issue (malaria problem) and set priorities: The objectives of the Model must be decided at this point. It has been found important to explore the model issue with the committee, in the broader community perspective. The information must be analysed and priorities have to beset for action. The technical staff need to plan together with the community and the objectives have to be known by every community member at joint planning session towards creating a community action plan.

Act and supervise together with the community: The committee’s roles have to be determined in a companying the community action. The information has to be analysed and priorities have to be set for action cycle. Progress must be monitored towards achieving the goal. As a committee with community members, a room has to be provided for problem solving, trouble shoot, provision of advice and mediation of conflicts as you go along implementing the CB-IRS Delivery Model. The role must be defined, refined in an approach that can make impact. General resources (local) must be defined. The monitoring and evaluation system must be developed through a community score card. The community institutional development for scale up must be supported by the technical team and the community.

Community participatory mapping for the successful implementation of the model

The resource mapping for community –based interventions has been an important methodology for 1) Building the community 2) Community understanding of their assets, strengths and weaknesses 3) Sustainable economic viability. The community mapping for the CB-IRS Delivery model must be participatory mapping that creates a tangible display of people places including experiences that make up a community through members of the community themselves identifying them on their community map. The participatory asset mapping offers visual representation of community knowledge. The maps are asset based approach that represent culturally and socially distinct understanding of the community for implementing the model and include information

that must be excluded from the stream maps representing the views of groups outside the community.

Community basic concepts of community-based IRS delivery model

The community concept has been differently described depending upon the discipline using it or handling the term [51]. Hillary collected and analysed the definitions of this term and ended up concluding that there have been three major basic components of the community. Bracht described the term community as a group of people that share common values and institutions and Nutbean explains that the community comprises a specific group of people who often live in a defined geographical zone, share common values, norms and culture [52]. In order to fill this definition the community has to be organized through social structure according to the relationships that the community has developed over years [53]. I agree to the descriptions by the trio about the community and their descriptions that a community is a group of people who know each other better than outsiders can know it. Rifkin argued that community knowledge automatically creates desired changes in behaviours. Importantly, ensuring Community –Based IRS Delivery Model sustainability has been critical for the targeted sparsely populated communities or the community in disease hot spots. If the program has been no longer sustainable its impact decreases, leading to unmet expectations that affect the community as a whole such as resurgence of malaria. Sustainability factors need to be scrutinized for the community based model to prove to be essential. There have been several reasons why program sustainability must be important 1) terminating an effective program that leads to the negative effects for the implementing urgency and the community involved 2) The program initial costs become high 3) The experiences the community comes in un expected program termination lose trust for future Community-Based IRS Delivery Model related programs.

Community sustainability and sustainability factors for CB-IRS delivery model

Clearly, sustainability for the model encompasses three suggested indicators such as households, individual and community levels. It has been important to understand the factors or features that differentiate it from the traditional projects:

- That rely on a community based approach [54].
- That imply community acceptance and involvement
- That require socio-cultural acceptability
- That require the management capacities of the community based capabilities [55].

However, there has been an argument by some writers that sustainability of community programs has been influenced by the social-political will champions or the capacity of community stakeholders identified six critical factors for sustainability of community programs: networking, partnering, information exchange, prioritizing, planning, implementing and supporting/sustainability [56]. Further, eight contextual factors were also identified that influence the capacity building process such as existing capacity-coordination, roles, community connection, nature of partners, funding, social context and geographical scale support for the program political legitimation or the context of socio-economic spheres [57]. The Model program sustainability factors must be divided in three categories such as: 1) focused on the program itself 2) focused on the District Health Services organization and 3) the overall impact for sustainability. The conceptual sustainability model considers such types of factors for the Community –Based programs; organization and the community. These factors have been found to have an impact on the community based on the model;

Community-Based IRS delivery model specific areas

However, above all the list below hinges on the IRS program specific areas of success:

Coordination: Competence by health staff and partners in setting up realistic goals for selected catchment areas for the model.

Transparency: Informing community stakeholders about the model or its processes and outcomes through utilizing recognized and suitable approach methods such as public meetings.

Responsibility to adapt: To meet the continued community health needs and changes through community action cycle for social mobilization

Staff involvement and integration: Of qualified staff [EHTs, HPOs, SOs, CHAs, Data clerks and CBVs and Support staff] in all stages of the model during implementation.

Model funding and resources: Indicating the availability of funds and community resources for the implementation of activities

Model theory: Describing the existence of coherent and clear framework for the target population (hot spots, hard-to-reach, high refusal areas, other special populations and community needs or the expected outcomes) [59].

Model effectiveness and flexibility: The capability to document the successes, lessons learnt, best practices and initiatives by disseminating them to community stakeholders through community public meetings [60].

Model champions: Where individuals or organizations promote the model in a wide array of activities that are considered separate sustainability facts of their own management of practices for human and other local resources.

Model Organization Stability: Frequent changes of technical staff in positions leads to program failure [61].

Partnering: The DHMT capacity to initiate and maintain strong relations with many partners and stakeholders at grassroots level make interventions succeed. Partnering initiates financing and community acceptance that in turn could make the CB-IRS Delivery Model sustainable even through information exchange and its transformation across IRS perspectives.

Specific sustainability model processes and actions: The specific sustainable model describes actions that have been established by the DHMT targeting fund raising strategies and scaling up maintenance of partnerships. Partnership initiatives through funding and community acceptance that in turn must make the CB-IRS Delivery Model more sustainable.

Dependency syndrome: Must be reduced by every model action one takes. Centre acting dependency remains implementer`s prime goal. When building the community capacity about the model, the animator must keep that prime goal in mind and act accordingly. Let no community receive anything for nothing that encourages dependency on monetary gifts. Communities must always be encouraged to carry out own activities or programs and offer them with skills and tips but work must be done by them.

However, the community empowerment increases the community strength, improvement in its capacity or ability to accomplish goals. Community empowerment has been a process of the community becoming stronger in contrast to the charity approach that aims at strengthening the community rather than encouraging it to remain dependent upon the outside resources. The empowerment methodology does not make everything easy for the individual community because that has been seen as resistance and struggle as physical experience produces more strength.

Community engaged leadership in (Traditional &Political) CB-IRS delivery model)

Health has been a human right and equity in health has implied everyone must have a fair opportunity to attain their full potential and more pragmatic and that no one must be disadvantaged from achieving the potential. However, it has been the responsibilities of the health professionals implementing health programs to ensure individuals, families and communities are healthy through collective integrity-ethical based leadership that can promote community reduction of health disparities and advance health equity everywhere in the community as in the case of the CB-IRS Delivery Model [62].

Community specific for CB-IRS delivery model

Following the IRS program commitment, there are also community specific considerations such as:

Community participation: The level of community awareness and involvement in planning and implementation of the model determines the establishment of the model and its consolidation responses and adaptation to meet the changing needs. Community context encompasses the community problem like the relations with the government health workers, the social inequalities that usually vary from study to study and from community to community. It describes the relations with government agencies in particular. Conversely, dependency syndrome remains an attitude and belief where a community fails to solve own problems with outside help [45]. Dependency syndrome must be fought and that the model must not be seen to belong to implementing institution because when the organization leaves all the community efforts go to waste and the community remains demotivated and fails to sustain the model. Unquestionably, the community members must have a sense of responsibility for the community model that has been described as "Ownership" by the community. The sense of responsibility or ownership by the community has been involved in the decision making process about program planning and management. As the population increases every year the government reaches a fatigued phase and gets access to fewer and fewer resources per capita every year. As fatigue grows by government, it becomes no longer feasible for community interventions to be funded adequately. However, there has been an argument by some writers that sustainability of the community programs is influenced by the social-political factors such as the existence of political will, champions or the capacity of community stakeholders.

Organizational specific needs for the successful CB-IRS delivery model

On the other hand, the implementing leadership (DHMT& Partner) has to observe the following similarly to the other two specifics mentioned above:

Leadership: Health management team capacity has to establish the goals of MOH, congruent with the program for the community in order to integrate IRS community model development and the pro-activeness in the achievement of the goals. Under Innov8 "Leave no one behind" has been the core principle of the Sustainable Development Goals (SDGs). Equity, human rights and gender equality are central to all the goals, while SDG3 calls for universal health coverage and health and well-being for all ages. Everyone has to make it on the bus of the SDGs by using new approaches and tools (CB-IRS Delivery Model) that help identify gaps and then address health inequity [44].

Organizational system: must be that which comprises an assessment of the Community-Indoor Residual Spraying Delivery Model or rather analysis of community socio-economic needs. Logistics are to be transported by the district to health posts or RHCs for storage during the campaign for IRS campaign. The equipment must be adequate at all costs with less problems of frequent breakdowns. In most Community-Based IRS Delivery Models, mobile filter pits must be used, wash areas at community,

health posts and RHCs are encouraged, areas not accessible by vehicle, logistics must be transported by community ox-carts or any other means. Communities must be mobilized to dig soak-pits and help in fencing the structures. Used masks must be collected together with empty sachets and contaminated cartons and all to be stored at the health post or RHCs.

Gender disparities in implementing the CB-Based IRS delivery model

Health inequality between women and men continue to plague many societies in the 21st century. All IRS meetings hosted in the community must allow women to attend the public meetings. The disabled, the youth, the aged, the very poor, the disenfranchised, the marginalized, the shy in public and those that retired from public service must be present at every Community based IRS Delivery Model campaign meetings.

To sum up, there must be measures that must allow more women to serve as team leaders, spray operators, storage facility guards, porters and clerks etc. All positions for spray teams must be open to all men and women in that particular Community. CB – IRS Delivery Model advantages women and men to go home and sleep instead of residing in camps. The spray team model must have at least two more women and men as spray operators in community-based operations. The end spray operation must provide feedback sessions with spray teams to get their perspectives and recommendation on the process. The men and women's views must both be solicited at public meetings. All training must incorporate key gender messages about equal respect and opportunity. Monitor gender issues that might arise during the spraying campaign. Conduct community peer review through committees on the spray operations to solicit men's and women's perspectives on their experience with the model just like any other health program processes for improvement and address about solving community problems observed by teams.

Influencing forces that pull the community apart (Clan ethnic groups, Gender, ages, education, mental abilities, occupation, home, wealth) for the successful implementation of the model

The historical process of the types of human communities such as the clan, tribe, nation and nationality have influence to the implementation of the model in the community. According to Adafa Balon, a clan has been described as the basic call of the primitive social system [63]. The members of the clan are usually joined together by blood and family ties, by clan ownership of the means of production through collective production and consumption, and by religious beliefs and clan customs. Implementers have to be cautious of the implications arising from the clan and tribe forces. The main tool to be used must be public meetings in which discussions become the centre future. The model implementer must thoroughly be conversant and be informed with the community mobilization aspect. The community confers no one and must not preach like a priest; speeches must not be made like politicians and must not lecture like a professor and must avoid pontificating, or dictating in speech. Therefore, it has been emphasized that the facilitator must appear relaxed, confident and informed of the model to be introduced. In public meetings brain storm sessions must be introduced and must be used again in planning sessions of the Community-Based IRS Delivery Model Executive Committee.

Challenging the community on the model implementation approaches

It has been found that resistance produces strength, it and is like one's muscles when one wants to do push – ups. When muscles do not meet resistance, they usually grow weak and when you do too much for the community, it will not become strong. Does the community have the capacity to build and maintain the community-based model program? What problems will the CB – IRS –Delivery Model solve? And what likely problems will it cause? At this point it has been important to empower the community by letting them defend their choice [2]. The community has to be reminded that it is them (Local people and resources) to remember that it is their own resources that go into building the model to end malaria for their community. It is more humane, cheaper and less risk to have own people running the CB – IRS Delivery Model. Implementation must not passively accept the community first choice goal is to end malaria.

Organizing for community strength for the CB-IRS delivery model

Individuals mobilizing the community must have a concern of the way the community must be organized apart from contributions to capacity building, strength or empowerment. The level and effectiveness of community organization towards the model determines the group strength, the community or agency. Better organization makes better capacity. However, community learning by doing has been found to be very effective for any community in the world. The Executive Committee must be put to micro-manage the CB – IRS –Delivery Model and must be detailed with participatory assessment of conditions that include problems and resources in the community [64]. Through brain storming techniques the committee must prepare an action plan. The facilitators must guide the Community Executive Committee in presenting the findings to the community as a whole. Then using the brain storming techniques, the community modifiers/facilitators have to approve the action plan. Train the community in the importance of monitoring the implementation

of the CB – IRS –Delivery Model and have them decide on what must be done for them to be satisfied of their involvement, participation, effectiveness and finally empowerment. According to Bartle, the community must form an Executive Committee independently or jointly and inclusively from the Neighbourhood Health Committee and assess community conditions surrounding the implementation of the model. Together with the community develop a plan that must be followed on how to implement the model. Obtain the community needed resources/ skills, human resource, ox-carts, machinery/ IRS equipment, water, bicycles and ensure that all community activities are monitored and organized most effectively for action [65-70].

Formulating the community executive committee for CB – IRS – delivery model (CIM)

The Executive Committee has to oversee the implementation of the model and chosen by the whole community and not just a fraction or few fractions of the community. That is why unity organization remains important. The executive must be part of the community and be responsible to the community. The mobilizer or implementer must make this clear to the community members. The communication skills must be known that it is advisable to repeat oneself in different ways and to different groups depicting in different circumstances and scenarios. The formulation of the committee must be transparent and democratic process for good representation of the community from NHCs and other community members integrated. The community must undertake the implementation of the activity from an informed base. The committee must make its resources assessment [CHWs, HPOs, SOs, CHAs, MA, FBOs and other CBVs including CBOs] and this assessment must be onsite and analysed then the findings must be presented to the community as a whole at a public meeting. The resource map must be drawn on an appointed day within the community or communities. The transect walk across the community must help also identify mosquito breeding areas for the implementation of Larval Source Management and Entomological Surveillance. The Committee can put up a situational analysis of their findings [71-75].

Preparing a community action plan (CAP) for the implementation of the model

However, in community capacity building and encouraging the community; the executive must bear stronger and more self-reliance. Impress upon the community the necessary planning and management of the model. The community vision has to be "End malaria". "If you do know where you are going then any road will do". Let the community be unified and this has to be ensured. The four questions have to be answered by the community about malaria elimination [76-80].

- "What do we want about malaria?"
- "What do we have to end malaria?"
- "How do we use what we have to end malaria?
- "What will happen when we work together in implementing the model?" The community assessment must answer Q2.

Monitoring of the implementation of the CB –Based IRS delivery model

The IRS campaign spray days must involve the Community Executive Committee to ensure that all targeted houses are sprayed. The community committee must constantly monitor, any small deviations, and must quickly and easily be corrected and failure avoided and reported to the whole community as implementers at public meetings [81-83]. The role of the mobilizer or implementer is to facilitate needed teaching activities and ensure there has been a need about the free information about all aspects. Let there be strong capacity building to the community and promote public knowledge acquisition, transparency and gender balance to empower them in the implementation and monitoring of the model. The job of the implementer/facilitator has been not to implement the plan, but facilitate the community to do so. Continuously the Executive Committee has to be reminded that monitoring has been part of the design, importance and must be always carried out by it. The Community Executive Committee must hold public meetings to ensure a good flow of information between the executive and the community as a whole. The executive not to lecture but to get means of IRS activities. The end of the spray campaign celebrations has been said to be very cardinal. Organizing and the implementing of community celebrations for the hard work are quite important and are vital part of community mobilization. Celebrations at end of IRS campaign has been described as an exciting break from the monitoring of the field work activities. In this situation, ensure that a variety of entertainment during launching and celebration has been cardinal and use local culture groups and ensure community shots attend to make speeches of public praise and not politically hijack the occasion. It has been observed to be of value to invite the media and press. The celebration adds public recognition, validation and legitimacy to the whole development process of the model. Launching and celebration have been described as good criterion for raising awareness, improving transparency and making the community program more high profile activity. The goal of the member or implementer has been sustainable development of the activity.

Lessons learned and awareness of possibilities from the model implementation

After the implementation of the model campaign period, we must learn from both successes and failures, from achievements to

mistakes. The mistakes, failures and disasters have not been the same. A mistake has not been failure; to err is too human. A failure is not a disaster; failing to achieve something does not mean one has been a failure and a disaster has not meant the end of life or time. Despite many participants' satisfaction with IRS, some of them were found to refuse IRS campaign and have their houses sprayed. The refusals were associated with spray operator selection from different communities, performance of IRS and difficult in removing household assets. Many participants during the engagement meetings in Southern Province of Zambia specifically Sinazongwe district expressed dissatisfaction with the selection of spray operators as having influenced their acceptance of the IRS campaign. Community members and leaders expressed resistance in allowing unknown individuals into their home because they were not trusted to not damage their goods or later rob the homes. Another barrier to IRS acceptance frequently stated by most participants was related to the need of removing household goods during the spraying period. Participants frequently mentioned that they found it difficult to accept that the Spray Operators would see inside their houses when they remove their household assets during spraying. For example, one man stated during the community engagement meetings that, at his age, he can't carry things from inside to the outside, so he denied his house to be sprayed.

Major Findings

Given, the lessons learnt outlined in the previous sections, it is quite predictable that the relationships of community action cycle for community mobilization, community-based development and community-based service provision remain distinct community empowerment strategies for the model. In the community coalition, it was found important that the focus of collaboration across has to concentrate on the collective power from community members, CBVs, CBOs, CBAs, FBOs and focus it on implementing CB-IRS Delivery Model. Collaboration has been based on the concept of "Community practice for the model". Community engagement, motivation, mobility means must be conducted in a manner that has to be respectful of all partners and being mindful of their need to benefit from collaboration for the successful implementation of the model and ultimately eliminating malaria.

Conclusion

Indoor Residual Spraying(IRS) has been an effective strategy to control malaria and ultimately eliminating the disease. The move from morbidity control to interruption of transmission and achievement of malaria elimination, requires novel advanced innovative technologies aimed at reducing the infection reservoir or reducing the rate at which infections spread. This must be done by an innovation research portfolio that has to be expanded such as Community-Based IRS Delivery Model. The model lies upon capacity building, a key ingredient in redressing social exclusion, inequality and vulnerability in the community. Good planning by the implementing urgency helps communities to shape and exercise control over their social, physical, economic and cultural environment. CB-IRS –Delivery Model is the most appropriate model regards the desired outcome to intervene to IRS community challenges. We recommend that, to get a good outcome, the intending urgency to implement the model must have a good operational plan and must begin with community action cycle for the community mobilization. The implementation of community development must also be facilitated to blend the "bottom–up" action driven by the community to remove barriers that prevent people from participating in Indoor Residual Spraying campaign. Collaborative leadership and empowerment approach must be provided. Integration of the model into primary health care approach can yield good results and outcome. Then, if all these strategies are followed, success of the model is assured. Despite the efforts to have a good approach of the model, more research is needed for quality spray of IRS performance activities for impact for the model.

Declaration

Ethics approval and consent to participants

Not Applicable

Consent of publication

Not Applicable

Availability of Data and Material

The data sets generated during the analysis period are available from the Corresponding Author Dr Emmanuel Hakwia Kooma on reasonable request

Competing Interest

There are no financial or other competing interests and the Authors declare that they have no competing interests whatsoever.

Authors Contribution

All the Authors read and approved the abstract and the final manuscript

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