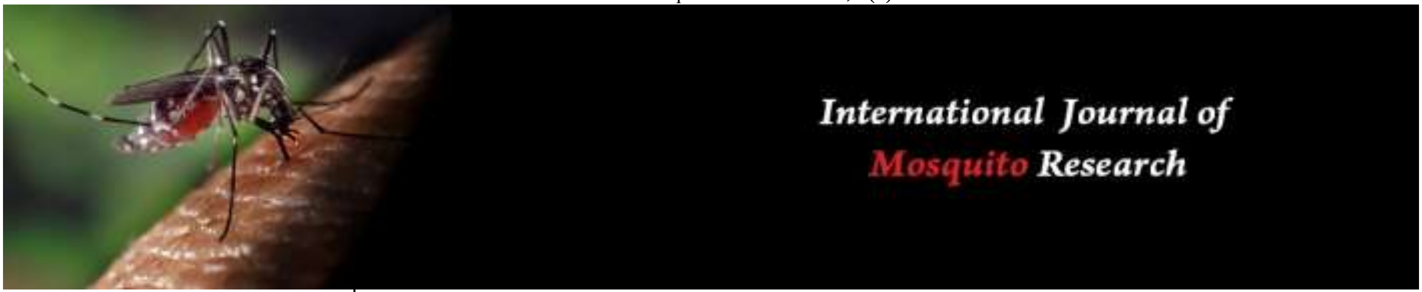

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Assessment the effectiveness of community based dengue and chikungunya intervention: Keren, Anseba zone Eritrea (2020)

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Abstract
Diseases caused by *Aedes* mosquitoes mainly DF, CHIKN and yellow fever are emerging and reemerging globally. Dengue fever and CHIKN are well established in Eritrea that endemic of dengue fever were repeatedly seen. In addition to this CHIKN has become a public health problem specially at the western part. The strategies which were conducted against dengue fever were not resulted in to substantial reduction over the past years. As a result the ZMCP has introduced a community based strategy at keren, Anseba zone Eritrea as a pilot and evaluating its effectiveness it will be replicated to other sites. It was aims at increasing community awareness by visit door-to-door and emptying or elimination non-permanent water containers and covering permanent water storage used as *Aedes* mosquito breeding habitats. During this intervention six administrative areas and 39 neighborhoods were participated. In which a total of 63,438 population and 106 facilitators were participated during this intervention. 13,704 HH and 26,852 containers were inspected by these facilitators and they found that a total of 10,626 HH and 9,236 containers were found to be positive for larva/pupa. During the training given door-to-door a total of 25,036 community members from all ages were trained on dengue and CHIKN and as a result community knowledge on mosquito immature stages were increased from 8.4% before the intervention to 77.8% after the intervention. Consequently entomological induces were dramatically reduced with in short period of time. This newly adapted community based intervention would be very effective if a new communication strategy called COMBI and community based incentives for community leaders/facilitators have introduced.

Keywords: Dengue fever, chikungunya, community, larval indices

Introduction
Diseases caused by *Aedes* mosquito mainly dengue fever (DF) and chikungunya (CHIKN) are emerging and re-emerging globally [1]. Dengue virus alone causes nearly 390 million human infections per year; very recently CHIKN virus is spreading throughout the world and yellow fever (YF) is continuing to appear as an outbreak in the African and Americans [2, 3]. The global spreading of *Aedes* borne diseases may have different reasons, and it may be summarized to a favorable condition creating to the proliferation of the vector though global trade and unplanned urbanization, unsustainable vector control interventions, poor waste disposal systems and poor management of household (HH) water storage containers [4].
In Eritrea, DF was introduced in early 1990Th through Massawa port, and it was mainly localized along the red sea cost. In 1990, almost all the combatants of the Eritrean people liberation front (EPLF) who were involved in the liberation of Massawa contracted the diseases. As a result they called it "WELCOME". Since then dengue fever is called welcome in Eritrea. Afterward dengue fever starts to appear in the western part of the country since 2005. At early 2005, an epidemic of dengue fever was seen in Agordet city in Gash Barka zone. According to ministry of health (MoH) Eritrea, national master plan for neglected tropical diseases, the second epidemic was reported from Massawa port and its surrounding areas in Northern Red Sea zone in 2010 (MoH, Eritrea national master plan, 2013). Generally dengue outbreaks were appeared in different places with different altitudes. It appears in an altitude extends from 20 meter above sea level (masl) in Massawa to 1954 masl in Mendefera [5]. The following table shows the occurrence of dengue fever by year since 2005-2015.

Table 1: Population and DF cases by year and Zobas in Eritrea [5]

	Dengue fever cases						
Year	**Anseba**	**Debub**	**Gash barka**	**Maekel**	**NRS**	**SRS**	**National**
2005	214	28	19	239	-	3771	4,271
2007	--	-	-	266	3	349	618
2009	-	-	378	11	1	2150	2540
2011	742	23	5405	461	51	5786	12,468
2013	695	38	6777	424	305	3256	11,495
2014	852	54	5451	56	184	3581	10,178
2015 (Jan-Jun)	498	164	2555	235	241	2951	6,644

DF has now become the most important vector-borne disease in Eritrea following to malaria. Every year at the rainy season it has been continuously burdened the inhabitants of Anseba zone specially the towns of Keren, Hagaz and Elabered. Keren a capital city for Anseba zone has a densely populated and with a HH water supply scarcity. Piped water supply scarcity push the community to own various water storage containers and thus it serves as *Aedes* mosquito breeding habitats. Considering this, the zonal malaria control program (ZMCP), MoH anseba region has introduced a community based intervention in Keren as a pilot. The intervention was adapted from experience by Espino [6]. And other studies revealed that the most effective to control dengue is community involvement and participation [7, 8, 9, 10].

It should be responsibility shared by many and multi-sectoral cooperation is a strategic approach for successful interventions. It is a package which aims community as a core of the intervention and modifying health risk behaviors of the community.

The package has included mass-health education to the community, addressing risk factor, and community based innovative laws and penalties. The whole package of the intervention is listed in table 2 and the modified frame work of the intervention is displayed in figure 1.

Almost all the intervention for dengue control and elimination are based on a community (community based interventions) and are basically targeted to eliminate water holding containers in and around HHs which serve as *Aedes* mosquitoes breeding habitats. In resources-poor-societies, if the responsibility and the owner ship of the program are given for them, the diseases would be best controlled [11].

Multi-sectoral organization or individuals who would directly or indirectly involve in dengue control have to be identified. These could be governmental organizations, non-governmental organizations, line ministries and local government.

Many people may think that Knowledge alone can bring a change in any diseases control and prevention. However, social factors and in this case life style has a very big contribution in proliferation of the vector and expansion the diseases [12].

Behavioral change is the best instrument in place where water supply is a persistent problem. In a ground of this kind, the communities need to own a number of water holding containers and thus increases vector breeding habitats and consequently the community store water throughout the year which in turn sustain the transmission of the diseases though out the year.

Table 2: Conceptual framework for IAM system [13]

Integrated surveillance	Entomological Surveillance	Productivity of breeding sites	**Supporting activities**
		Insecticide resistance monitoring	
		Seasonal dynamic and mapping	
	Epidemiological surveillance	Evaluation of public health threats	Capacity building
		Monitoring of trends	
	M & E	M & E of control measures	
		Risk assessment	
Vector control	Adult	Spraying	Advocacy
		Insecticide treating materials	
		Trap and repellents	
	Larva	Larviciding	Research
		Environmental management	
	Social mobilization	HE, community participation and communication	
	Multi-sectoral collaboration	Inter-sectoral	Public & laws
		Intra-sectoral	

Interventional Designs

Vector Surveillance

i. Pre and post entomological and epidemiological surveillance.

Multi-sectoral collaboration

Aedes control cannot be successful without effective and sustained intra- and inter-sectorial collaboration. The malaria control program was therefore integrated with the health promotion unit with in the health sector and with different stakeholders and line ministries outside the health sector.

Social mobilization

Vector control (VC)

Vector control was mainly targeted to non-chemical way in which management of water holding containers at HH level and collectively removal of discarded tyres and discarded tins from the surrounding. Chemical vector control (temophose) was exceptionally used in large and unavoidable big water holding containers.

Supporting activities

Capacity Building

i. Training of neighborhood leaders (zone leaders) on the following topics.

- DF and CHIKN epidemiology, clinical features, complications, transmission and prevention.
- Training on the discussion guide prepared by both MCP and HP
- Training on interpersonal communication (IPC).

ii. Training health workers on malaria, DF and CHIKN and the vector.

iii. Door-to-door training HH by zone leaders based on the provided discussion guide.
iv. HH entomological surveillance

The responsibility of these facilitators
- Supervising of households for the presence/absence of larva/pupa.
- Drainage water containers if necessary
- Advising household based on the result
- Application of temophose (larviciding), for unavoidable big water storage.
- Penalty for families who sustained the presence of larva/pupa.
- Training households based on the provided training anual.
- Report their activity to their respective head of local administration.

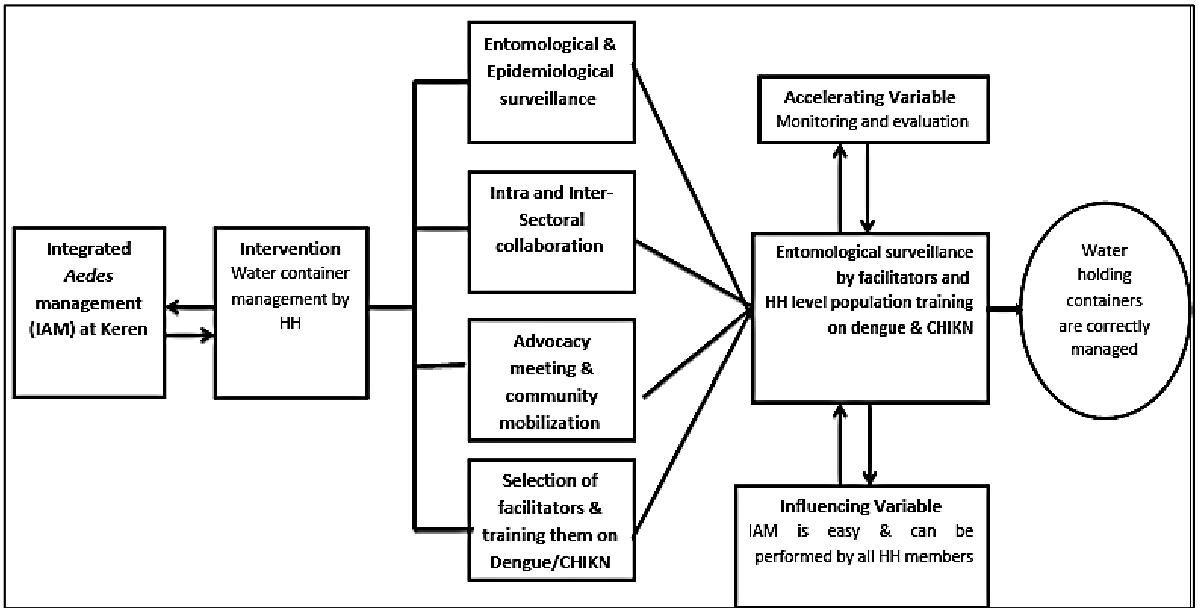

Fig 1: Frame work on IAM at Keren, Anseba zone Eritrea (2020)

Methodology
Study Design
As part of the community-based intervention conducted in Keren, Anseba zone Eritrea, a prospective cross sectional study will be used between May and October 2021. An entomological survey will be implemented during the whole rainy season. A baseline entomological survey was conducted in 2020 at the same period. In addition to this an epidemiological aspect of this concern will be followed over the whole period of the study time. Each time of observation will be compared and evaluated with that of 2020.

Study area and population
Study area and period
The study was conducted at Keren town Anseba zone, Eritrea on May-October, 2021. Keren, also spelled Cheren, is the second-largest city in Eritrea. It is situated around 91 kilometres northwest of Asmara at an elevation of 1,390 meters above sea-level. The city sprawls on a wide basin surrounded by granitic mountains on all sides.

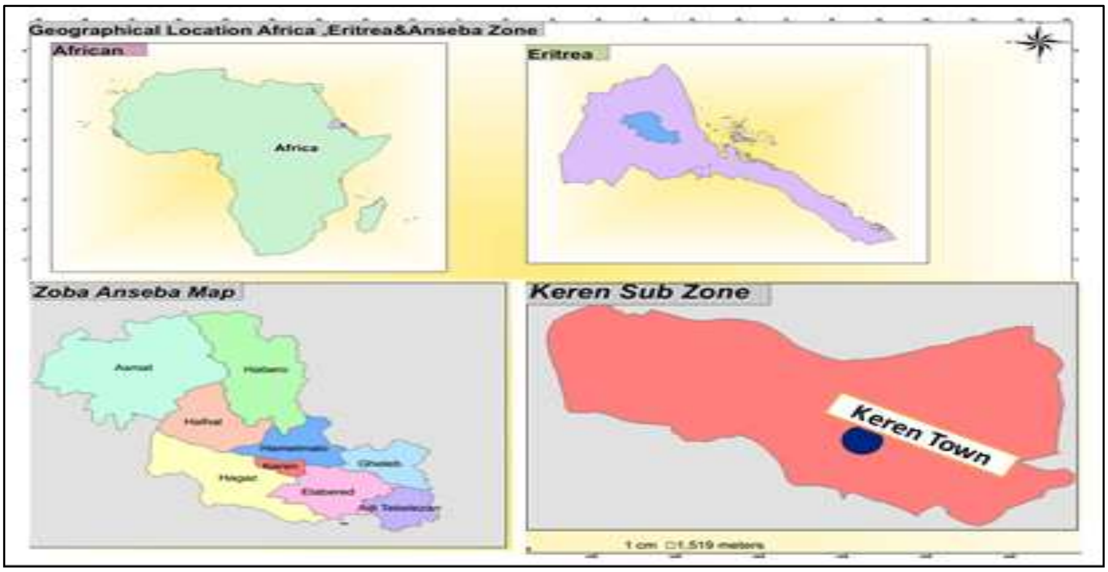

Fig 2: Africa, Eritrea, Anseba zone and Keren Town

Keren town was selected from among the 3 town (Hagaz, Keren and Elabered) which are found in Anseba zone. These towns were the most prevalent areas in the zone that more than 90% of DF and CHIKN cases were from these three towns. Keren was similar to the other towns in their housing condition, source of water on both towns was from irregular piped water and tanker trucks which were not adequate as a result storing water was very common. An average of 4 water holding containers per HH was found during the entomological surveillance conducted before the intervention among all the towns. Barrel was the most used water holding containers in all the towns and clay-pots, jerry-cans, cement basin were among the other highly used containers. keren was particularly selected due to its very high incidence of DF and CHIKN, population number and density and accessibility.

As depicted in Figure 1.2. this community based DF/CHIKN intervention was based on a population and aimed at management of water holding containers at HH level. During the introduction of the intervention a series of steps of activities were implemented. The activities were advocacy meeting to sub zonal health committee, sensitization to influential people from each local administration, training of facilitators (people who directly involved in HH inspection), training health workers (likewise these health workers were also involved in HH inspection with facilitators). In addition to this, a discussion guide were developed (see fig.1.1) and used by the facilitators to training HH members at HH level. After all these steps of activities, facilitators and health workers were started to inspect HHs for presence or absence of immature forms of mosquitoes at each and every HH in their respective neighborhoods (Zone). Consequently if a HH had available with the immature mosquitoes, the water was pour to the ground and clean the containers. All HHs irrespective to their presence or absence of mosquito immature stages were trained on DF, CHIKN, malaria and entomology and vector control at their homes. This HH training has taken a minimum of 15 minutes per HH. A regular supervision by health workers from health facilities, malaria control program, health promotion unit and members of the municipality and local administration was made during inspection and HH training.

Since the intervention in to the area, planned regular meeting was held between the ministry and the local administration. During the meeting, health workers from respective health facilities and the facilitators were involved. Regular evaluation has helped to exchange experience, best practices between the facilitators and local administrations and accelerated the interventions.

HHs were visited at a range of two weeks. If the HH was sustained the presence of immature mosquito forms, a penalty was made by the local administration. The penalty extends to banning of HH from all the social services provided by the municipal.

Based on a similar study conducted by Espino *et al*., (2012), a similar framework was used to understand community response to a new intervention. Two models of behavioral change for the desired outcome (absence of *Aedes sp.* breeding in the homes): and the second criteria was if the community were believed dengue/CHIKN are series diseases and consequently believe proper management of HH water containers prevent from contracting the diseases (Espino *et al*., 2012).

HHs that are trained on home water management, and where water management is easy to do and can be performed by all household members (Espino *et al*., 2012). Training HH members will impact on correctly managing water containers.

Study population

Larva and Pupa collected from larval habitats

Sample Size determination

The sample size was determined using the following formula:

$$n^{*} = \frac{z^{2} pq}{(d^{2})} deff$$

Where:

n = the sample size

z = the critical value for achieving (1-α) % confidence level, here, z = 1.96.for 95% confidence interval.

p = the anticipated proportion. Here p=0.5 because there are no previous studies.

q = 1-p

d = the desired margin of error, we took d=5%

deff= deff was taken as 2 based on previous similar household surveys.

Sampling technique

In this community-based study; cluster sampling was used based on the six administrative areas. A total of 400 households were randomly selected from a total of 39 neighborhoods and equally distributed according the number of HH of respective neighborhood. The starting point was in the middle of every neighborhood. Pen was rolled to indicate the starting HH, and a HH nearest to the sharp end was taken as a direction and starting. Then moving to the right and counting according to the sample interval (number of houses in the Administrative Area divided by the number of houses to be surveyed in that administration). The next house was selected. This procedure was used till the required number of HHs in the selected neighborhood reached.

Data analysis

Analysis was done on the changes in the overall proportion of positive containers for *Aedes* aquatic stages per household before and after the intervention. It was quantified a within-household change (before and after) in the proportion of positive containers for mosquito aquatic stages as an aggregated measure of these entomological indices used in this study. The total analysis was performed using SPSS version 23 and a Chi- square test will be used to compare the distribution of positive containers between indoor and outdoor locations.

Stogomyia indices was calculated according to the following formula:

The entomological indices: House Index (HI), Container Index (CI), and Breteau Index (BI), were used for measuring the larval population. These indices were measured as follows: HI (No. of houses positive/ No. of houses inspected x 100); CI (No. of containers positive / No. of containers inspected x 100); Breteau Index (No. of containers positive / No. of houses inspected x 100); PI (No. of pupae / No. of houses inspected x 100) and PDI (No. of pupae / No. of population x 100).

Ethical clearance

Clearance to conduct the study was obtained from ethical approval committee at the ministry of health, Eritrea. The objective of the study was explained to the study subjects and informed consents was guaranteed. Every participant has had the right to withdraw from the study if not willing.

At the completion of the study, neighborhoods leaders and local administrators were informed about the outcomes of the study.

Result

Interventional population

Keren town has seven local administrations named as 01, 02, 03, 04, 05, 06 and 07 and 53 neighborhoods (zones) (Table 3.1). The town has a total of 16,231 HH with 75,875 populations. Pre-interventional entomological surveillance was previously conducted in all the seven local administration and found that the seventh administration has a very limited and a continuously used HH water holding containers and thus *Aedes mosquitoes* were not their prior problem. Zone 07, was part of the municipality but economical and geographically placed as a rural community. Considering the social and economic differences of these communities but under the same sub region, the study excluded the seventh administrative area and zones of the same background from other administrative areas. As depicted in table 3.1, 12,437 populations from 14 neighborhoods were excluded from the intervention because of their geographical placement (rural community). The intervention was community based and it has a total of 106 facilitators chosen by the local administration. Almost all the facilitators were community leaders (zone leaders), and they are very accepted by their respective communities.

HH entomological surveillance

The intervention was mainly conducted by door to door visiting. Every community leader visited each and every HH in their respective zones. During the visit they checked each wet-water holding containers for the presence and absence of mosquito immature stages. Basically these facilitators were trained for HH level training and HH entomological surveillance. Table 3.2 shows, a total of 13,704 HHs were surveyed for the presence or absence of *Aedes* mosquito immature stages. Out of these a total of 10,626 water holding containers at indoor and outdoor were found to be positive for larva/pupa. The same table shows among the 26,852 wet water holding containers inspected, 9,236 (24.4%) containers were positive for larva, pupa or both. Consequently advices were given for all the HH inspected during that entomological surveillance for sustainability of absence of mosquito immature stages or vise-versa. In addition to this, 2,635 positive wet water holding containers were poured and a warning was given for a total of 475 HHs who sustained the positivity of their containers. A big water holding containers (*i.e.* cement/plastic/metal basin which were inconvenient to pour was managed using a chemical (temephos).

The best prediction of arboviruses to occur in a particular area is most of the time done using entomological indices. The most used entomological indices are HI, CI and BI. The entomological surveillance conducted by the facilitators was also included measurement of these indices. As depicted in table 3.2 the indices were found to be 34.4%, 77.5% and 67.4 for CI, HI and BI respectively.

Table 3: Total number of HHs and populations at Keren Anseba zone Eritrea (2020)

Town	Local administrations	Number of Neighborhood (zones)	Total No. of HH	Total No. of populations	Total No. of facilitators	No. of neighborhood excluded from the intervention	No. of population excluded from the intervention
Keren	01	07	3,183	10,017	14	01	1,344
	02	08	2,676	11,622	16	01	1,134
	03	07	2,580	10,595	14	01	2,295
	04	9	2,008	9,740	18	01	851
	05	9	3,015	14,307	18	0	0
	06	4	1,919	15,244	8	01	2,463
	07	9	850	4,350	18	9	4,350
Total		53	16,231	75,875	106	14	12,437

Table 4: Total number of HH and containers inspected during HH inspection by facilitators, Keren Anseba zone Eritrea (2020).

Local administration	No. of zones	Total No. of HH inspected	Total No. of HH +ve for larva/pupa	Total No. of containers inspected	Total No. of containers +ve for larva/pupa	Action taken			No. of containers applied with temophose	Entomological indices		
						No. of Advice given	No. of HH Water poured	No. of Warning/penalty		CI	HI	BI
01	6	2985	2130	6,268	3,510	2985	1360	75	56	56%	71.4%	117.6
02	7	2446	1838	3,946	1,144	2446	420	211	20	29%	75.1%	46.8
03	6	2073	1720	3,938	1,220	2073	370	21	32	31%	83%	58.9
04	8	1848	1380	4,065	1,056	1848	201	67	46	26%	74.7%	57
05	9	3015	2580	5,427	1,248	3015	79	0	34	23%	85.6%	41.4
06	3	1337	978	3,208	1058	1337	205	101	67	33%	73.1%	79
6	39	13,704	10,626	26,852	9,236	13,704	2,635	475	255	34.4%	77.5%	67.4

Training populations on dengue/chikungunya at HH visit

Every facilitator and local administrators were provided with a laminated 2-page discussion guide prepared by both ZMCP and HP unit (see fig. 1.1).

This discussion guide was a series of questions with their clarifications on malaria, dengue and CHIKN. And it was developed considering the capacity of the facilitators. Based on this, as depicted in table 3.3, a total of 25,036 community members were trained at their homes on malaria, dengue, CHIKN and the vector.

Knowledge of the community on the mosquito immature stages was assessed before and after the intervention. Table 3.3 shows, community knowledge on larva/pupa of mosquitoes before and after intervention. Before the intervention only 8.4% of the community was named as mosquito for this immature mosquito stages.

But the rest 91.6% of the population placed the mosquitoes to other harmless insects. After the intervention and HH population training, the knowledge of the community was raised to 77.8% on classification of mosquito developmental stages.

Changes in community knowledge and entomological indices right after intervention.

Dengue/CHIKN community based intervention can be easily evaluated using entomological and epidemiological results. Our intervention was also evaluated using entomological results.

Entomological surveillance was conducted before the intervention as a baseline and right after the intervention. Both the surveillances were conducted at the raining season between July-October, 2020. And as depicted in tables 3.4 and table 3.5, 79.8% of HHs was positive for mosquito immature stages whereas it reduces to 32.5% right after the intervention. Similarly as shown in table 3.5, CI was reduced from 37.7% to 12.4% before and after the intervention. The most convenient reliable indices among all the entomological induces is BI.

It was also calculated during the surveillance and it was found that 148 before the intervention and 55.6 after the intervention.

Table 5: Dengue/CHIKN training at HH level and Knowledge of participants on identifying *Ae.* Mosquito immature stages at Keren, Anseba zone, Eritrea

Local administration	No. of people trained at their HH	% of people knows *Ae. mosquito* immature stages	
		Before intervention	After interventions
1	4,307	8.2%	75.4%
2	4,532	7.7%	67.7%
3	3,072	9.1%	89.5%
4	3,993	6.9%	87.6%
5	4,864	8.7%	90.5%
6	4,268	9.6%	56.3%
Total	25,036	8.4%	77.8

Table 6: Entomological surveillance before and after intervention (HH positivity) at Keren, Anseba zone, Eritrea (2020).

Local administration	Before intervention			After intervention		HI
	Total No. of HH inspected	Total No. of HH +ve for larva/pupa	HI	Total No. of HH inspected	Total No. of HH +ve for larva/pupa	
01	65	42	64.6	65	27	41.5
02	54	52	96.3	54	12	26.7
03	45	26	57.8	45	13	28.9
04	41	38	92.6	41	18	43.9
05	67	55	82.1	67	7	10.4
06	30	28	93.3	30	21	70
Total	302	241	79.8	302	98	32.5

Table 7: Entomological surveillance before and after intervention (container positivity) at Keren, Anseba zone, Eritrea (2020).

Local administration	Before intervention			After intervention			BI before intervention	BI after intervention
	Total No. of containers inspected	Total No. of containers +ve for larva/pupa	CI	Total No. of containers inspected	Total No. of containers +ve for larva/pupa	CI		
01	133	71	53.4	305	43	14.1	109	66
02	260	68	26.2	273	23	8	125	43
03	147	50	34.0	173	24	14	111	53
04	298	60	20.1	301	39	12.9	146	95
05	248	145	58.3	193	7	3.6	216	10
06	100	53	53	105	32	30.3	176	106
Total	1186	447	37.7	1350	168	12.4	148	55.6

Discussion

The present study was conducted in Keren sub region, Anseba region, Eritrea, only in the urban setting to evaluate the effectiveness of community based dengue/CHIKN intervention which was implemented on September 2020-October 2020. The pre-urban setting of the same region was dis-include from the study for low *Aedes* entomological indices resulted from low number and frequent utilization of containers. Entomological surveillance was conducted prior to introduction of the innovative community based intervention on the pre-urban places and it was found that the communities own a single water storage containers and utilizes it very frequently. As a result it was not suitable for *Aedes* inhabitation. Frequently used wet water holding containers was found to be inconvenient for *Aedes* inhabitation in different studies [14, 15]. On the contrary containers retain water for long period of time are suitable for *Aedes* inhabitation [16]. Generally the geographical distributions of *Ae. aegypti* is highly adapted to the domestic environment, and therefore its abundance is positively correlated with increasing urbanization [17, 18]. The same finding was observed in our study. *Aedes* mosquitoes were observed to inhibit at the urban place that their presence was very localized to the urban placed. And epidemiologically dengue/CHIKN was found to be very prevalent in the urban settings of our region. Among the 9 sub regions present in our region only 3 sub regions were prevalent to dengue and CHIKN despite their geographical and ecological difference is almost the same. Of these three sub regions the diseases were localized to the three towns (vis: Keren, Hagaz and Elabered towns).

Historically, *Aedes* control was based on chemicals mainly on DDT. The introduction of DDT was results to the control of malaria and *Ae. aegypti* in different countries [19]. However this strategy was failed due to the resistance of DDT in 1960th. These days, many programs are still continuing to use or advocating others to employ, chemical in *Aedes* control. That includes space spraying and ultra-low volume spraying to kill adult mosquitoes [20]. Despite the effect of indoor residual spraying (IRS) depends on the behavior of *Aedes* mosquitoes, Eisen and Beaty, motivates to use IRS as an emergency as a control measure for *Ae. Aegypti* [21]. But IRS and space spraying to control adult mosquitoes are always difficult to adhere and costly too [22].

Community managed dengue vector control was proven to be the most cost effective and sustainable strategy among the other methods [23, 24]. A sustainable community based dengue vector control can be achieved through participation of every individual in a community. To do this an intensive education should be provided aiming at behavior change. The present community based intervention was aimed at the community based on communication for behavioral impact (COMBI). This was achieved through community training at HH level. The education was done by door-to-door visits and was included emptying or eliminating non-permanent water containers and covering permanent water storage used as *Aedes* breeding habitat. The effectiveness of such strategy was found to be very successful by different lectures [23, 25]. Community training at HH level was quite difficult and time consuming. But the community leaders (facilitators) were very devoted that they came to manage all the difficulties unlike other studies. Many studies were found very difficult to find committed community leaders who commit themselves for the benefit of their respective community in urban settings [25]. However in rural communities it takes place in an appropriate manner [26]. Another study from Burkina Faso was also found difficulties to find committed leaders and associations willing to invest themselves voluntarily and unconditionally in fight against mosquitoes [26]. But the present study found that very devoted community leaders, line ministries, governmental organizations, local administrators and health workers from respective health facilities. *Aedes* control cannot be successful without effective and sustainable intra- and inter-sectoral collaboration [27].

A symptomatic management is only possible for dengue and CHIKN and a vaccine for dengue does not provide equal protection for all serotypes, rather a vaccine for anyone of these serotypes would have a series complication if you infect with another serotypes [28]. Therefore, vector control would be the best option for dengue/CHIKN control. Human behavior is a common denominator would play a crucial role in preventing or distributing vector borne diseases thus increasing the knowledge of the community is very crucial. Health education is rather used to develop a proactive program to protect vulnerable community [13, 29]. The present study was given a great emphasis to the knowledge of the community thus community was trained at their home by the trained community leaders. Their knowledge come-up with active and sustainable participation resulted to reduction of entomological indices. The outcome of the intervention in our setting was evaluated by the stegomian indices before and after the intervention. Most of the time risk to dengue has predicted using stegomia indices [30]. Globally source reduction has been a key component in dengue, zika and CHIKN control programs [31]. Source reduction should primarily target artificial and natural containers located in and around HH [14]. Larviciding are generally log lasting, costly and Temephos and bacillus thuriengensis (Bti) do not have strong evidence in reducing *Aedes* borne diseases [14]. Similarly the present study was targets on artificial containers located at indoor and outdoor. Containers located outdoors specially discarded tyres and discarded tins were managed by locally arranged sanitation campaign on weekly bases. However, Temephos was used in big positive containers which cannot be poured or managed in any way else. Some cement basins were filled with more than 60 barrels or 12,000litres of water that using chemical was the only option. Many studies proved that reducing larval indices by community participation is effective in diseases reduction [32]. This study revealed that, the strategy was time consuming and a fulltime work. The community leaders who were actively participated in such strategy need to be motivated financially. So budget was a real challenge for the implementation of the HH visit for training and for HH container inspection. A study from Atkinson was revealed that financial incentive has a positive influence in community participation [33]. In such strategies different stakeholders need to be participated on financially and technically.

Conclusion

DF has been established for more 2 decades and lately CHIKN have become a public health problem in Eritrea. Both of these diseases are adding a burden to malaria, since malaria is one of main vector borne diseases in Eritrea despite a drastic reduction absorbed on the last 20years. DF and CHIKN control is nowadays emerged to the malaria control program, in which the strategies for both of these diseases might be different. For these reason a new strategies for DF and CHIKN was adapted in Keren, Anseba zone. Community based intervention shows a satisfactory result that with participate all community members and stakeholders, it would be a step toward explaining theory of intervention and the result of this study can be a base for replication of this strategy to other parts of the country.

Recommendations

- WHO recommends the use of communication for behavioral impact (COMBI), an approach that integrates behavior and social communication to reduce risk and prevent diseases? So this approach has to be introduced to our strategies in controlling and preventing communicable and non-communicable diseases.
- Community leaders need to be motivated by community innovative incentives.

References

1. Wilder-Smith A, Gubler DJ, Weaver SC, Monath TP, Heyman DL, Scott TW. Epidemic arboviral diseases: priorities for research and public health. Lancet Infectious Diseases 2017;17(3):e101-e106.
2. Mayer SV, Tesh RB, Vasilakis N. The emergence of arthropod-borne viral diseases: A global prospective on dengue, chikungunya and zika fevers. Acta Tropica

2017;166:155-163.
3. Lindsay SW, Wilson A, Golding N, Scott TW, Takken W. Improving the built environment in urban areas to control *Aedes aegypti*-borne diseases. Bull World Health Organ 2017;95(8):607-608.
4. MoH. National master plan for neglected tropical diseases, 2013–2016. Asmara: Ministry of Health 2013.
5. Usman A, Ball JD, Rojas DP, Berhane A, Ghebrat Y, Mebrahtu G, *et al*. Dengue fever outbreaks in Eritrea: 2005–2015. Global health research and policy, 2016;1(1):17
6. Espino Fe, Marco Jesusa, Salazar Nelia P, Ferdinand Salaza, Mandoza Ysadora, Mendoza, Velazco Aldwin. Community-based dengue vector control: experiences in behavior change in Metropolitan Manila, Philippines. Pathogens and Global Health 2012;106(8):455.
7. Suwanbamrung C. Community capacity for sustainable community- based dengue prevention and control: domain, assessment and capacity building model. As Pacific Journal of Tropical Medicine 2010;3(6):499-504.
8. Khun S, Manderson L. Community and school-based health education for dengue control in rural Cambodia: a process evaluation. PLoS Neglected Tropical Diseases 2008;1(3):e143.
9. Sanchez L, Perez D, Perez T, Sosa T, Cruz G, Kouri G, Boelaert M, *et al*. Inter-sectoral coordination in *Ae. aegypti* control. A pilot project in Havana City, Cuba. Tropical Medicine International Health 2005;10(1):82-91.
10. Heintze C, Velasco-Garrido M, Kroeger A. What do community-based dengue control programs achieve? A systematic review of published evaluations. Trans Royal Soc Tropical Medical Hygiene 2007;101:317-325.
11. Espino F, Koops V, Manderson L. Community participation in tropical disease control in resource-poor settings. UNICEF/ UNDP/World Bank/WHO Special Program for Research and Training in Tropical Diseases 2004. TDS/STR/SEB/ST/ 04.1 Special Topics No. 2.
12. Hairi F, Ong CHS, Suhaim A, Tsung TW, Ahmad MA, Sundaraj C, Soc M. Knowledge, attitude and practices (KAP) study on selected rural communities in the Kual Kangsal District. Association Pacific Journal of Public Health 2003;15(1):37-43.
13. Roiz David, Wilson Anne L, Scott Thomas W, Fonseca Dina M, Jourdain Frederic, Muller Pie, *et al*. Integrated Aedes management for the control of Aedes-borne diseases. PLOS Neglected tropical diseases: 2018;12(12):e0006845
14. Mensur YS Nebinur, Nabil HH Bashir, Mustaf YH Dukeen. Presence, Characterization and productivity profiles of aedes mosquitoes (Diptera: Culicidae), in Barentu, Gash Barka Zone, Eritrea. International journal of mosquito research 2019;6(5):10-19.
15. Wilson JJ, Sevarkodiyone SP. Spatial and temporal distribution of mosquitoes (Culicidae) in Virudhunagar district, Tamil Nadu, South India. International Journal of Mosquito Research 2014;1(3):4-9.
16. Ngugi HN, Mutuku FM, Ndenga BA, Musunzaji PS, Mbakaya JO, Aswani P, *et al*. Characterization and productivity profiles of *Ae. aegypti* (L.): Breeding habitats across rural and urban landscapes in western and coastal Kenya. Parasites & Vectors, 2017;10(1):331.
17. Maciel-de-Freita R, Neto RB, Goncalves JM, Codeco CT, Lourenco-De-Oliveira R. Movement of dengue vectors between the human modified environment and an urban forest in Rio de Janeiro. Journal of Medical Entomology 2006;43:1112-1120.
18. Tsuda Y, Suwonkerd W, Chawprom S, Prajakwong S, Takagi M. ifferent spatial distribution of *Ae. aegypti* and *Ae. albopictus* along an urban-rural gradient and the relating environmental factors examined in three villages in northern Thailand. Journal of the American Mosquito Control Association 2006;22:222-228.
19. WHO. Use of indoor residual spraying for scaling up global malaria control and elimination. Geneva: WHO/HTM/MAL/ 2006, 1112.
20. Perich MJ, Danvilla G, Turner A, Garcia A, Nelson MJ. Behavior of resting *Ae. aegypti* (Culicidae: Diptera) and its relation to ultra-low-volume adulticide efficacy in Panama City, Panama. Journal of Medical Entomology 2006;37:541–546.
21. Eisen L, Beaty BJ. Innovative decision support and vector control approaches to control Dengue. In Vector-Borne Diseases: Understanding the Environmental, Human Health and Ecological Connections. Washington, DC, USA: Workshop Summary. The National Academies Press 2008.
22. George L, Lenhart A, Toledo J, Lazaro A, Han WW, Velayudhan R. Community-Effectiveness of Temephos for Dengue Vector Control: A Systematic Literature Review. PLOS Neglected Tropical Diseases 2015;9(9):e0004006.
23. George Leyanna Susan, Aswathy S, Nimitha Paul, Leelamoni K. Community based interventional study on dengue awareness and vector control in a rural population in Ernakulam, Kerala. International journal of community medicine and public health 2017;4(4):962-967.
24. Andersson N, Nava-Aguilera E, Arosteguí J, Morales-Perez A, Suazo-Laguna H, Legorreta-Soberanis J. Evidence based community mobilization for dengue prevention in Nicaragua and Mexico (Camino Verde, the Green Way): cluster randomized controlled trial. BMJ 2015;351:3267.
25. CDI Study Group. Community-directed interventions for priority health problems in Africa: results of a multicountry study. Bull World Health Organ 2010;88:509-18.
26. Saré Diane, Pérez Dennis, Somé Paul-André.; Kafando Yamba, Barro Ahmed, Ridde Valéry. Community-based dengue intervention in Ouagadougou: intervention theory and implementation fidelity. Global Health Research and Policy 2018;3:21
27. WHO. Comprehensive guidance for prevention and control of dengue and dengue hemorrhagic fever. Revised and expanded edition. *WHO*, Regional Office for South-East Asia 2011.
28. Stanaway JD, Shepard DS, Undurraga EA, Halasa YA, Coffeng LE, Brady OJ. The global burden of dengue: An analysis from the Global Burden of disease study. Lancet Infectious Diseases 2016;16(6):712-23.
29. Selvarajoo Sivaneswari, Wee Kent, Liew Jonathan, Tan Wing, Lim Xin Ying, Bowman LR, *et al*. Is dengue vector control deficient in effectiveness or evidence?: systematic review and meta-analysis. PLoS/ Neglected Tropical Diseases 2016;10(3):e0004551

30. Fonseca DM, Unlu I, Crepeau T, Farajollahi A, Healy SP, Bartlett-Healy K. Area-wide management of *Aedes albopictus*. Part 2: Gauging the efficacy of traditional integrated pest control measures against urban container mosquitoes. Pest Manag Science 2013;69(12):1351-61
31. Alvarado-Castro V, Paredes-Solis S, Nava-Aguilera E, Morales-Perez A, Alarcon-Morales L, Balderas-Vargas NA. Assessing the effects of interventions for *Aedes aegypti* control: systematic reviewand meta-analysis of cluster randomised controlled trials. BMC Public Health 2017;17:384
32. Atkinson JA, Vallely A, Fitzgerald L, Whittaker M, Tanner M. The architecture and effect of participation: a systematic review of community participation for communicable disease control and elimination. Implications for malaria elimination 2011;10:225.